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UNITED STATES DEPARTMENT OF AGRICULTURE

Soil Survey of Trempealeau County, Wisconsin

By

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and

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Wisconsin Geological and Natural History Survey

Bureau of Chemistry and Soils

In cooperation with the Wisconsin Geological and Natural History Survey and the University of Wisconsin College of Agriculture

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SOIL SURVEY OF TREMPEALEAU COUNTY, WISCONSIN

By M. J. EDWARDS, in Charge, E. H. BAILEY, and W. J. GEIB, United States Department of Agriculture, and J. F. FUDGE, BUREL BUTMAN, and HAROLD COOK, Wisconsin Geological and Natural History Survey

COUNTY SURVEYED

Trempealeau County is in the west-central part of Wisconsin about 125 miles north of the Illinois State line. Mississippi River forms the southwestern boundary and Black River the southeastern. The area of the county is 745 square miles, or 476,800 acres.

The central and southern parts of Trempealeau County, with the exception of the stream bottoms and the terraces of Mississippi River, range from rolling to very hilly. Local variations in altitude range from 100 to 500 feet. In the northern part of the county the variation in elevation is not so great, slopes are not so steep, and a gently rolling or rolling relief predominates. The extreme southern part of the county is a level or gently undulating plain covering an area of about 45 square miles. The plain is broken by an isolated "island," or outlier of the upland, which lies directly west of the town of Trempealeau. This islandlike area, including about 2 square miles, is rugged and steep, rising to an elevation of about 500 feet above the Mississippi River bottoms.

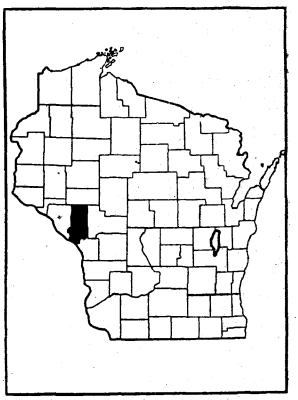

FIGURE 1.—Sketch map showing location of Trempealeau County, Wis.

The main upland of the county rises rather abruptly from the north edge of the Mississippi River terrace and extends northward to the central part of the county where the Trempealeau River Valley crosses the county from east to west. North of the Trempealeau River Valley is a smaller area of rolling upland similar to that south of the river. These hilly or rolling sections of the county are completely dissected by the drainage systems. The valleys are well developed, the ridges are narrow, and the intervening valley slopes and lower ridges have a rolling surface.

The dolomitic limestone ridges south of Arcadia reach the highest elevations and have the steepest relief found within the county. These ridges are somewhat wider than those in the remainder of the county; the upper 150 feet of the slopes are very steep and the valleys are comparatively narrow. The maximum elevation of the limestone ridges above the adjacent valleys is about 400 feet, whereas throughout the rest of the rolling upland area the elevation is about 250 feet. The northern part of the county, particularly the northeastern corner, has for the most part a gently rolling or undulating

relief, the elevation in few places being more than 140 feet above the valley and for the most part less than 80 feet. The land immediately north of the Buffalo River Valley becomes more rolling, and the elevation increases to 180 or 200 feet.

The following elevations above sea level of various points throughout the county illustrate the local relief: Trempealeau, on Mississippi River, 692 feet;[1] Centerville, on the Mississippi River terrace, 738 feet; Arcadia Ridge School, which represents the average elevation of the limestone ridges, 1,281 feet; Fargness Church, 6 miles south of Whitehall, representing the average elevation of the lower ridges, 1,090 feet; Arcadia, in the Trempealeau River Valley at the west edge of the county, 744 feet; Whitehall, in the Trempealeau River Valley in the central part of the county, 819 feet; Eleva, in the Buffalo River Valley in the northwest part of the county, 871 feet; and Osseo, in the Buffalo River Valley in the northeast part of the county, 959 feet.

Trempealeau County is completely dissected by a well-developed drainage system. On the whole the divides are comparatively high, giving good fall to the smaller tributary and headwater streams. The only areas not well drained are the first-bottom lands along some of the larger streams. The largest poorly drained areas occur along Trempealeau River, from south of Dodge to Mississippi River, and in Tamarack Valley where a peat marsh covers about 4 square miles. All the surface drainage flows directly or indirectly into Mississippi River.

The bottoms of the main stream valleys are rather broad, and well-drained terraces are conspicuous features along many of the larger streams. The Mississippi River Valley is about 5 miles wide in Trempealeau County, Trempealeau River Valley is from three-fourths to 1 mile wide, and Buffalo River Valley is from one-half to three-fourths mile wide. Most of the smaller streams have definite valley floors ranging from one-fourth to one-half mile in width. The average elevation above sea level of the main streams other than Mississippi River is about 720 feet in the southern part of the county and 900 feet in the northern part.

The first settlement in the country now included in Trempealeau County was made in 1685, when Nicholas Perrot established a trading post near the present site of Trempealeau. This post was abandoned about 1732. In 1836 Swiss missionaries made a futile attempt to establish a mission for the purpose of interesting the Indians in agriculture. In 1837 the Sioux's claims east of the Mississippi were ceded to the United States, and about two years later John Doville, an Englishman and the first permanent settler, located near the present site of Trempealeau. Two or three other English settlers located here within the next few years and during this period, up to about 1848, a few French trappers and hunters from Prairie du Chien settled in this general vicinity. A post office was established at Trempealeau in 1852.

Settlement of the interior began about 1850. The first settlement on Beaver Creek was made in 1851, and the first settlements in the vicinities of Ettrick, Arcadia, and Dodge were made in 1855. Settle-

[1] Elevations from United States Geological Survey sheets.

ment of the northern part of the county began between 1856 and 1859. The village of Osseo was settled about 1857 by a group of seven farmers who came originally from Ohio. Most of the early settlers came from southern and southeastern Wisconsin and were largely of English and French extraction. Decorah Prairie was settled largely by Scotch, who began coming into the area about 1853.

After the earliest settlements were established, northern and eastern Europeans played an important part in the development of the county. Probably the first Polish people to come were those who settled in the vicinity of Dodge in 1862. Another Polish settlement was started in Burnside Town at about the same time. The first German settler came into the Trempealeau River Valley in 1857, and the first Norwegian settler located in the vicinity of Blair in 1855. At the present time people of Polish extraction predominate in the vicinities of Independence, Arcadia, and Dodge, and in the communities around Pigeon Falls, Whitehall, Blair, Ettrick, and Galesville Norwegians predominate. People of German, English, and Irish extraction are scattered over the county.

Trempealeau County was formed in 1854 from territory formerly included in Buffalo, Jackson, and La Crosse Counties. The seat of the county government was first established at Galesville but later was moved to Whitehall. According to the United States census for 1930[2] the population of the county is 23,910, all classed as rural, and the density of population is 32 persons to the square mile.

There are no cities within the county. The towns and villages serve as business centers and shipping points for the farm produce. The Green Bay & Western Railroad, the Chicago, St. Paul, Minneapolis & Omaha Railway, the Chicago, Burlington & Quincy Railroad, and the Chicago & North Western Railway afford good access to distant markets. A small proportion of the produce is consumed in the towns, but most of it is shipped to the large market centers. Livestock is shipped mainly to Chicago and a small amount is marketed in Milwaukee, Eau Claire, St. Paul, Minn., and Winona, Minn. Milk products, such as butter, condensed milk, and a very small amount of cheese, are shipped to the large market centers.

The highway system of the county is extensive and well maintained. A network of patrolled State highways, most of which are surfaced with gravel, connect all the principal towns, and many less important highways, maintained and patrolled by the county, render practically all sections easily accessible.

CLIMATE

The climate of Trempealeau County is characterized by comparatively long, severe winters and short, warm summers. Seasonal variations in temperature are wide, the winter temperatures ranging from 60° F. to −49° and the summer temperatures ranging from 30° to 105°. Temperatures below zero occur very frequently during the winter. The colder periods generally last two or three days and are followed by periods of gradually rising temperature. Hot spells are almost invariably experienced during the summer, but are seldom of more than a few days' duration.

[2] Soil survey reports are dated as of the year in which the field work was completed. Later census figures are given whenever possible.

The average frost-free season in different parts of the county ranges from 130 to 160 days, being shortest in the northern part. In the southern part of the county the frost-free season is practically the same as in the southern part of the State. The length of the frost-free period also varies with the elevation, frost occurring sooner in the low narrow valleys than on the higher ridges. Frost has been known to occur as late as June 12 and as early as August 21. In some seasons corn throughout the county is frosted before it reaches maturity.

The rainfall is well distributed for crop production. In general, frequent showers occur during the spring and early summer. During harvest season the actual rainfall is nearly as great as in the spring, but it occurs less frequently and as thunderstorms, and, owing to this and to a higher rate of evaporation, a comparatively drier condition prevails. Fall rains are well distributed and generally leave the soil in a moist condition for spring planting.

Good water is available in nearly all parts of the county, though on the higher ridges it is often necessary to drill to considerable depth. Although some of the land along the larger streams is periodically overflowed, swamps are not common, and healthful atmospheric conditions prevail throughout the county.

The climatic data in Table 1 are summarized from the records of the Weather Bureau station at Whitehall and are representative of average conditions in Trempealeau County.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Whitehall*

[Elevation, 675 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1895)	Total amount for the wettest year (1903)	Snow, average depth
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	19.7	58	−33	1.31	1.30	0.84	8.3
January	13.7	55	−49	1.10	1.00	.22	10.4
February	14.8	60	−46	.94	.35	1.35	8.0
Winter	16.1	60	−49	3.35	2.65	2.41	26.7
March	30.7	85	−25	1.71	.20	2.17	7.4
April	46.8	87	9	2.34	3.40	4.13	2.5
May	56.9	93	17	4.22	2.74	5.70	.2
Spring	44.8	93	−25	8.27	6.34	12.00	10.1
June	66.1	100	30	4.17	4.40	2.43	.0
July	70.1	105	35	3.44	2.64	5.52	.0
August	67.8	100	30	3.44	1.85	6.53	.0
Summer	68.0	105	30	11.05	8.89	14.48	.0
September	61.1	99	19	3.62	4.80	11.48	.0
October	49.2	91	7	2.52	.30	1.78	.7
November	33.5	76	−20	1.40	.88	.17	4.1
Fall	47.9	99	−20	7.54	5.98	13.43	4.8
Year	44.2	105	−49	30.21	23.86	42.32	41.6

AGRICULTURE

The development of agriculture in Trempealeau County has progressed definitely and steadily since 1880. Previous to that time, grain farming was the main industry and wheat was the principal crop. The development of available markets for dairy and livestock products, the adaptation of this region and the aptitude of the people for dairying, and probably, in part, the invasion of the chinch bug and wheat rust, which gradually reduced yields, caused a change from the production of grain for market to production of feed for livestock. During the decade following 1880 the wheat acreage fell off sharply despite the fact that the acreage of improved land increased 15 per cent. During the same period the production of feed crops, particularly corn, oats, and hay, increased rapidly. The data in Tables 2 and 3 indicate the trend of agricultural development in the county during the last 50 years.

TABLE 2.—*Number of farms, farm areas, and tenancy in Trempealeau County, Wis., in census years*

Year	Farms	Area of county in farms	Average size of farms	Improved land in farms	Owner-operated farms	Tenant-operated farms
	Number	*Per cent*	*Acres*	*Per cent*	*Per cent*	*Per cent*
1880	2,459	78.7	153.0	47.0	95.5	4.5
1890	2,676	83.1	149.0	51.5	88.6	11.4
1900	3,138	95.7	145.9	55.3	89.3	9.7
1910	3,008	94.2	150.0	57.8	86.5	13.3
1920	3,138	96.4	147.1	58.6	82.2	16.9
1930	3,051	92.8	145.6	----------	79.5	20.2

TABLE 3.—*Acreage in principal crops in Trempealeau County, in stated years*

Crop	1879	1889	1899	1909	1919	[2]1929
Corn	13,728	24,193	23,934	21,638	20,153	15,417
Oats	19,539	45,726	76,009	67,325	61,324	52,582
Wheat	72,738	14,740	17,677	8,183	27,383	4,299
Rye	1,125	4,390	5,898	8,880	12,379	3,563
Barley	2,889	1,344	3,823	18,146	10,334	8,409
Hay	28,409	52,585	54,707	59,150	59,419	66,593
Alfalfa [1]	----------	----------	7	3	67	----------
Potatoes	----------	1,781	2,405	1,717	1,852	----------
Tobacco	9	1	1	520	953	----------

[1] Included in hay. [2] Preliminary figures, subject to correction.

The value of agricultural products in 1919 is given in Table 4. Comparable figures are not available for 1929.

TABLE 4.—*Value of agricultural products by classes in Trempealeau County, Wis., in 1919*

Crop	Value	Livestock products	Value
Cereals	$4,539,905	Domestic animals	$1,451,322
Other grains and seed	341,247	Dairy products, excluding home use	2,631,748
Hay and forage	2,779,331	Poultry and eggs	604,997
Vegetables	528,962	Wool	66,592
Fruits and nuts	90,492		
All other crops	275,364	Total	4,754,659
		Total agricultural products	13,309,960
Total	8,555,301		

Even after the cropping system for the furtherance of livestock farming was well established, a gradual change in crops and their relative acreage continued. The corn acreage has had a tendency to decrease, whereas the acreages of oats and hay have increased somewhat. Hay crops, which were previously largely nonleguminous, are steadily being displaced by leguminous crops. The increase of the alfalfa acreage is particularly noticeable. During recent years, a marked development of supplementary cash crops has taken place, chief among which are peas for canning, cucumbers for pickling, and tobacco.

Agricultural crops and practices at the present time vary slightly in different parts of the county. In the hillier parts, the farms are larger and a smaller proportion of the land is cleared. In some of the hilliest parts dairying is the only farm enterprise carried on, whereas in other parts of the very hilly sections dairying combined with sheep raising is practiced. Cash crops are more commonly grown in the less hilly areas. Crop rotation and systematic fertilization are also more commonly practiced in the smoother sections.

On the whole, dairying is the chief industry, supplemented by hog, sheep, or poultry raising and one or more cash crops. The main breeds of dairy cattle are Guernsey and Holstein. According to the Wisconsin Biennial Crop and Livestock Review, there were 36,000 milk cows in the county on January 1, 1926, and 176,400,000 pounds of milk were produced during the preceding year. Most of the milk is used in the manufacture of butter. A condensary at Osseo affords a market for part of the milk in that vicinity. A very small quantity of milk is used for the manufacture of American cheese. Two community factories, one at Norden, Buffalo County, and the other in sec. 7, T. 23 N., R. 9 W., Trempealeau County, afford limited facilities for cheese production.

A few hogs are raised on practically all farms. Most of the pigs are farrowed in the spring, fed during the summer on skim milk, some grain, and pasture, and fattened during the fall and early winter on grains, particularly corn. They are then shipped to the large packing centers of Chicago and Milwaukee, and a few are sent to Eau Claire. The number of hogs in Trempealeau County, January 1, 1926, was about 35,000. The main breeds raised are Poland China, Duroc-Jersey, and Chester White.

Sheep raising is not so widespread as are cattle and hog production but is common in some sections, especially in the hilly parts of the county where much of the land is better adapted to grazing than to cultivation. Sheep are raised both for mutton and wool. On January 1, 1926, there were 17,800 sheep in Trempealeau County.

Poultry and eggs are produced on practically all farms. Single-combed White Leghorn, Barred Plymouth Rock, and White Wyandotte are the most popular breeds of chickens. Some geese, ducks, and turkeys are raised for market. The poultry is marketed alive and is handled in part by local retail dealers but largely through private poultry shippers. Most of the eggs produced are handled by local retail dealers. The value of poultry and eggs sold each year has increased rapidly during the last two decades; in fact, more rapidly than has the value of dairy products.

Subsistence crops, or the crops used or consumed on the farm, occupy about 92 per cent of the cropped acreage; cash crops, or the crops grown to be sold, occupy the remainder. Oats are the most important subsistence crop. They are grown on practically every farm but are more predominant in the more rolling part of the uplands where erosion makes it inadvisable to grow corn for grain. Oats are particularly well adapted to the heavy-textured light-colored soils, such as the Boone, Clinton, Dubuque, and Bertrand silt loams. When grown on the dark-colored soils they have a tendency to lodge before maturity. Oats are grown principally as feed for cattle and horses. They are used extensively as a nurse crop for the hay-crop seeding but are not considered so good for this purpose as barley, rye, or wheat. The average yield in 1925 was 37.1 bushels to the acre.

Hay ranks second in importance among the subsistence crops. It is grown on practically all types of soil except the fine sands. Red clover and alfalfa, however, are not grown on the poorly drained soils. The hay crop, like the oat crop, is of greatest importance in the hilly sections where the possible acreage of corn is small. In these areas hay is commonly grown on the same field for three or four years in succession. On the gently rolling uplands and the terrace soils, it is more commonly grown in rotation with other crops. Mixed timothy and clover (medium red and alsike) is the most common hay crop on the poorly drained areas of the Waukesha and Bertrand silt loams and the better-drained areas of the Genesee and Wabash silt loams. Of the emergency hay crops, mixed field peas and oats, Sudan grass, Billion Dollar grass, and soybeans are the most common, all of which produce well under conditions that are favorable to oats. Of these four crops, soybeans are probably the best suited to the sandy soils. The hay crops are utilized as feed for cattle, horses, and sheep, timothy being favored for horses and the leguminous hays for dairy cattle.

Corn, though limited in acreage possibilities by the large amount of rolling and steep land, ranks third in acreage and is an important crop both for forage and grain. It is most successfully grown on the deep silt loams of the Clinton, Bertrand, and Waukesha series, but produces very good yields on the lighter-textured soils and soils of the Boone series, with the exception of the fine sand types. Dubuque silt loam is not well suited to corn production, owing to its shallow heavy clay subsoil. In the rolling sections of the county, the better-drained areas of the Wabash and Genesee silt loams are used to a great extent for the production of corn. The grain is fed largely to hogs and to some extent to dairy cattle, horses, and sheep. More than half the corn grown is utilized as silage, which is fed mainly to dairy cattle.

Barley, although occupying a smaller acreage than wheat, is next to corn in importance as a subsistence crop. It is grown primarily as a grain feed for hogs and dairy cattle, and is also a good nurse crop for clover and alfalfa seedings. This crop gives better average yields over a number of years on the light-colored heavy soils than on the dark-colored soils, as its tendency to lodge is even greater than that of oats. On sandy soils, barley appears to do better than oats.

Rye is an important crop on the sandy soils, being better suited to these soils than any other grain crop. Probably 90 per cent of the rye is sown on the fine sandy loam, sandy loam, and fine sand soils. This crop is sown in the fall and is generally ready to be harvested before the hottest part of the summer. It is used mostly as hog and cattle feed, being fed mixed with the more bulky grains, particularly oats.

Wheat ranks fourth in total acreage. It is largely a cash crop but some of it, especially the poorest quality grain, is used as feed for livestock. Winter wheat occupies about three-fifths of the wheat acreage and spring wheat about two-fifths. In Trempealeau County, winter wheat seems to produce the better grain. Wheat is grown to a large extent on the steep phases of the Clinton and Boone silt loams, but it is also grown on the other heavy-textured well-drained soils of the uplands and terraces.

Peas for canning are one of the most important cash crops of the county. Because they must be grown within 6 or 7 miles of the canning factories, the production of this crop is somewhat localized. Canning factories are located at Galesville, Blair, and Osseo, consequently practically all the peas for canning are produced in the eastern and south-central parts of the county. The acreage devoted to peas has become fairly well stabilized. The crop is grown principally on the level or gently rolling well-drained silt loam soils, the Bertrand, Trempealeau, and Clinton silt loams probably being the most desirable soils for peas. The crop is purchased by contract and handled by the local canning companies. The forage, which is stacked at the viners, is generally retained by the respective farmers and hauled back to the farms for cattle feed during late fall or early winter. Peas are very commonly used as a nurse crop for clover and alfalfa.

Tobacco, although occupying not much more than one-fourth as large an acreage as peas in 1925, slightly exceeded the pea crop in value. Most of the tobacco is grown in the northern half of the county, mainly in patches ranging from one-half to 2 acres in size and generally on the deep well-drained heavy soils of the valleys. The Clinton, Waukesha, and Bertrand silt loams are the best tobacco soils in the county. However, good tobacco is produced on some of the sandier soils and also on Boone silt loam. On all soils, heavy applications of barnyard manure are used. The crop is sold either through the local tobacco pool or to private buyers.

The production of cucumbers for pickling is an important farm industry. As in the production of peas for canning, the producing areas are limited by the location of the factories. Salting stations for the pickles are located at Galesville, Blair, Arcadia, Independence, Whitehall, Eleva, Strum, and Osseo. Cucumbers are generally grown on sandy soils, the Boone and Bertrand fine sandy loams being the most favored. Some cucumbers are produced on the fine sand soils, and good yields are generally obtained on the well-drained silt loam soils. The salting stations are operated by private companies who contract for the crop at the time of planting.

Buckwheat is grown to some extent, particularly in the northern part of the county. It is frequently sown as a catch crop after

some other crop has failed early in the season. It may be grown on any soil except the fine sands and the poorly drained soils.

The clover-seed crop, particularly red-clover seed, varies in acreage and yield from year to year, the possibility of a crop depending considerably on weather conditions. Red-clover seed is harvested from the second crop of the season, and the yield ranges from 1 to 2 bushels to the acre.

Soybeans are grown to a small extent for forage. They are either broadcast, drilled in rows from 32 to 36 inches apart, or drilled or checked with corn for silage. They are well adapted to most of the well-drained soils but appear to do best on the loams and sandy loams. Inoculation of the seed is in general practice.

Apples are grown for household purposes throughout most of the county except on the sandier soils. A few commercial orchards are located in the valley of Little Tamarack Creek. The upland soils, Clinton silt loam and Boone silt loam, are best suited to the production of this fruit.

Potatoes and strawberries are produced in nearly all gardens, mainly for home consumption. Potatoes are grown to a small extent on a commercial scale, particularly in the vicinity of Pine Creek. The surplus crop is marketed in Winona, Minn. This crop is grown both on the sandy loams and the silt loams, the sandy loams being preferred for the early varieties and the heavier soils for the later varieties. A few strawberries are marketed, but very few are sold outside the county.

Methods of farming and the crops grown are influenced to a marked extent by the relief. In sections of the county where the steep or rolling upland soils predominate, a very small acreage is devoted to cultivated crops. Small grain, hay, and pasture grasses are the main sources of feed, and dairying and sheep raising are the most common farm enterprises. In the less rolling sections, a greater acreage is in cultivated crops and a greater diversity of cash crops is practiced. Here crop rotation is more diligently followed, and fertilization of the several fields is more nearly equalized.

The advisability or advantage of growing certain crops on particular soils is recognized to a noticeable degree. The smoother-surfaced loams and silt loams are preferred for corn. This crop is particularly favored for the better-drained areas of the Wabash and Genesee soils. Because of its shallow surface soil and heavy-textured clay subsoil, very little Dubuque silt loam is planted to corn. Alfalfa is grown mostly on the well-drained loam and silt loam soils, and there is a comparatively large acreage on Dubuque silt loam. Mixed timothy and alsike are well adapted to the imperfectly drained tillable areas of soil. Barley and oats, because of their inclination to lodge, are seldom grown on the fertile, well-drained areas of Wabash and Genesee silt loams. Rye and cucumbers are generally grown on the fine sandy loam and sandy soils, and apples are almost invariably grown on the rolling upland areas of Boone silt loam and Clinton silt loam.

Cultivation of the land is primarily influenced by the topographic features, very little cultivation being done in areas where the slope is more than 14 per cent. The universal practice, however, is to

plow the ground previous to planting or sowing on both the steep and the smoother areas. Most of the plowing is done during the fall, after which the ground is left until sowing or planting time in the spring, when it is harrowed with disk or spring-toothed harrows in preparation for seeding. Small grains are generally drilled although some are broadcast. Grass seed is sown with some of the small grain for the following year's hay crop. Wheat, barley, rye, and peas for canning are the favorite nurse crops but oats are used by many farmers. Corn is generally checkrowed when grown for grain and drilled when grown for silage. After the corn is planted the field is generally lightly harrowed with a spike-toothed harrow, or "blind cultivation" (cultivation before the corn is up) is practiced. Regular cultivation of the corn crop starts soon after the plants show above the ground, and, as a rule, is repeated three or four times, and the crop is "laid by" about the middle of July.

The first crop of alfalfa is cut about the first of June and the second about the first of August. Clover and timothy hay are cut during the first part of July, and small grain is cut between the first of July and the first of August. Rye is harvested first, followed by wheat, barley, then oats. Corn for silage is cut from the last of August to the last of September, and corn for grain is harvested after the middle of September. A small amount of corn is husked by hand directly from the standing stalks. As soon as the fields are cleared of the harvested crops, plowing for fall-sown grains begins. Most of the plowing for spring-sown grains is done during the month of October.

Crop rotation is rather uniformly practiced in the more level sections of the county. A 3-year rotation of corn, small grain, and hay is the most common. This system is varied by growing any one of these crops two successive years on the same land or by pasturing the land for one or two years. Crop rotation is not systematically practiced in the hilly sections, owing to the general inadvisability of growing cultivated crops. As a result, small grain is alternated with hay, and a cultivated crop is grown occasionally.

Plant food is added almost wholly through the use of barnyard manure, which is usually applied to the ground on which corn is to be grown or to a new seeding of clover. Land for tobacco and potatoes invariably receives large applications of manure previous to planting. Some green manuring, or the turning under of green crops, is practiced, particularly on the sandy soils, rye or clover generally being used for this purpose. Crushed limestone is used rather extensively. Some of it is shipped in car lots into the county from commercial quarries within the State, and a large part of the crushed limestone used in the southern part of the county comes from local quarries. Crushed limestone is used for peas for canning, alfalfa, and sweetclover and is applied at a rate ranging from 2 to 3 tons to the acre. A small amount of commercial fertilizer of about a 2–12–2 [3] formula has been used on corn and small grain, the average application for corn being between 125 and 150 pounds to the acre and for small grain about 250 pounds. Commercial fertilizer serves as a supplement to barnyard manure rather than an inde-

[3] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

pendent or major source of fertility. According to the United States census report, $16,099 was spent for fertilizers (including lime) in Trempealeau County in 1924.

The equipment necessary for average dairy farming is rather more elaborate than that required for other types of farming. Sufficient and well-constructed buildings to house all livestock and to furnish storage space for all feed and equipment are practical necessities. Modern labor-saving machinery is used in nearly all farm operations. Electric light and power from a home plant or from a power line, milking machines, and ½-ton or 1-ton trucks are rather general but not universal equipment. An average of 18 head of cattle, 4 head of horses, and 11 head of hogs is found on the farms.

Farm labor is almost wholly American and is fairly efficient. During recent years, owing to high wages and the low prices of agricultural products, the tendency has been to operate the farms with less hired help. Though labor is not abundant, the supply appears to satisfy the demand. Most of the laborers are hired by the month for the busiest five or six months of the year. Some labor is hired by the year on some of the larger farms, and some is hired by the day during the very busiest seasons and for specific purposes. The monthly wage ranges from $45 to $55. The total amount expended for labor in 1924 was $455,662.

The average size of farms in 1930 was 145.6 acres, but the actual size varies considerably. In the hilly sections the farms probably average about 200 acres in size, and in the smoother parts of the county the range, in general, is from 80 to 120 acres.

Farm tenancy has gradually increased since 1880. In that year 4.5 per cent of the farms were operated by tenants, and in 1930, 20.2 per cent. Both cash-rent and share-rent systems are practiced. Under the cash-rent system, the tenant furnishes all equipment and labor and receives all the farm income, paying a stipulated sum for the use of the farm. The farms are generally rented for a period of one year. The share-rent system is somewhat flexible. Under one common arrangement the owner furnishes the farm and the grass seed, and the renter furnishes the labor, machinery, and the productive livestock; the owner receives one-third of the gross income and the renter two-thirds. In another arrangement the owner furnishes part of the livestock and receives a larger proportion of the farm income. The exact ageement in share renting depends partly on the amount of capital the renter has available for operating the farm.

The agricultural values of the various soils of the county differ widely. The present value (1927), of the best land, according to actual sales, ranges from $150 to $175 an acre, including buildings. In the hilly sections average farm land, consisting for the most part of rolling areas of the silt loam soils, ranges in value from $75 to $90 an acre. Owing to the fact that sales of farms are made under various conditions and that farms invariably include two or more distinct soil types, it is impossible to establish, with any degree of accuracy, an actual monetary value for each different soil. A relative value, however, can be established to some degree by a comparison of the soils according to their productivity and range of usefulness, which will be brought out under the descriptions of the various soil types.

SOIL SERIES AND TYPES

Soils are classified on the basis of soil characteristics which result from climate, natural vegetation, and the character of the material from which they are derived. A soil series includes soils which are similar in structure; color; relative arrangement, chemical composition, and thickness of the horizons; and character of the parent material. The members of a series differ from each other in texture, or the relative amount of sand, silt, and clay in the soil, and are called soil types. Minor variations within the soil types are the basis for further differentiation into phases. In Trempealeau County the soils are grouped in 11 soil series, including 19 soil types and 15 soil phases. In addition three miscellaneous classes of material are mapped.

The Boone series includes the timbered or previously timbered light-colored upland soils derived from sandstone or shale. The subsurface soils of the Boone soils, with the exception of Boone fine sand, are heavier textured than the surface soils and are underlain by material which grades into disintegrated or rotten sandstone or shale. Four soils and six phases of soils of the Boone series are recognized.

The Clinton series includes the timbered or previously timbered light-colored upland soils composed mostly of loessial or wind-blown material. The subsurface soils are heavier than the surface soils, but the underlying material is floury silt. Soils of this series are acid in reaction, but, where the silt is 10 or more feet deep, calcareous or limy material occurs. Only one member of this series, Clinton silt loam, with a steep phase, is mapped.

In the Dubuque series are grouped the timbered or previously timbered grayish-brown upland soils derived from and underlain by limestone. The subsoils are reddish-brown heavy hard clay underlain at a depth of about 30 inches by chert and rotten limestone fragments. The soil material is acid in reaction. One soil of this series, Dubuque silt loam, is recognized in this county.

The Bates soils are upland prairie soils, composed mainly of silty material and underlain at a depth of 40 or more inches by shale or sandstone. The subsoils are heavy silt loam. The soils are acid in reaction throughout. Bates silt loam is mapped.

The Sparta series includes the brown sandy river-terrace soils. They are acid in reaction. The soil material is derived from sandstone but has been transported and redeposited by the larger streams. Sparta fine sand, with a gently rolling phase, and Sparta sandy loam are mapped.

Soils of the Bertrand series are the grayish-brown river-terrace soils having an acid reaction. The subsurface soils are heavier than the surface soils, and the subsoils range from silty to sandy loam material. Bertrand silt loam, with a mottled-subsoil phase, Bertrand loam, and Bertrand fine sandy loam are mapped.

The Trempealeau soils are the river-terrace soils having a distinct reddish-brown color continuing to a depth ranging from 18 to 24 inches, below which depth is a lighter-colored sandy subsoil. The fine sandy loam, loam, silt loam, and sandy loam members of the Trempealeau series occur in this county.

Soils of the Waukesha series include the prairie or black river-terrace soils. The subsurface soils are generally a little heavier than the surface soils, and the subsoils in most places are heavy silt loam. The soil material is acid in reaction. Waukesha silt loam, with a mottled-subsoil phase, is mapped in Trempealeau County.

No typical areas of the La Crosse soils occur in this county, but dark-colored phases of the silt loam, loam, fine sandy loam, and sandy loam members are mapped. They include the dark-brown river-terrace soils having gravelly or sandy subsoils. The soils are acid in reaction.

The Wabash series includes the dark-colored or nearly black soils occurring in the stream bottoms. The subsoils are variable but tend to be heavy and dark colored. Wabash silt loam, with a better-drained phase, is mapped.

The Genesee series includes the light-colored or light-brown first-bottom soils. Only the silt loam occurs in Trempealeau County.

The alluvial soils (undifferentiated) include areas of first-bottom land so variable in character that separation into soil types is not possible.

Peat includes the organic soils, that is, those soils composed for the most part of disintegrated and partly decomposed organic matter. Peat, with a shallow phase, is mapped.

Rough broken land includes all areas that are exceedingly steep (having more than a 28 per cent slope), stony land, or both, which have only a thin covering of soil material. This land is nonagricultural.

In the following pages the soils of Trempealeau County are described in detail and their utilization is discussed. The map accompanying this report shows the distrbution of the soils, and Table 5 gives their acreage and proportionate extent.

TABLE 5.—*Acreage and proportionate extent of the soils mapped in Trempealeau County, Wis.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Boone silt loam	18,368		Trempealeau loam	1,792	0.4
Rolling phase	117,632	28.7	Trempealeau silt loam	832	.2
Level phase	512		Trempealeau sandy loam	1,152	.2
Boone loam	10,112		Waukesha silt loam	3,968	
Steep phase	8,256	4.1	Mottled-subsoil phase	3,968	1.6
Level phase	1,344		La Crosse silt loam, dark-colored phase	1,792	.4
Boone fine sandy loam	25,280		La Crosse loam, dark-colored phase	1,408	.3
Steep phase	7,040	7.3	La Crosse fine sandy loam, dark-colored phase	2,048	.4
Level phase	2,368		La Crosse sandy loam, dark-colored phase	576	.1
Boone fine sand	9,408	2.0	Wabash silt loam	11,904	4.3
Clinton silt loam	35,904	12.4	Better-drained phase	8,640	
Steep phase	23,424		Genesee silt loam	7,552	1.6
Dubuque silt loam	6,336	1.3	Alluvial soils (undifferentiated)	17,920	3.8
Bates silt loam	896	.2	Peat	8,704	2.1
Sparta fine sand	13,312	4.6	Shallow phase	1,408	
Gently rolling phase	8,384		Rough broken land	77,440	16.2
Sparta sandy loam	1,984	.4	Total	476,800	
Bertrand silt loam	14,656	3.5			
Mottled-subsoil phase	2,048				
Bertrand loam	1,728	.4			
Bertrand fine sandy loam	12,992	2.7			
Trempealeau fine sandy loam	3,712	.8			

BOONE SILT LOAM

Boone silt loam is the predominant upland soil of the county and is the most important soil agriculturally. In virgin areas the surface 1½-inch layer is dark-brown silt loam mixed with partly decomposed organic matter. Below this the soil is grayish-brown or light yellowish-brown floury smooth slightly crumbly silt loam underlain, at a depth of 8 or 10 inches, by dark yellowish-brown rather hard crumbly heavy silt loam or clay loam which breaks into cubical somewhat resistant hard blocks ranging from one-fourth to 2 inches in diameter. Below a depth of 20 or 22 inches the soil material may grade into yellowish-brown soft smooth but heavy silt loam containing some shale or sandstone fragments. Invariably at a depth of 34 or 36 inches sandy or stony material occurs. About 70 per cent of Boone silt loam is underlain by shale and the remainder by sandstone. In a few places the underlying shale has been found to be alkaline, but this condition does not seem to affect the reaction of the soil. Almost invariably the material in the surface layer is slightly acid, and throughout the rest of the profile it is strongly acid. In spots the surface soil has been eroded, and the heavier subsoil is exposed. In such places the surface is frequently strewn with shale or sandstone fragments.

The aggregate area of Boone silt loam and its phases is 213.3 square miles. This soil and its phases occupy the major part of the ridges and slopes of the upland, with the exception of the high ridges south and southeast of Arcadia.

Drainage is good. A few seepy or springy spots occur, but most of them are less than an acre in extent.

Probably 90 per cent of the land is cleared and farmed, and it is almost wholly devoted to general farming. Some cash crops are grown, particularly tobacco, peas for canning, and some cucumbers for pickling. Only a small acreage is used as grazing land because in most places areas of the rolling phase, which is better adapted to grazing than to cropping, are closely associated with the typical soil.

Corn ordinarily yields from 40 to 45 bushels to the acre, oats about 40 bushels, barley about 35 bushels, and mixed timothy and clover hay from 2 to 2½ tons. Alfalfa, which is being grown in a small way, yields from 3 to 4 tons to the acre. Tobacco, when given good care, will produce acre yields ranging from 1,300 to 1,500 pounds, and exceptional yields of more than 1,700 pounds are reported. Buckwheat is grown to some extent, particularly in the northern part of the county. Cucumbers during dry seasons frequently do better on this than on the lighter-textured soils. The soil is well suited to the production of apples.

Where Boone silt loam occurs in fairly extensive areas or in conjunction with other fertile gently rolling soils, a fairly definite crop rotation is followed. A 3-year rotation of corn, small grain, and mixed timothy and clover is the basic cropping system. This is frequently varied; two successive crops of corn are sometimes grown, or it may be necessary to plant a second crop of small grain for a nurse crop, or a poor "catch" of seeding elsewhere on the farm makes it advisable to hold an old meadow over for another year. When tobacco is grown it generally follows corn and in turn is

followed by a small grain. Where small areas of Boone silt loam are farmed in conjunction with large areas of steep land, the rotation system has to be practically abandoned, owing to the apparent necessity of growing cultivated crops continuously on the less rolling land.

The fertility of Boone silt loam is maintained mainly with barnyard manure which is generally applied before plowing for corn and to some extent is used as a top-dressing on new seedings of grass or grain. When this soil is farmed in conjunction with steep land, it receives comparatively heavy applications of manure, owing to the heavier cropping and to the comparatively greater difficulty of applying it on the steeper soils. When alfalfa is being started, crushed limestone at the rate of 2½ or 3 tons to the acre is applied after plowing but before seeding. Some mixed fertilizers (about a 2–12–2 mixture) have been used successfully on corn, but at the present time are not in general use.

Boone silt loam, level phase.—The level phase of Boone silt loam is differentiated from Boone silt loam entirely on the basis of relief. It includes those areas of Boone silt loam that have a slope of less than 4 per cent. The soil characteristics of the phase are practically identical with those of the typical soil. Practically all this level land occurs in the northeastern corner of the county just south of Osseo, in small tracts ranging in size from 15 to 60 acres. Though the surface is nearly level, drainage is good, and there is practically no danger from erosion. On account of its smooth surface, soil of the phase is more desirable than the gently rolling land.

Practically all the land is under cultivation and is devoted almost wholly to general farm crops. Crops, yields, methods of handling the soil, and fertilization are practically the same as on typical Boone silt loam.

Boone silt loam, rolling phase.—The rolling phase of Boone silt loam differs from the typical soil in degree of average slope, the typical soil having a slope ranging from 4 to 14 per cent, whereas the rolling phase has a slope ranging from 14 to 30 per cent. Soil of the rolling phase is somewhat shallower and includes more stony and eroded patches, but in general the undisturbed soil is identical with that of typical Boone silt loam. The aggregate area of this soil is considerably greater than that of the typical soil.

Drainage is good. In the steeper areas, where the topsoil has been eroded, a large part of the rainfall is lost as surface run-off. Vegetation on these spots suffers from the lack of soil moisture. In a few small areas along the bases of the slopes, springs or seeps keep the ground saturated with water. Erosion is a problem to be considered in the management of this soil. Because of the heavy resistant subsoil deep gullies do not develop very rapidly, but where the soil is cultivated sheet erosion is very damaging. In some places fields have been abandoned for cropping purposes because the surface soil has been washed away.

Probably 60 per cent of the rolling phase of Boone silt loam is tilled, and about 40 per cent is in permanent pasture, either timbered, covered with brush, or more or less cleared. In some of the more remote areas the timberland is not pastured. The timber, most of which has grown up within the last 45 years, is mainly red oak, with

some black oak, white oak, hickory, poplar, white birch, and cherry. Oak at the present time is used mainly for fence posts and stove wood, though some is cut for cordwood, particularly when land is being cleared, and the best is sawed into rough lumber. Poplar is cut and shipped to Eau Claire as pulpwood.

Owing to the susceptibility of this rolling land to erosion, cultivated crops are not grown extensively. Small grain, particularly oats, barley, winter wheat, mixed spring wheat and oats, and mixed timothy and red clover hay are the predominant crops. Oats and mixed oats and wheat occupy 18 or 20 per cent of the land, barley about 4 per cent, winter wheat about 4 per cent, hay crops about 20 per cent, pasture in rotation with other crops about 10 per cent, and cultivated crops about 3 per cent. The soil is well suited to apple growing, and most of the orchards of Little Tamarack Valley are located on it.

A systematic rotation is not easily followed on this soil. Generally small grain is grown two or three years in succession, followed by a hay crop. If the stand remains good the second year, it may be cut for hay again, and the land frequently remains in meadow for three years or is used as pasture for a season or two. When the sod is broken, corn, mixed oats and wheat, or wheat alone may be grown. Where alfalfa is grown on this soil, it is generally left for a period of years, or as long as the stand remains good.

Under favorable conditions oats yield 50 bushels to the acre, and the average yield is between 35 and 40 bushels. Hay generally yields about 2½ tons and wheat 18 or 20 bushels, although some yields as high as 30 bushels have been reported. Much of this rolling land receives very little manure because of the difficulty of hauling and applying it. Very little commercial fertilizer is used. Lime has been used by a few farmers in getting alfalfa started, from 2½ to 3 tons to the acre being the usual rate of application.

BOONE LOAM

In cultivated areas of Boone loam the surface soil to a depth of 6 or 8 inches is grayish-brown or brown friable loam. In timbered areas the topmost inch of material is dark grayish brown, as it contains a variable amount of disintegrated and partly decomposed organic matter. Below a depth of 6 or 8 inches the material becomes heavier loam or sandy clay loam and the color grades to yellowish brown. The most compact material occurs at a depth of about 18 inches below the surface. At a depth ranging from 24 to 28 inches, the subsoil grades into looser sandier material, and below a depth of 28 or 30 inches the soil is somewhat sticky bright yellowish-brown or yellow loamy sand. Shale, or more generally, sandstone fragments almost invariably occur in the deeper part of the subsoil, and in many places rotten sandstone bedrock is reached at a depth ranging from 30 to 40 inches. As a rule the surface soil on the more exposed areas is sandy loam or fine sandy loam rather than loam. The soil is medium or strongly acid throughout.

Boone loam is an upland soil and is fairly well distributed throughout the northern part of the county, particularly in the northern tier of townships. It does not occur to great extent in the upland south of the Trempealeau River Valley.

The surface of the land is undulating or gently rolling, and drainage is good. Erosion does not interfere very much with cultivation except where the soil receives surface run-off from land above.

Nearly 95 per cent of the Boone loam is under cultivation, and most of this is devoted to general farming. The crops are rotated to some extent, depending on the soils farmed in conjunction with this soil. Corn, small grain, and mixed timothy and clover hay are the most common crops, and barley, rye, and buckwheat are grown to some extent. Cucumbers for pickling do well but are not so commonly grown as on Boone fine sandy loam and Boone fine sand. Some of the land is kept in permanent pasture and furnishes good grazing except during long dry periods. On farms where Boone loam is farmed in conjunction with steeper land, it is used extensively for the production of cultivated crops. In such places, corn may be planted several years in succession or alternated with a crop of oats or other small grain.

Under good management, this soil is nearly as productive as the Clinton and Boone silt loams. Under continuous cropping, however, it is not so durable as Clinton silt loam. The average yield of corn is between 40 and 50 bushels to the acre; of oats, between 35 and 40 bushels; of barley, about 35 bushels; and of mixed hay, about 2 tons.

The use of commercial fertilizers is not very extensive. In starting alfalfa some crushed limestone has been used with good results. Barnyard manure is generally saved and applied to the cultivated crops or the young hay crop. Where special crops, such as cucumbers or tobacco, are grown the soil is given a heavy application of manure.

Boone loam, level phase.—Areas of the level phase of Boone loam are level or gently undulating, and, except for the difference in slope, they are identical with typical Boone loam.

This level soil is inextensive. It occurs for the most part in small irregular patches, all of which are in the northeast part of the county. The largest area is 1½ miles southwest of Osseo, and the other areas are within 4 miles southeast and southwest of this tract.

Practically all the land is under cultivation, being used almost wholly for the production of general farm crops. Peas for canning are grown as a cash crop to some extent. Crops, yields, methods of handling the soil, and fertilization practices are practically the same as on typical Boone loam.

Boone loam, steep phase.—The steep phase of Boone loam differs from the typical soil primarily in that it occurs on steep slopes. It includes areas that are so steep as to make the prevention of erosion an important factor in the care and methods of cropping this soil. On the whole, the soil is shallower than the typical soil and stony knolls and sandy outcrops are more common.

This steep soil occurs in comparatively small and irregular areas, principally on hillsides and at the heads of small coulees. It is most extensive in the central part of the county north of the Trempealeau River Valley, but small areas are scattered throughout most of the county.

The land is well drained. Owing to its lighter subsoil, it is somewhat more susceptible to erosion than the rolling phase of Boone silt loam, but the cropping systems on the two soils are very similar.

A large part of the land is devoted to hay crops, permanent pasture, and oats. Winter wheat, barley, and buckwheat are also grown, but the acreage in cultivated crops is very small.

Yields average a little lower than on typical Boone loam, because the soil is shallower, there is smaller reserve of water for plant growth, and the steep lands do not receive so much manure as do the more accessible and level fields.

Probably 65 per cent of this steep land is cleared and cropped; the remainder is more or less timbered and is used for permanent pasture. The timber growth consists chiefly of red oak, with some black oak, white oak, hickory, poplar, and cherry, but few trees are more than 14 inches in diameter.

BOONE FINE SANDY LOAM

The surface 1½-inch layer of Boone fine sandy loam is dark-brown fine sandy loam containing some organic matter. Below this and continuing to a depth ranging from 7 to 10 inches the soil is light-brown or brown fine sandy loam which grades into yellowish-brown slightly compact heavier fine sandy loam or fine sandy clay loam. This heavier layer in turn grades into lighter-textured material at a depth of about 22 inches, and at a depth ranging from 24 to 30 inches yellow or pale-yellow fine sand of loose open consistence occurs. This material may rest on sandstone at a depth of 30 inches or it may extend to a depth ranging from 5 to 6 feet, at which depth it invariably overlies sandy shale or sandstone.

In some areas the surface soil is dark brown to a depth of 8 or 10 inches and the subsoil is dull yellow or drab. The greater thickness of the dark-colored surface layer is owing to a higher content of organic matter, the preservation of which has been favored by poor drainage resulting from seepage water. The two principal areas of this variation are about 35 acres lying along the east side of Tappen Coulee in sec. 22, T. 21 N., R. 7 W., and about 15 acres on the north side of Elk Creek, in the NE. ¼ NE. ¼ sec. 19, T. 23 N., R. 7 W.

Boone fine sandy loam is slightly acid in reaction in the upper 2 inches, below which it is strongly acid.

The aggregate area of this soil and its phases is 54.2 square miles. It is an upland soil, occurring mainly on the lower slopes throughout the eastern part of the county north from the vicinity of Ettrick and throughout the northern tier of townships. A few areas occur along the Trempealeau River Valley as far south as Arcadia. The most extensive areas are in T. 24 N., R. 7 W.

Areas of this soil are undulating or gently rolling. Drainage is good except in a few small seepy spots, and in such places tile drainage would be beneficial.

Probably 90 per cent of the land is tilled. On farms where it is the predominant soil, a fairly definite rotation of corn, oats, and mixed timothy and clover for hay and pasture is followed. Small grains (oats, barley, and rye) probably occupy the largest acreage, followed in order by corn, hay crops, and pasture. Small acreages of cash crops, usually from 5 to 10 acres of buckwheat, from one-half to 1 acre of cucumbers, or from 1 to 3 acres of tobacco, are common on this soil, especially in those parts of the county where the predominant soils are silt loams.

Crop yields are good on this soil where the land is properly cared for. Though this is a light-textured soil it is not particularly droughty, as it contains enough fine material to give it a fairly good water-holding capacity, and it is not so susceptible to crusting or baking as are the heavy upland soils. However, its natural fertility is less than that of the heavier-textured soils. Corn ordinarily yields from 35 to 40 bushels to the acre, oats from 30 to 35 bushels, and mixed timothy and clover hay about 2 tons.

Soil fertility is supplied almost wholly through the use of barnyard manure which is generally applied preceding a cultivated crop or as a top-dressing on the young hay crop. When cultivated cash crops, such as cucumbers or potatoes are grown, a heavy application of barnyard manure is made on this soil.

Boone fine sandy loam, level phase.—The level or gently undulating relief of the level phase of Boone fine sandy loam is the only characteristic distinguishing this soil from the typical soil. The total extent of the phase is rather small, but it occurs in comparatively large or contiguous areas, almost all of which are in the central and southeast parts of T. 24 N., R. 7 W.

Although the surface is nearly level, drainage is good, and practically all the land is tilled. This soil is not subject to erosion. The crops grown, yields, and methods of handling the soil are the same as on typical Boone fine sandy loam.

Boone fine sandy loam, steep phase.—The steep phase of Boone fine sandy loam differs from the typical soil primarily in its occurrence on slopes. As a result of the steeper slope of the land, the soil is shallower. As a rule the subsurface soil is not distinctly heavier than the surface soil, and the subsoil generally becomes stony at a depth of 18 or 20 inches. Stony and sandy outcrops are common.

This soil occurs in small irregular areas, mainly on the steep hillsides where sandstone is the underlying rock. Nearly all of it is in the eastern part of the county north of Ettrick and south of Osseo.

Drainage ranges from good to excessive. The relief, texture, and shallowness of the soil all tend to limit its water-holding capacity. This soil is susceptible to erosion.

About 65 per cent of the land is tilled, and the rest is in pasture. Small grain and mixed timothy and clover hay are the most common crops. The soil is best adapted to hay crops and to grazing. Pasture grasses do well during seasons of plentiful rainfall but soon dry up during a dry period. Corn is not grown to a great extent. Little fertilizer is applied as this soil has low producing power and is susceptible to washing.

BOONE FINE SAND

Boone fine sand is the dry sandy soil of the gently rolling or sloping uplands. In undisturbed areas, the surface 1½-inch layer is dark-brown loamy fine sand containing a few fibrous grass roots, but under cultivation this darker layer disappears. To a depth of about 14 inches, the soil material is brown or yellowish-brown loose loamy fine sand. Below this depth the color gradually fades to light brown or brownish yellow and the texture becomes fine sand or sand, and below a depth of 30 inches the material almost invariably is yellow loose fine sand. Sandstone fragments may

occur in this layer, but in most places the loose sand material extends to a depth of more than 40 inches. The soil throughout is medium or strongly acid in reaction.

This soil occurs largely on the southern lower slopes of the Buffalo River Valley, in appreciable areas along the southern side of Elk and Pigeon Creek Valleys, and to some extent along the Trempealeau River Valley in the vicinities of Blair and Whitehall. Small scattered areas occur elsewhere.

The relief is undulating or gently rolling, being smoother on the whole than that of the silt loam, loam, or fine sandy loam of the Boone series. Areas of Boone fine sand in the Buffalo River Valley are undulating, whereas most areas of the other three soils are gently rolling. No steep phase of Boone fine sand has been indicated, whereas the greater part of Boone silt loam occurs as a steep phase.

Drainage is excessive, due to the loose sandy character of the soil. Erosion is not a very serious menace, although where drainage channels have begun to cut through this soil, the eroding action is very rapid and deep on account of the lack of resistance afforded by the sand against actual stream action.

Probably 90 per cent of the land is cleared, but about half the cleared land lies fallow. The cropped acreage is devoted largely to general farm crops, particularly rye, corn, and oats, with buckwheat and mixed timothy and red clover next in importance. Cucumbers are grown extensively and give good yields if the weather does not become too dry during the harvest season. This soil is poor grassland and very little of it is used for pasture.

Yields of all general farm crops are comparatively low. Although the soil is lacking in fertility, it generally receives less consideration in regard to crop rotation and the application of fertilizers than do the other soils of the Boone series. Under ordinary conditions, rye yields about 10 bushels to the acre, corn about 25 bushels, oats about 25 bushels, buckwheat about 10 bushels, and mixed timothy and clover hay about 1 ton.

Where this soil is farmed in conjunction with more fertile types of soil, it receives applications of barnyard manure, particularly for the cultivated crops. Heavy applications of manure are always made for the cucumber crop. Some crushed limestone has been applied for the purpose of starting alfalfa, the usual application being about 2½ tons to the acre.

As much of this soil is unfit for crop production under any practical circumstances it could well be reforested.

CLINTON SILT LOAM

Clinton silt loam is the deep silty soil occurring on many of the slopes and lower ridges of the upland areas. In its undisturbed condition the upper 1½-inch layer is dark grayish-brown friable silt loam which is underlain to a depth of about 8 inches by grayish-brown soft friable silt loam. Though grayish brown is the predominant color of the topsoil, variations to brownish yellow occur in places. Below this layer the material gradually becomes heavier and of a more pronounced brown color. From a depth of 12 or 14 inches to a depth of about 36 inches, the color is yellowish brown or brown, and the texture is very heavy silt loam or slity clay loam.

When broken or crumbled the soil material breaks readily into firm angular particles ranging from one-fourth to 1½ inches in diameter. In the lower parts of this layer the blocks are larger and are not so firm or resistant to pressure. This heavier layer is underlain by yellowish-brown or brownish-yellow silt loam that rapidly loses, with depth, its tendency to break into blocks. Downward the yellowish-brown color becomes less pronounced until, at a depth of 70 inches, gray is the predominant color. In many places the soil is lightly mottled with brownish yellow, gray, and bluish gray below a depth of 60 inches.

The depth of the silt loam varies from 5 to 30 feet, the shallower areas occurring mostly on the ridges. Where it is more than 10 feet deep, the material below that depth is generally limy or calcareous and in many places it contains lime aggregations or concretions. The underlying rock is sandstone or shale.

Areas of this soil occur in nearly every township in the county. The most extensive areas are in the upland of the central and southern parts, particularly in the region directly south of Whitehall and east of Arcadia. The soil commonly occurs on the lower gentle slopes of the valleys or on the ridge tops. The areas, which are irregular in shape, conform markedly to the relief, following the ridge tops on the one hand or continuing along the valleys on the other.

The relief is undulating or gently rolling, and the soil is well drained. Owing to its silty texture and favorable structure, its water-absorbing and water-holding capacity is good, and as a consequence the late summer droughts are not so disastrous to crops on this soil as to those grown on most of the other soils of the county. Because of the gentleness of the slopes, erosion is not very serious. Gullies are seldom developed except where water draining from other soils flows through areas of this soil.

The natural forest vegetation is mixed red and white oak, the red oak predominating. Some hickory, cherry, poplar, and aspen are intermixed. The aspen generally appears in areas from which the hardwood timber has been cut. In the more open timbered areas a dense growth of underbrush, predominantly hazel brush and blackberry, readily develops. The natural grass is bluegrass (locally called June grass), and in places white clover is intermixed with the bluegrass.

Probably 90 per cent of the land is tilled, the remainder being in cleared or timbered permanent pasture. Small grains occupy the largest acreage. Oats and mixed oats and wheat are most extensively grown, but barley and winter wheat are also important. Mixed timothy and clover is the common hay crop and probably ranks next to small grain in acreage. Alfalfa is becoming common on this soil, although the acreage is not very large as yet. Corn is grown rather extensively on areas of this soil occupying the lower slopes but is grown less commonly on the ridges, owing to the greater difficulty of caring for the crop and applying manure. The acreage in tame-hay pasture probably equals that in corn. Of the cash crops, peas rank foremost in acreage, and tobacco, though not occupying a large acreage, has a total money value approaching that of peas. A part of the winter wheat is grown as a cash crop, and the rest is used as feed or is milled for home use.

Under normal conditions, oats yield from 45 to 50 bushels to the acre, barley from 35 to 40 bushels, corn about 45 bushels, wheat from 20 to 25 bushels, mixed timothy and clover about 2½ tons, and alfalfa between 3 and 3½ tons. Oats have been known to yield more than 60 bushels to the acre, and wheat has averaged more than 30 bushels.

Crop rotation is practiced on the lower slopes of Clinton silt loam areas, but the crops grown on the ridge tops are not commonly rotated systematically, owing to the greater difficulty of handling the crops and applying manure. The ridges are devoted largely to the production of mixed timothy and clover and to small grain, particularly oats and mixed oats and spring wheat. Where a systematic rotation is used, a small-grain crop follows corn and is in turn followed by mixed timothy and red clover for hay. Sometimes small grain is grown two years in succession, making a 4-year rotation, but the 3-year rotation is probably more common.

Barnyard manure is generally applied before plowing for corn, or it may be applied on the new hay-crop seeding. Tobacco receives a heavy application of manure. Land for growing peas very frequently is given a treatment of 2½ or 3 tons of crushed limestone to the acre, and alfalfa land is almost invariably given this treatment. Some commercial fertilizer of about a 2–12–2 mixture has been used successfully for corn.

Clinton silt loam, steep phase.—The steep phase of Clinton silt loam differs from the typical soil in having a rolling or steep surface. Where this steep soil has been cropped continuously, particularly where cultivation has been practiced, more or less of the surface soil has been eroded and as a consequence this layer is thinner, but in undisturbed or virgin areas the surface soil is practically as deep as that of the typical soil.

This soil occurs principally in the central and southern parts of the county, particularly on the steep valley slopes south of Arcadia and east of Dodge. Smaller areas are scattered over various parts of the county.

Owing to the rolling or steep surface of this soil, drainage is good or excessive. Over virgin areas or grass-covered areas erosion is not a serious problem, but where cropping is practiced care must be taken to prevent the washing away of the topsoil and the development of gullies.

Probably 60 per cent of the land is tilled, and the remaining 40 per cent is in permanent pasture either timbered, covered with brush, or partly cleared. The timber growth is the same as that on typical Clinton silt loam.

Cultivated crops are not grown extensively, because of the danger of erosion when the topsoil is left unprotected. Under the usual cropping system small grain is grown for a period ranging from one to three years, followed by mixed timothy and clover for hay for a similar period. Occasionally corn is grown for one year after a meadow sod is broken up.

Oats, winter wheat, barley, and mixed oats and spring wheat are the most common small-grain crops grown. The yields of all crops average a little lower on this steep soil than on typical Clinton silt loam. Fertilization ordinarily is not practiced systematically. Some

barnyard manure is used, and where alfalfa is to be started crushed limestone is applied at a rate of 2½ or 3 tons to the acre.

In Table 6 are shown the results of mechanical analyses of samples of the surface soil, the subsurface soil, and several layers of the subsoil of typical Clinton silt loam.

TABLE 6.—*Mechanical analyses of Clinton silt loam*

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
314321	Surface soil, 0 to 2 inches	0.0	0.2	0.5	1.2	28.0	61.5	8.6
314322	Subsurface soil, 2 to 9 inches	.2	.2	.8	1.7	26.9	62.3	8.0
314323	Subsoil, 9 to 36 inches	.9	.3	.6	.9	22.7	64.5	11.0
314324	Subsoil, 36 to 72 inches	.0	.8	1.8	2.8	38.0	50.0	6.5
314325	Subsoil, 72 to 108 inches	.0	.7	.7	1.0	39.5	52.4	5.6
314326	Subsoil, 108 to 180 inches +	.2	.6	.7	6.4	43.2	45.0	3.8

DUBUQUE SILT LOAM

Dubuque silt loam is a light-colored shallow upland soil underlain by limestone. The surface 1½-inch layer is grayish-black silt loam mixed with grass roots and partly decomposed organic matter. A small amount of chert may be scattered on the surface. Below the surface layer light grayish-brown friable soft silt loam extends to a depth of about 6 inches, below which the material gradually becomes heavier and to a depth of 16 inches is predominantly yellowish-brown compact heavy silt loam or clay loam which is sticky when wet. Between depths of 16 and about 25 inches is hard, firm, brownish-red clay that breaks into angular fragments from one-fourth to 2 inches in diameter. Some chert or flint is intermixed with the material. At a depth of 25 or 30 inches the color becomes a little darker (reddish-brown), a little more chert is in evidence, and the lumps are harder and more resistant to pressure. At a depth ranging from 40 to 60 inches the soil material rests on a mass of weathered cherty limestone fragments.

Dubuque silt loam occurs on the limestone-capped ridges south of Arcadia and northwest of Galesville, and a few small isolated areas are along the county line north of Arcadia.

The relief ranges from gently rolling to steep. The outer edges of the ridges, especially at the heads of the small valleys, are steeper than the main part of the ridges, but owing to the small size of these steep areas they were not mapped separately as a steep phase.

Although the heavy clay subsoil retards the downward movement of water, drainage as a whole is good, owing largely to the fact that the ridges are narrow and have sufficient slope to rapidly remove all surface water.

About 85 per cent of the land is cleared and tilled. The farmed areas are devoted to the production of grain and forage crops to be consumed on the farms by dairy cattle.

The natural vegetation is red oak, white oak, and some hickory, with a thin undergrowth of hazel brush and blackberry vines. The undergrowth becomes dense where the timber is thin or has been cut. Natural grass vegetation, where the timber and brush growth is not

heavy, is luxuriant and develops a firm tough sod which affords good grazing during most of the growing season.

Oats probably cover the largest acreage of any crop, with mixed timothy and red clover ranking second, and tame pasture grasses third. Alfalfa is probably more commonly grown on this than on any other soil in the county. Owing to the heavy clay subsoil, corn does not do so well as it does on other well-drained silt loam soils and is not grown so extensively.

Oats yield from 40 to 50 bushels to the acre and mixed timothy and clover hay about 2½ tons. Yields of corn are comparatively low and vary considerably from one year to another.

Barnyard manure is commonly used to supply fertility, but little, if any, commercial fertilizer is used. Crushed limestone applied at the rate of 2½ or 3 tons to the acre, is more generally used for starting alfalfa on this soil than on other soils, largely because of the convenient location of limestone quarries.

BATES SILT LOAM

The surface soil of Bates silt loam, to a depth of 12 or 14 inches, is mellow friable nearly black silt loam. Below this layer the color is dark brown, and the material grades to heavy silt loam or light silty clay loam in texture. At a depth of about 20 inches the color grades to lighter brown or brownish yellow and the heavy texture gives way to floury friable silt loam. Sandstone or shale lies at a depth ranging from 42 inches to 8 feet below the surface.

The areas of this soil are small and scattered. They occur along the lower edges of the valley slopes. The principal areas are in sec. 21, T. 21 N., R. 7 W., just south of Blair; in the vicinity of Galesville in secs. 27, 30, 31, and 33, T. 19 N., R. 8 W.; and just northwest of Centerville in secs. 27, 29, and 32, T. 19 N., R. 9 W.

Areas of Bates silt loam are for the most part undulating or gently rolling, and drainage is good.

Practically all the land is cleared. The steeper slopes are devoted partly to grazing, but the greater part of the land is used for the production of grain and forage crops. Corn and oats occupy about equal acreages, with mixed timothy and clover ranking next. Alfalfa, barley, and mixed oats and wheat are grown to some extent.

Bates silt loam is one of the most fertile soils in the county. Corn ordinarily yields about 50 bushels to the acre, oats about 50 bushels, and mixed timothy and clover about 2½ tons. Methods of cropping and fertilization are similar to those practiced on Clinton silt loam.

The results of mechanical analyses of samples of the surface soil, the subsurface soil, and the subsoil of Bates silt loam are given in Table 7.

TABLE 7.—*Mechanical analyses of Bates silt loam*

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
314354	Surface soil, 0 to 14 inches	0.5	2.0	4.4	7.2	21.6	52.3	11.9
314355	Subsurface soil, 14 to 22 inches	.0	1.9	4.5	7.1	25.0	52.6	8.7
314356	Subsoil, 22 to 48 inches+	.6	2.1	4.3	11.3	33.5	40.9	7.1

SPARTA FINE SAND

The surface soil of Sparta fine sand to a depth of 10 inches is light-brown or brown loamy fine sand. Below this depth the loaminess decreases and the color fades to lighter brown, and below a depth ranging from 22 to 28 inches the soil is light yellowish-brown or yellow loose fine sand.

In some places on the Mississippi River terrace thin laminations of sticky fine sandy loam or fine sandy clay occur below a depth of 50 inches. The area mapped as Sparta fine sand in T. 18 N., R. 10 W., is much coarser in texture than typical but was included with the fine sand because of its limited area.

The most extensive areas of this soil are on the Mississippi River terraces, in the valleys of Trempealeau and Buffalo Rivers, and smaller areas occur along Elk, Pigeon, and Beaver Creeks.

Areas of this soil are gently undulating or nearly level, and drainage is excessive, except in the depressions, where the soil is a little heavier and underdrainage is not so free.

Probably 70 per cent of the land is tilled. Practically all of it has been cleared and was farmed at some time in the past, but, owing to their unproductiveness, some areas have been allowed to lie fallow in recent years. Some farmers crop the poorer areas every other year and allow the land to lie fallow during the alternate years.

Rye is the predominating crop on this soil, and many of the areas that are cropped in alternate years are used for nothing else. The average yield is about 10 bushels to the acre. Corn is grown to some extent but only where barnyard manure is available. Owing to the looseness of the sand, corn demands care in cultivation in order to prevent disastrous blowing of the soil, but where fertilization has been practiced, fairly good crops have been obtained. When properly fertilized the soil, owing to its good drainage and aeration, produces good crops of high-quality cucumbers. Buckwheat, which is grown in small quantities, does comparatively well. Some oats and hay are grown on the better areas, but the soil is too droughty for the successful production of these two crops.

Fertilization is not given much attention on a considerable part of this soil. Fields that are cropped continuously receive barnyard manure in the years in which corn is grown. Legume-hay crops, particularly mammoth clover, are grown in rotation with corn and rye on a few farms. A small amount of lime has been used on the better areas of this soil on the Mississippi River terrace.

Sparta fine sand, gently rolling phase.—The gently rolling phase of Sparta fine sand differs primarily from the typical soil in having an undulating surface. The profile shows the same characteristics as those of the typical soil except that the surface soil averages a little lighter in color. Due to the more rolling surface, the gently rolling land is somewhat more subject to droughtiness.

This soil occurs throughout the southern half of the Mississippi River terrace in T. 18 N., R. 8 W., and T. 18 N., R. 9 W. The small area in T. 18 N., R. 10 W., is coarser textured, being loamy sand, but due to its small extent was included with the Sparta fine sand, gently rolling phase, in mapping.

Drainage as a rule is excessive.

Much of the land lies fallow, a great part of it being cropped every other year or so. In places, particularly where the soil has been well cared for, fair crop yields are obtained, but as a rule yields are low. Only a part of the land receives any fertilization other than a little barnyard manure.

The poorest areas of this soil could well be devoted to the production of timber. Jack pine, white pine, and spruce do well, as indicated by a 15-year-old planting of these trees in sec. 12, T. 18 N., R. 10 W.

SPARTA SANDY LOAM

Sparta sandy loam is similar to Sparta fine sand, differing from that soil principally in texture. The surface soil to a depth of 10 or 12 inches is medium-brown or dark-brown sandy loam. Below this layer the color fades to brown or light brown and the texture generally becomes loamy sand, although in places it remains sandy loam. Below a depth of 24 inches the material is brown loose sand that grades to yellow sand at a depth of about 36 inches.

This soil is of minor agricultural importance. It occurs in a few small scattered areas along Buffalo River, particularly in the vicinities of Eleva and Osseo, along Trempealeau River, and along the southern edge of the Mississippi River terrace.

Drainage of this soil is good, but it is somewhat excessive for shallow-rooted crops, owing to the open porous character of the soil. Practically all the land is tilled and is devoted mainly to general farm crops, principally corn and rye. When this soil is handled in a rotation good crops are produced, corn yielding about 35 bushels to the acre, rye about 14 bushels, and oats from 30 to 35 bushels. Mixed medium-red clover and timothy constitute the predominant hay crop, and cucumbers for pickling are grown successfully.

Fertilization is limited to the use of barnyard manure, which is generally applied to the corn crop. Lime has been applied in places for the purpose of starting alfalfa, the usual rate of application being 2½ tons to the acre.

Land of this kind is well suited to such special crops as cucumbers, potatoes, beans, and other crops demanding a well-drained soil that warms up quickly in the spring and is conducive to rapid growth.

BERTRAND SILT LOAM

Bertrand silt loam is the light-colored level well-drained silty soil that occurs on the terraces or benches along the larger streams. The surface soil is grayish-brown floury smooth silt loam to a depth of 10 inches, below which the material gradually becomes more compact and shows a change of color toward yellowish brown. Between depths of 15 and about 38 inches the material is yellowish-brown comparatively firm heavy silt loam or light silty clay loam which, when crumbled, breaks into firm angular blocks ranging from one-fourth to 1½ inches in diameter. Below this layer the color becomes lighter brownish yellow and the silty material becomes softer and more friable, until at a depth of 65 or more inches the soil is pale-yellow or nearly gray soft structureless silt loam, in many places somewhat splotched or mottled with pale yellow, bright yellow, and gray.

In some places, as in the area of this soil 1 mile northeast of Arcadia, the subsoil below a depth of about 40 inches is yellow sand containing no mottlings.

The surface soil of Bertrand silt loam is medium acid, and the underlying layers are generally strongly acid or very strongly acid in reaction. Where the silty material extends to a depth of more than 6 feet the acidity generally decreases considerably, and in a few places, as in sec. 24, T. 19 N., R. 10 W., calcareous or limy material is present in the silt at a depth of about 10 feet.

This soil is developed on terraces along all the main streams except Buffalo River, the greater part and the largest areas occurring in the Trempealeau River Valley from the vicinity of Arcadia to a point about 2 miles south of the village of Dodge, and in the Beaver Creek Valley from the vicinity of Ettrick to the vicinity of Galesville.

Areas of this soil are level or gently undulating. No very definite drainage system is developed except where drainage ways from the adjoining upland have cut across the land. In such places ditches, or deep gullies, have developed in some places. The underdrainage in most places is good, being somewhat better in areas having a sandy subsoil within 42 inches of the surface than in areas underlain by silty material.

Practically all the land is cleared and tilled. The small amount of timber remaining consists largely of red oak and white oak. Most of the land is devoted to the production of grain and forage crops, a comparatively small acreage being used as grazing land. Corn and oats, which occupy about equal acreages, are the main crops, and mixed timothy and clover for hay rank next. Barley is an important grain crop, and the acreage of winter wheat, which is grown for feeding purposes, for household use, and as a cash crop, nearly equals that of barley. Alfalfa, though not covering a very extensive acreage, is becoming an important forage crop. Of the cash crops, peas for canning lead in both acreage and value. They are grown principally in the valleys of Beaver Creek and its tributaries. Tobacco and buckwheat are grown in some localities. In the vicinity of Pine Creek potatoes for marketing are grown to some extent.

Owing to its high productivity, Bertrand silt loam is one of the most desirable soils of the county. Corn and oats ordinarily yield about 50 bushels and barley from 40 to 45 bushels to the acre. Winter wheat probably averages 25 bushels to the acre but in specific cases has exceeded 30 bushels. Yields of other crops are comparatively high.

Crop rotation is followed to a considerable extent, especially where the soil occurs in extensive areas. Barnyard manure is the principal material used to supply fertility, and a small amount of mixed commercial fertilizer has been used on cultivated crops. Crushed limestone for alfalfa and peas is used on about 75 per cent of the land devoted to these crops, the usual rate of application being from 2 to 8 tons to the acre.

Bertrand silt loam, mottled-subsoil phase.—The surface soil of the mottled-subsoil phase of Bertrand silt loam is dark-gray soft friable silt loam to a depth of 5 or 6 inches. Below this a tinge of yellow or brownish yellow appears, but the texture and structure do not noticeably change. At a depth of 16 inches below the surface a mottling

of gray and yellowish brown occurs, and the structure becomes somewhat compact and slightly crumbly. Below a depth of 34 inches some of the yellow mottling is replaced by darker rust-colored mottling and the soil becomes fairly plastic heavy silt loam or light silty clay loam.

This soil occupies comparatively poorly drained areas on the stream terraces. It is very inextensive, the only areas mapped being in the vicinity of Beachs Corners, Ettrick, and Frenchville.

Drainage of the land is deficient, owing to the level surface, the heavy subsoil, and a comparatively high water table. Tile drainage would greatly improve the utility of this land, all of which is cleared and the larger part cropped. Except during wet years, corn does well. The soil is well suited to hay crops and grazing. Alsike clover produces a good crop, but alfalfa does not grow well because of the poor drainage.

BERTRAND LOAM

The surface layer of Bertrand loam, to a depth of 7 or 8 inches, is grayish-brown or brown friable loam. Below this is yellowish-brown heavy loam or sandy clay loam, the texture of which gradually becomes heavier with depth. Between depths of about 16 and about 34 inches is the heaviest layer of the soil, the material ranging, in different localities, from heavy sticky loam to sandy clay loam which is rather crumbly bright yellowish-brown or brownish-yellow material. Below this layer the material rapidly becomes lighter textured, and below a depth of 36 inches it is almost invariably yellow sandy loam grading to yellow sand within a distance of 6 inches. In some places the heavy layers are thinner and relatively lighter textured.

Bertrand loam is inextensive. It occurs in small irregular, scattered areas on the terraces of the main streams, the principal areas being in sec. 13, T. 20 N., R. 7 W., sec. 22, T. 22 N., R. 8 W., sec. 31, T. 23 N., R. 8 W., and secs. 12, 13, and 24, T. 22 N., R. 9 W.

The surface relief is similar to that of Bertrand silt loam, and the drainage is good. On account of the sandier subsoil and lighter-textured surface soil, internal drainage is better than in the deep silty areas of Bertrand silt loam.

Practically all the land is cleared and tilled. The crops grown, the methods of handling, and fertilization practices are practically the same as on Bertrand silt loam, but crop yields are not quite so high as on the heavier soil.

BERTRAND FINE SANDY LOAM

Bertrand fine sandy loam is the level rather light-brown sandy soil occurring on the benches or terraces of the larger streams. The surface 10 or 14 inch layer in most places is light-brown or brown fine sandy loam, the color invariably being darker in depressions. The underlying layer, which extends to a depth ranging from 20 to 28 inches, varies in color from yellowish brown to golden brown, and the texture in most places is fine sandy loam. In some places this material is rather compact and crumbles into comparatively firm angular blocks when broken. Below this layer the color gradually fades to brownish yellow or yellow and the texture is fine sand. The areas occurring on the terraces of Trempealeau and Buffalo Rivers and Beaver Creek have a general tendency toward a gray

shade or at least toward a lighter brown, whereas the areas on the Mississippi River terrace have a more brown or rich-brown color.

In a few areas on the Mississippi River terrace the soil, between depths of about 6 inches and 10 inches, has a darker-brown color, indicating a higher content of organic matter. Another variation from typical occurs in the northeast part of T. 18 N., R. 9 W., and in the north part of T. 18 N., R. 8 W. In these areas a thin layer, only 2 or 3 inches thick, of dark-yellow or brown light sandy clay loam occurs in many places at a depth ranging from 33 to 38 inches. This material is crumbly and breaks into weakly coherent angular blocks. Cuts 10 or 15 feet deep in these areas expose 2 or 3 such laminations at greater depths.

The character of the original vegetation on the soil occurring on the Mississippi River terrace was that of oak openings, and a small acreage of red oak still remains. The darker areas before mentioned have evidently been prairies which have been altered on the surface by more or less wind-drifted sand.

This soil occurs on the terraces of the larger streams, particularly those of Mississippi and Trempealeau Rivers. The largest areas are in the northeast part of T. 18 N., R. 9 W., and in the north part of T. 18 N., R. 8 W. About half the total acreage occurs on the Mississippi River terrace.

The relief is nearly level or gently undulating. Natural drainage is good, owing to the open sandy subsoil, and practically all the land is tilled. Crop rotation is practiced rather consistently, a 3-year rotation of corn, small grain, and hay being common. Deviations from this rotation must, of course, be made according to the condition of the new seeding and pasture, the amount of cash crops and alfalfa grown, and the character and extent of other soil types occurring on the particular farm.

Corn and oats are the main crops, each occupying about 25 per cent of the total area of this soil. Mixed timothy and clover is the main hay crop and probably occupies 20 per cent of the land. Alfalfa also is grown successfully but does not cover a very large acreage. The remainder of the soil is used largely for pasture, barley, rye, and a small amount of buckwheat.

Under ordinary conditions, corn yields from 35 to 40 bushels to the acre, oats from 30 to 40 bushels, rye about 13 bushels, and mixed timothy and clover hay about 2 tons. Alfalfa has been known to yield 3 tons to the acre.

Barnyard manure is the principal source of fertilization. Considerable crushed limestone from the Trempealeau quarry has been applied to this soil, the usual rate of application being from 2 to 3 tons to the acre. Some 16 per cent superphosphate (acid phosphate) has been successfully used for corn and small grain.

TREMPEALEAU FINE SANDY LOAM

Trempealeau fine sandy loam is one of the red soils occurring on the benches or terraces of the larger streams. The surface 8 or 10 inch layer is dark chocolate-brown or bright reddish-brown friable fine sandy loam. The next lower layer is heavy somewhat sticky fine sandy loam or loam which is more compact than the surface soil and more red in color. Below a depth ranging from 18 to 24 inches the texture changes rapidly to light fine sandy loam, loamy fine

sand, or loamy sand and the iron coloring quickly disappears. At a depth of 40 inches the material is loose pale reddish-yellow or yellow fine sand or sand splotched or streaked vertically with darker iron stains.

This soil is normally acid in reaction throughout, owing to leaching and to the low lime content of the parent material, the surface soil being medium acid and the lower strata strongly acid. As indicated by the profile description there is a high iron content in the soil to a depth ranging from 18 to 24 inches, whereas below a depth of 40 inches most of the quartz sand grains are colorless or nearly white. In some places iron incrustations and concretions occur on the surface and in the upper 16 or 18 inches of the soil, in a few places being so abundant as to interfere with tillage.

Individual areas of this soil seldom cover more than 25 acres. The soil occurs most extensively in the Trempealeau River Valley between Arcadia and Whitehall, in the Beaver Creek Valley, and to a small extent in both Elk Creek Valley and Buffalo River Valley.

Drainage is generally good, and in a few places it is excessive. The surface is level or gently undulating and in places becomes bumpy, but the range of elevation within any one area seldom exceeds 10 feet.

The land is practically all under cultivation and is largely devoted to grain crops. Corn leads in acreage, occupying nearly 35 per cent of the total area, and oats rank second, occupying probably 25 per cent. The other grain crops grown are barley and rye. Mixed timothy and clover hay frequently follows a small-grain crop. Owing to its sandiness, the soil is not so well adapted to other common grass crops.

Trempealeau fine sandy loam under ordinary farming conditions produces from 30 to 35 bushels of oats to the acre and from 35 to 40 bushels of corn. Mixed timothy and clover, which is the common hay crop, yields about 2 tons to the acre. When midsummer rains follow the removal of the first crop, a good second crop of medium red clover for grazing, hay, or seed is produced.

Barnyard manure, which is practically the only plant food used, is plowed under for corn by some farmers, is used as a top-dressing after plowing for corn, or as a top-dressing on young grass seedings. Very little commercial fertilizer is used. A small amount of lime has been used, the usual rate of application being 2½ or 3 tons to the acre.

Table 8 shows the results of mechanical analyses of samples of the surface soil, the subsurface soil, and the subsoil of Trempealeau fine sandy loam.

TABLE 8.—*Mechanical analyses of Trempealeau fine sandy loam*

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
214331	Surface soil, 0 to 8 inches	0.1	6.0	20.3	36.0	5.1	18.8	10.8
214332	Subsurface soil, 8 to 24 inches	.6	3.9	14.3	33.0	6.3	30.7	11.4
214333	Subsoil, 24 to 38 inches	.0	2.3	10.9	40.7	8.1	27.7	10.2
214334	Subsoil, 38 to 48 inches	.5	25.3	46.5	22.2	.5	.4	.6

TREMPEALEAU LOAM

The surface soil of Trempealeau loam to a depth ranging from 7 to 10 inches is chocolate-brown or dark-brown loam. Below this and continuing to a depth ranging from 16 to 30 inches the color is redder, being reddish brown or bright brownish red, and in practically all places the texture is heavier but this layer nowhere contains finer material than heavy loam or medium silt loam. The third layer, which generally extends to a depth of 35 or 40 inches, is reddish yellow or orange in the upper part and becomes brown, reddish brown, gray, and yellow before a depth of 40 inches is reached. The material in the upper part of this layer may be fine sandy loam but at a depth of 38 or 40 inches the texture becomes fine sand or sand. Below a depth of 40 inches the material generally grades to streaked yellow and cream-colored sand which in some places is nearly white.

As in Trempealeau fine sandy loam, ferruginous incrustations and concretions occur in some areas of this soil, generally in the upper 24 inches, and in a few places they have accumulated to such an extent as to interfere somewhat with tillage. In the area in sec. 6, T. 21 N., R. 7 W., this ferruginous material is particularly noticeable in spots between depths of 8 and 24 inches from the surface.

Trempealeau loam is about as widely distributed as Trempealeau fine sandy loam, the largest areas occurring along Trempealeau River as far down the valley as Arcadia, and in the vlleys of Beaver Creek, Elk Creek, Pigeon Creek, and Buffalo River.

Although the land is nearly level, the porous sandy subsoil provides good drainage.

Practically all the land is cleared and tilled. Corn is the main crop, and oats rank second. Yields average a little higher than on Trempealeau fine sandy loam. Tobacco may be grown on this soil, but it is not so commonly grown on the Trempealeau soils as on some other soils. The crops grown and methods of handling and fertilizing the land are very similar to those on Trempealeau fine sandy loam.

TREMPEALEAU SILT LOAM

The surface soil of Trempealeau silt loam to a depth of 6 or 8 inches is chocolate-brown or light reddish-brown soft slightly resilient silt loam. Below this depth the predominantly dark shade gives way to brownish red which gradually fades to yellowish red or reddish yellow. The texture at a depth of 8 inches loses its slightly resilient character and becomes firm somewhat granular silt loam or loam. At a depth ranging from 28 to 30 inches the color definitely fades to light reddish yellow mottled with reddish brown and iron brown. The sand content increases as the color fades, until, at a depth of 42 inches, the material becomes pale incoherent sandy loam or sand.

In places iron incrustations and concretions ranging from one-fourth inch to 1½ inches in diameter have accumulated, generally in the upper 24 inches of the soil. In places this accumulation lies so thick on the surface that it is somewhat detrimental to the tillage of the soil.

Areas of this soil are level or gently undulating, and the land is well drained. Though the subsoil is sandy, the surface soil and the

upper part of the subsoil are heavy enough to retain sufficient soil moisture for good crop production.

This is the least extensive soil of the Trempealeau series in Trempealeau County, and the areas are small and scattered. The largest area, which includes about 60 acres, occurs on the north edge of the village of Blair. Four or five small bodies are in the vicinity of Whitehall in the Trempealeau River Valley, and a few others occur in Elk Creek and Beaver Creek Valleys.

Practically all this soil is tilled. Corn, oats, and mixed timothy and medium red clover hay are the most common crops. Peas for canning have been grown successfully to a small extent. Under reasonably good conditions, corn yields from 40 to 45 bushels to the acre, oats around 40 bushels, and hay 2 or 2½ tons.

Soil fertility is supplied mainly by the use of barnyard manure. Practically no commercial fertilizers have been used.

In Table 9 are given the results of mechanical analyses of samples of the surface soil, the subsurface soil, and the subsoil of Trempealeau silt loam.

TABLE 9.—*Mechanical analyses of Trempealeau silt loam*[1]

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
314357	Surface soil, 0 to 8 inches	0.4	4.4	7.2	19.0	5.1	43.9	20.0
314358	Subsurface soil, 8 to 18 inches	.1	1.4	3.3	16.1	5.7	48.5	25.0
314359	Subsoil, 18 to 36 inches	.1	.8	1.9	17.3	7.3	51.1	21.5
314360	Subsoil, 36 to 48 inches+	.2	10.7	25.5	38.7	3.8	13.4	7.8

[1] After treatment with hydrogen peroxide.

TREMPEALEAU SANDY LOAM

Trempealeau sandy loam includes the sandiest soils of the Trempealeau series. The surface soil to a depth ranging from 10 to 16 inches is light chocolate-brown or brown sandy loam. Below this the darker shade fades and the reddish tinge becomes more marked, the color ranging from brownish red to reddish yellow. The texture gradually changes from sandy loam or loamy fine sand to sand or fine sand. Below a depth ranging from 28 to 36 inches the sand or fine sand may be mottled or variously stained with iron red, brown, and yellow, or it may be yellow or pale yellow with no mottling.

Trempealeau sandy loam occurs in comparatively small areas, principally along Buffalo River and along Trempealeau River between Independence and Blair. Several areas along Buffalo River in the vicinity of Osseo and a few small scattered areas along Elk Creek have a loamy fine sand surface soil.

Drainage of this soil ranges from good to excessive. The lack of fine material in the surface soil and the sandiness of the subsoil allow water to drain away rapidly. Like other soils of the Trempealeau series, the sandy loam is medium or strongly acid throughout.

Practically all the land has been cleared and is being farmed. Its fertility is markedly lower than that of the other Trempealeau soils, but where good care has been given the soil fairly good crop yields have been obtained. Corn and rye do well, but this soil is ordinarily a little droughty for good yields of other small-grain and hay crops. Corn under ordinary farming conditions yields from 20 to 25 bushels to the acre, oats about 20 bushels, rye from 12 to 15 bushels, and hay from 1 to 1½ tons. These yields could be materially increased by improved farm practices.

WAUKESHA SILT LOAM

The surface soil of Waukesha silt loam to a depth of 10 or 12 inches is nearly black smooth friable silt loam. Below this layer the color grades to grayish brown and the texture gradually becomes heavier, and below a depth ranging from 16 to 20 inches the material is yellowish-brown or brown crumbly heavy fairly compact silt loam or light silty clay loam. The soil mass breaks into comparatively firm angular blocks ranging from one-fourth inch to 1½ inches in diameter. Below a depth of about 32 inches, the soil material is brownish yellow or nearly yellow slightly compact smooth silt loam, and below a depth of 40 inches is slightly mottled dark-brown, light-yellow, and gray silt loam.

Most areas of this soil occur on the terraces in the central and southern parts of the county. The tracts are comparatively small and most of them are associated with areas of Bertrand silt loam. The largest single area occurs on Decorah Prairie in the southeastern corner of T. 19 N., R. 8 W., but the soil is most extensive in the Beaver Creek Valley from Frenchville to about 1½ miles southwest of Galesville.

The surface relief is level or gently undulating. As in Bertrand silt loam, no definite drainage system has been established except where run-off water from the adjoining upland flows through areas of this soil. In such places, shallow gullies, or ditches, frequently develop unless particular care is taken to prevent erosion. Underdrainage is good, although the heavier subsoil does not allow so free movement of ground water as do the sandier subsoils of some other soils.

All the land is tilled, being used almost wholly for the production of grain and forage crops and some cash crops. Very little of it is pastured. The crops grown, their proportionate acreages, the cropping methods, and fertilization are almost identical with those on Bertrand silt loam. The natural fertility of Waukesha silt loam, however, is a little greater, and crop yields are a little higher. The Waukesha soil is less susceptible to drought than the Bertrand soil, owing to the higher content of organic matter. Small grains, particularly oats and barley, are more susceptible to lodging on Waukesha silt loam than they are on Bertrand silt loam.

Waukesha silt loam, mottled-subsoil phase.—The mottled-subsoil phase of Waukesha silt loam to a depth of 12 or 14 inches is black or nearly black heavy silt loam. In most places the color fades to dark brown in the lower part of this layer. Below this the soil material is dark grayish-drab or dull yellowish-brown slightly plastic silt loam becoming gray, mottled with rust brown and yellow,

at a depth of about 22 inches. The plasticity increases somewhat with depth, but the material in its natural moist condition breaks into weak crumbs or blocks. The texture is rarely heavier than light silty clay loam and in some places is heavy silt loam. The mottled condition varies. In some places the iron-brown stains increase with depth, and small iron concretions may occur at a depth of about 36 inches. At a depth of 48 inches, the predominant color is dull gray with some iron stains, and at a depth of 65 or 70 inches the material may be gray heavy silt loam containing no mottles. In some places no development of the small iron concretions occurs and the rust iron-brown stains are less evident. In such places the predominant color below a depth of 22 inches is dull gray.

Included with the mottled-subsoil phase of Waukesha silt loam are two rather extensive areas of heavier poorly drained terrace soils. The 10-inch surface layer is clay loam or silty clay loam which is nearly black in the upper part but becomes lighter colored and contains some mottling in the lower 4 inches. Below this layer and continuing to a depth of 30 inches the soil is dull bluish-gray, mottled with pinkish-brown, stiff plastic clay. The mottling decreases with depth, and brownish red becomes the dominant color. Below a depth of 30 inches the material grades to sandy clay, and at a depth of about 40 inches this grades to fine sandy loam.

The mottled-subsoil phase of Waukesha silt loam occurs on the stream terraces in irregular scattered areas, one of the largest of which is immediately south and west of Blair. The heavy variation of this soil occurs in two comparatively large areas, one immediately north of Centerville in secs. 28, 33, 34, and 35, T. 19 N., R. 9 W., and the other 2 miles southwest of Centerville in secs. 5, 6, 8, and 17, T. 18 N., R. 9 W.

Drainage of this soil is deficient, and tile drainage would increase its utility.

Practically all the land is tilled. Corn and mixed hay, mostly timothy and alsike clover, are the most common crops, and small grain, particularly oats, ranks third in importance. Pasture occupies an acreage almost equal to that of small grain.

Crop yields on this soil vary considerably, owing to differences in drainage conditions and variation in the amount of rainfall in different seasons. During wet seasons or in exceptionally poorly drained areas corn and small grains do not yield well, whereas hay and pasture crops thrive about as well as they do under less moist conditions. Except under these less favorable circumstances, the common yield of corn is from 40 to 50 bushels to the acre and of oats from 35 to 40 bushels. Under all conditions, however, oats are very susceptible to lodging. This soil is well adapted to grazing, as its poorly drained condition insures moisture for the grass during the drier periods of summer.

Applications of barnyard manure are not made so regularly on this soil as on some of the upland soils. When used, the manure is applied and plowed under for the corn crop.

In Table 10 are given the results of mechanical analyses of samples of the surface soil, the subsurface soil, and the subsoil of typical Waukesha silt loam.

TABLE 10.—*Mechanical analyses of Waukesha silt loam*

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
214315	Surface soil, 0 to 10 inches	0.1	0.2	0.3	0.5	18.4	71.1	9.3
214316	Subsurface soil, 10 to 16 inches	.0	.2	.2	.3	21.9	63.8	13.5
214317	Subsoil, 16 to 38 inches	.0	.2	.1	.3	24.5	46.8	28.0

LA CROSSE SILT LOAM, DARK-COLORED PHASE

The surface soil of La Crosse silt loam, dark-colored phase, to a depth of about 12 inches, is nearly black friable silt loam, in most places smooth and velvety but in some places slightly gritty. The next layer, which continues to a depth of about 22 inches, is brown, firm but not very compact silt loam. The heaviest layer of the soil, which occurs between depths of 22 and 35 inches, is yellowish-brown crumbly or granular light silty clay loam or heavy silt loam. The granules are angular and range from one-fourth inch to 1½ inches in diameter. Below this layer the texture grades rapidly to very sandy material and at a depth of 40 inches is yellowish-brown or yellow fine sand.

In sec. 31, T. 18 N., R. 8 W., the lower part of the subsoil is sandy gravel, mainly of granitic material. Along the north edge of sec. 13, T. 21 N., R. 7 W., an area of soil included with this phase approaches the Trempealeau soils in characteristics. Here the soil, to a depth of about 20 inches, has a dark-red tinge and contains scaly ferruginous fragments identical with those found in the Trempealeau soils.

La Crosse silt loam, dark-colored phase, occurs in widely scattered, irregular areas on the stream terraces. Most of it is on the Trempealeau River terraces, particularly in the vicinity of Blair. A few areas are in the southwestern part of T. 18 N., R. 8 W., and in the vicinities of Strum and Eleva.

The relief is level or gently undulating. Owing to the sandy character of the subsoil, the land is well drained. Practically all of it is under cultivation, most of it being devoted to the production of general farm crops, such as corn, small grain (principally oats and barley), and mixed timothy and clover hay. Peas for canning are grown on this soil in the vicinity of Blair. Tobacco, alfalfa, and potatoes, though not actually known to be grown on this soil in Trempealeau County, are well adapted to it.

Crop yields are comparable to those obtained on Waukesha silt loam. Because of its better-drained subsoil, La Crosse silt loam, dark-colored phase, produces better yields in exceptionally wet seasons than does Waukesha silt loam. Methods of handling the soil, crop rotation, and fertilization are almost identical with those applied to Waukesha silt loam and Bertrand silt loam.

LA CROSSE LOAM, DARK-COLORED PHASE

The surface soil of La Crosse loam, dark-colored phase, to a depth of 12 or 14 inches is nearly black friable loam. The color begins to

fade in the lower inch or two of this layer, and at a depth of 14 inches it is dark brown. The subsoil to a depth of about 27 inches is generally heavy crumbly loam which is rather sticky when wet. Below this layer the material rapidly grades to brownish-yellow or yellow loamy fine sand and at a depth of 40 inches or less is fine sand. A variation of this soil occurs in the vicinity of Blair, in which the upper 18 or 20 inches are dark chocolate brown in color, having the slightly red hue of the Trempealeau soils, and the soil also contains the indurated "iron" fragments that are so common in the Trempealeau soils. Another variation occurs on the Mississippi River terrace, particularly in the southern part, where most of the soil is underlain by gravelly sand or gravel.

This soil occurs in comparatively small scattered areas on the terraces of the main streams. About two-thirds of the aggregate area is on the Mississippi River terrace, but the largest single area lies just west of Blair. A few scattered bodies occur along the Trempealeau River Valley, and a very small acreage is on the Buffalo River terrace in the vicinity of Strum.

The land is level or gently undulating, and drainage is good. In most places this soil occupies areas having comparatively good surface drainage, but in the central part of the Mississippi River terrace it occurs in many slight depressions. However, this does not seem to interfere with drainage, as the sandy subsoil readily carries away any surplus water that can not be removed by surface drainage.

Practically all the land is tilled, and there are no timbered areas. Crops grown, yields, rotation, and fertilization on this soil are almost identical with those on La Crosse fine sandy loam, dark-colored phase.

LA CROSSE FINE SANDY LOAM, DARK-COLORED PHASE

The surface soil of La Crosse fine sandy loam, dark-colored phase, to a depth of about 14 inches is dark-brown or nearly black friable fine sandy loam. The subsoil to a depth of about 24 inches is brown, somewhat compact, and crumbly, and the material ranges in texture from fine sandy loam to loam. Below this the color and texture become lighter until, at a depth of about 28 inches, the material is brown or yellowish-brown loamy fine sand or fine sand. Below a depth of 28 inches the color generally grades to brownish yellow or yellow. In a few places the second layer continues to a depth of about 30 inches. Where the soil occurs in depressions the surface soil in many places is heavy fine sandy loam, owing to an accumulation of fine material from adjacent areas. The soil is medium or strongly acid throughout.

Of the dark-colored soils having sandy subsoils this is the most extensive. Small scattered areas occur throughout most parts of the county on the terraces of the main streams, but nearly 80 per cent of the soil is on the Mississippi River terrace, particularly in the central and northern parts of T. 18 N., R. 9 W.

The surface relief and drainage of this soil are similar to those of the dark-colored phase of La Crosse loam, with the exception that a greater part of the dark-colored phase of the fine sandy loam, possibly 60 per cent, occurs in slightly depressed areas.

Practically all the land is under cultivation. Corn and oats are the most important crops, and mixed timothy and clover hay rank

next. Alfalfa is grown successfully but does not cover a very great acreage. In the vicinity of Centerville peas for canning have been grown on a few acres of this soil, and in the northern half of the county tobacco has proved profitable. Other crops grown on a small scale are sweetclover for pasture, soybeans, and buckwheat.

Although the soil is sandy and is underlain by sand, its productivity under good farming methods ranks exceptionally high. Where a crop rotation including a legume is practiced and regular applications of barnyard manure are made, yields approaching those obtained on Waukesha silt loam are procured. The Waukesha soil is not so readily run down when subjected to continuous heavy cropping, but La Crosse fine sandy loam, dark-colored phase, is easier to handle, and in wet seasons crop growth is not hindered by an overabundance of soil moisture. As compared to the heavy soils of the upland, this soil is not so susceptible to crusting or baking in time of drought, and it is considered by many farmers to be no more subject to the effects of dry periods than are those soils.

Under ordinary circumstances corn and oats each yield from 35 to 45 bushels to the acre and hay about 2 tons.

Crop rotation is practiced on most of this soil, the most common sequence being corn, small grain, and mixed timothy and clover, or alfalfa. Fertilization is accomplished almost wholly with barnyard manure. When alfalfa is to be sown, crushed limestone is applied at the rate of about 2½ tons to the acre. Some phosphate fertilizer has been used successfully for grain crops on this soil.

LA CROSSE SANDY LOAM, DARK-COLORED PHASE

The surface soil of La Crosse sandy loam, dark-colored phase, to a depth of about 14 inches is dark-brown or nearly black sandy loam. The subsoil in most places is brown sandy loam or light sandy loam, underlain at a depth of 22 or 24 inches by yellowish-brown or brownish-yellow sand. In a few places along the southern edge of T. 18 N., R. 9 W., this lower material is gravelly sand. Where this soil occurs in slight depressions, the layer occurring between depths of 14 and 22 inches may be light sandy clay loam which grades at a depth of 20 or 22 inches into the lighter-textured substratum material.

This is a very inextensive soil in Trempealeau County. About 75 per cent of it lies on the Mississippi River terrace, and the remainder occurs as small scattered areas on the terraces of the other main streams of the county.

All the land is tilled except the area occupied by the town of Trempealeau. Agriculturally this soil is very similar to La Crosse fine sandy loam, dark-colored phase. It is, however, a little more subject to droughtiness and crop yields are a little lower.

WABASH SILT LOAM

Wabash silt loam is a dark-colored poorly drained first-bottom soil, occurring along the drainage ways and streams throughout the county. Areas of Wabash silt loam vary widely. The surface soil in most places is dark-brown or nearly black silt loam to a depth ranging from 5 to 9 inches. The texture ranges from heavy loam to

silty clay loam. Below the surface layer the color changes rather abruptly to gray or dark gray with a few limonite-yellow mottlings. At a depth of 14 or 15 inches the mottlings increase and become deeper in color; brownish-yellow and iron concretions are in evidence; and the color of the material tends to bluish gray mottled and specked with yellowish brown and iron brown. In some places the texture of this lower material ranges from loam to fine sand and the color is pale yellow and dingy gray, with some iron-brown stains. In places where the first bottom is particularly exposed to flood waters directly from the upland, the true Wabash silt loam is covered with a deposit, from 3 to 8 inches thick, of gray soft fine silt which has been recently carried down from the upland. In the bottom lands of the larger streams this soil is particularly variable. It is, in many places, cut up by old stream channels and small depressions occupied by peat bogs or black plastic very poorly drained silty clay loam. The soil is medium or strongly acid throughout.

Areas of Wabash silt loam are level except where cut up by irregular depressions and old stream channels. They are low lying and consequently poorly drained.

Probably 70 per cent of the land is either timbered or covered with brush; the remainder is open and in most places supports a fair bluegrass sod which affords fairly good grazing throughout most of the growing season. Some of the open areas are covered by a growth of sedges which are useless for pasture.

The forest cover consists largely of elm, soft maple, willow, box-elder, hoary alder, and some red oak and black oak. There is very little merchantable timber but a small amount is cut for post material, cordwood, and firewood. Many of the smaller stream bottoms have grown up to hoary alder and rank-growing weeds, such as nettle, milkweed, goldenrod, rosinweed, Veronica, and giant ragweed, which render the land practically useless. Very little or none of this soil is in cultivated crops.

Wabash silt loam, better-drained phase.—Areas of Wabash silt loam that are sufficiently drained to allow some crop production and which are not greatly susceptible to inundation by flood waters have been mapped as a better-drained phase. The better-drained soil occurs throughout the county, mainly in the higher and smaller valleys where the amount of flood water is comparatively small and is carried off shortly after the period of rainfall.

About 75 per cent of the land has been cleared and is either cropped or used as permanent pasture. Corn, for grain or silage, is the most common crop grown where the water table is 26 or more inches below the surface. Under favorable conditions corn yields 60 bushels to the acre. Mixed timothy and alsike clover hay does well, yielding about 2½ tons to the acre, but not a great deal of this kind of hay is grown, most of the hay consisting of timothy mixed with a little June grass and red clover. Small grains produce fair crops, but they are apt to lodge on this soil and under the moist conditions are rather susceptible to rust. The soil is of particular value in the hilly sections of the county where land available for cultivated crops is limited. In such places the well-drained alluvial soils are cropped several years in succession to corn, and in many places these are the only soils on which corn can be produced. The better-drained phase

of Wabash silt loam is a strong soil and can, perhaps, stand continuous cropping better than any other soil in the county.

The soil constitutes good grazing land. When the weeds and brush are kept out of the pastures the land will support one head of cattle to each 1½ acres. The low-lying position of the soil is a practical guaranty against the hazards of drought, and the natural fertility assures a luxuriant vegetative growth.

GENESEE SILT LOAM

The surface soil of Genesee silt loam to a depth of 6 or 8 inches is dark-gray or brown soft silt loam. Below this depth the color grades to grayish yellow or yellowish brown but the texture remains the same. Below a depth of 16 inches light mottlings of yellow and gray occur, and below a depth of 20 inches the mottling becomes more intense and the soil becomes a little more plastic. In some places an admixture of sandy material occurs below a depth of 24 or 26 inches, and in a few places thin layers of mucky material are found below this depth.

Drainage of this soil is better than in most first-bottom soils and in all places is sufficient to allow the production of some crops, particularly hay.

Genesee silt loam is widely distributed over the county, occurring for the most part in the smaller valleys or coulees where the fall is great enough to allow good drainage. An area of nearly 2 square miles occurs in T. 18 N., R. 10 W. Artificial dikes render this area somewhat better drained than typical first-bottom land, and a small part of it is being used for meadow.

Agriculturally this soil is very similar to the better-drained phase of Wabash silt loam, and it is farmed in practically the same way.

ALLUVIAL SOILS (UNDIFFERENTIATED)

Alluvial soils (undifferentiated) include all the variable soils on the first bottoms of the streams and rivers of the county. No definite soil profile can be given for this material, which ranges from heavy silt loam to fine sand in texture and from nearly black to pale yellow or light grayish brown in color. Areas of peat, Wabash silt loam, and Genesee silt loam, too small to be mapped separately, are included under this designation. Many of the areas are cut by old stream channels or swales.

The alluvial soils (undifferentiated) are rather widely distributed over the county, although most areas occur along Mississippi River, Black River, Buffalo River, Trempealeau River, and Beaver Creek.

Areas of these soils are nearly level or gently undulating. Drainage as a whole is poor, but some of the narrow strips along the small creeks are sufficiently drained to be used as hay land or to afford fairly good grazing. Most of the land is undeveloped and remains nearly in its natural state, being either timbered or covered with brush and marsh grasses. The timber growth is mostly soft maple, elm, willow, ash, boxelder, hoary alder, and red oak. Some yellow birch grows along Mississippi River. Most of the timber is less than 15 inches in diameter, and at the present time is not being used extensively other than for firewood and fence posts.

With the exception of the areas suitable for grazing or for cultivation under artificial drainage, this land should be left in forest.

PEAT

Peat occurs in poorly drained depressions, and most of it consists of partly disintegrated and partly decomposed plant remains. This material varies noticeably in two respects—in the kind of plants from which the organic matter developed and in the degree of disintegration and decomposition that has taken place. For the most part the peat material of Trempealeau County has developed from swamp or marsh grasses, or sedges, although in a few of the areas supporting tamarack woody peat occurs. The degree of disintegration and decomposition varies widely, depending largely on the height and variation of the water table.

A description of a fairly typical sample of this material follows: The upper 6 inches of material is nearly black, is finely divided, and is somewhat spongy when pressed in the hand. Few fibers or roots except those of the present growing plants are visible. Between depths of 6 and 18 inches the material is a brown or dark-brown feltlike fibrous mass which is very spongy when squeezed. It consists of fibrous plant remains that are more or less disintegrated but show practically no signs of decomposition. Below a depth of 18 or 20 inches the color is lighter brown and the mass of fibrous material shows little evidence either of disintegration or decomposition.

The woody peat is brown, granular, and, when practically dry, is rather crumbly. It does not have the marked spongy character of the fibrous sedge peat.

Peat areas occur on the bottom lands of the small and intermediate streams where drainage is exceptionally poor. In general it covers the entire width of the bottom and extends for more than a mile along the stream course. The most common occurrence of these areas is in T. 21 N., R. 7 W.; in T. 21 N., R. 8 W.; and along Tamarack Creek. The area along Tamarack Creek is exceptionally large, being 6 miles long, about one-half mile wide, and covering about 4 square miles. Other areas of peat are distributed over the county, but they are of very minor occurrence in the northern part.

The peat areas are nearly level and, as previously mentioned, drainage is very poor, the water table in most places being from 3 to 10 inches below the surface. Probably 95 per cent of the peat is either covered with marsh grass, weeds, and brush or with a dense growth of tamarack. As grazing land it is practically valueless, but in a few places where the ground is not too soft a small amount of marsh hay is cut. A small amount of the tamarack is used for studding for sheds and for fence posts in marshy areas, for which purposes it serves very well.

In addition to tamarack and the sedges, other plants common to peat are nettle, giant ragweed, goldenrod, cirpus, and smartweed, and where the peat is well disintegrated and partly decomposed, hoary alder grows.

The small acreage of peat that is cleared and farmed is used for the production of general farm crops. Corn is a common crop but is rather susceptible to frost on this land, and it is generally used as silage or livestock feed. Mixed timothy and alsike clover hay

does very well on the better-drained areas. In some places bluegrass has been seeded or has started itself, and in comparatively well-drained areas of peat this grass affords good grazing. Crop yields are variable and, owing to the small acreage devoted to crops, they can not be determined accurately.

Fertilization is not practiced very consistently. A light application of barnyard manure, particularly horse manure, made when the peat land is first cultivated is of great advantage in starting decomposition of the material.

Much of the peat land has no agricultural value at present. Areas that can profitably be drained can be utilized advantageously for the production of hay, corn, tame grass for grazing, or root crops such as potatoes, rutabagas, and turnips.

Peat, shallow phase.—The shallow phase of peat differs from typical peat primarily in depth, generally being less than 40 inches deep. As a rule the shallow peat shows more signs of disintegration and decomposition and as a result is more finely divided, darker colored, and firmer. Owing to these characteristics and to the slight depth to the underlying mineral-soil material, the shallow peat is better suited to agricultural use and is more productive than the deeper peat.

Areas of the shallow peat are small and not widely distributed. A larger proportion of the shallow peat is cultivated or pastured than of the deeper peat.

The crops grown, the methods of handling, and fertilization practices are the same for the shallow as for the deep peat, but crop yields probably average a little higher.

ROUGH BROKEN LAND

Rough broken land includes areas which are too rough, broken, or stony to be of practical agricultural use. This land has a slope of more than 30 per cent, and as a result of this steepness the soil material is rarely more than a few inches thick. The soil ranges from fine sand to silt loam and is underlain by fragmentary sandstone, shale, or limestone except where it occurs at the edge of the river terraces, where most of the underlying material is sand or gravelly sand.

Rough broken land occurs throughout all the upland parts of the county. Its typical occurrence is as narrow bands along the steepest parts of the hills or ridges, lying between the ridge tops and the less steep valley lands. In some parts of the county, where the ridges are comparatively high and narrow, as in parts of T. 19 N., R. 7 W., it occupies the ridge tops as well as the steep slopes.

Land of this kind has very little agricultural value. Its use as pasture land is very limited and unreliable, owing to the thin soil covering, low fertility, and lack of moisture during dry periods. Most of the land is timbered, the most common trees being red oak, white oak, birch, hickory, and poplar. Most of the trees are comparatively small, few being more than 12 inches in diameter. The timber is used for stove wood, fence posts, cordwood, and to some extent for rough lumber. The poplar is cut for pulpwood and shipped to Eau Claire.

This rough land should remain in forest, which will prevent erosion, will help protect the adjoining land, and at the same time will provide a source of useful timber products.

RECOMMENDATIONS FOR THE IMPROVEMENT OF TREMPEALEAU COUNTY SOILS

In discussing recommendations for the use and improvement of the soils of Trempealeau County, the various soil types and phases can be most advantageously considered in groups. The first group includes Boone silt loam and its level phase, Clinton silt loam, Dubuque silt loam, and Bertrand silt loam. The soils of this group are comparatively heavy textured and are low in lime, nitrogen, and phosphorus, but have a good water-holding capacity.

A crop rotation, consisting of corn, small grain, and a leguminous hay, is well adapted to these soils, which are probably the best soils of the county for the production of small grain and peas for canning and among the best for grass production. Dubuque silt loam is not particularly well suited to corn production because of its heavy clay subsoil. Manure is applied to the best advantage previous to plowing for the corn crop. Fall plowing is advantageous on these soils.

It is advisable to supplement the manure with superphosphate or with a mixed fertilizer having a high phosphate content. The fertilizer may be broadcast for the small grain that is to be used as a nurse crop for leguminous hay, or it may be checked in with the corn crop. In the former method both the small grain and the following hay crop benefit from the fertilizer, but in the latter the corn crop alone benefits. The rate of application for small grain should be from 250 to 300 pounds to the acre and for corn from 125 to 150 pounds.

The nitrogen supply of the soil should be increased by the growing of leguminous crops, which could well occupy from one-third to one-half the tilled acreage of these soils. For medium-red clover and alfalfa, which are the best legumes for these soils, applications of lime and phosphorus are advisable if not essential. The phosphorus is probably best applied with the nurse crop, as mentioned above, and the lime is best applied as pulverized limestone after the ground is plowed but previous to sowing the clover or alfalfa. Applications of lime ranging from 2½ to 3 tons to the acre are advisable.

The second group of soils, which is the heavy-textured dark-colored group, includes Bates silt loam, Waukesha silt loam, and La Crosse silt loam, dark-colored phase. These soils should be handled in much the same manner as those of the first group. They have a higher content of organic matter and nitrogen, however, and as a consequence are better suited to the production of corn and tobacco. Small grains are more apt to lodge on these soils than on the light-colored soils. About the same crop rotation as that suggested for the first group may be used, although it is possible and probably advisable in some cases to grow more cultivated crops on these darker soils than on the light-colored heavy soils. Although these dark-colored soils are more fertile than the soils of the first group, the use of barnyard manure, supplemented by superphosphate and lime, and the inclusion of a legume in the rotation are advisable in sustaining their fertility.

The third group of soils includes Boone loam and its level phase, Boone fine sandy loam and its level phase, Bertrand loam, Bertrand fine sandy loam, the dark-colored phases of La Crosse loam, fine sandy loam, and sandy loam, Sparta sandy loam, Trempealeau fine sandy loam, and Trempealeau sandy loam.

Crop rotation should be practiced on these soils. A 3-year rotation of corn, small grain, and a leguminous hay has proved beneficial. On the lighter-textured soils of the group rye is probably the best small grain because of its ability to withstand drought better than oats, barley, or wheat. Alfalfa is the most desirable hay crop, but it requires fertile soil for a good stand. Red clover may be grown on less fertile soil but is not a reliable crop if the fertility of the soil is very low. Mammoth clover produces comparatively good crops on the sandier soils and makes good hay on the poorer soils where it is unable to attain its characteristic rank growth. Soybeans are particularly valuable as an emergency hay crop.

The soils of this group are well suited to the production of cultivated crops such as corn, potatoes, and, when plenty of barnyard manure is available, tobacco. The best conditions for cucumber production are found in these soils.

Spring plowing is advisable on the lighter-textured soils. Manure is applied to good advantage on the new hay seeding, either in the fall following the removal of the nurse crop or early the following spring. Applications of manure on new seeding should be comparatively thin and even.

These soils are lower in fertility than the previously discussed groups of soils, being deficient in nitrogen, phosphorus, lime, and in most places potash. Particular attention should be given to the supply of organic matter and nitrogen. The plowing under of green crops should be practiced on the sandier soils, mammoth clover and the second crop of medium-red clover being among the best crops for this purpose. These should be plowed under in the fall while they are still green. Rye sown in the early fall will make a good growth to be turned under the following spring before the corn is planted. Corn is probably the best crop to follow a green-manure crop.

It is advisable to apply lime to these soils and to supplement the barnyard manure with a commercial fertilizer containing phosphorus and potash. For insuring a good stand of legumes, lime and in many places phosphorus are necessary. The lime should be applied before the legume is seeded, and the commercial fertilizer should be added to the soil at the time of seeding.

The sandy loams are not well suited to the growing of ordinary grazing grasses because of their droughtiness and the shallow root systems of most of the grasses. Sweetclover or alfalfa, when carefully pastured, furnish more consistent grazing than any other grasses.

The fourth group of soils consists of the rolling phase of Boone silt loam, and the steep phases of Boone loam, Boone fine sandy loam, and Clinton silt loam.

The danger of erosion is mainly responsible for the differences in farming methods and fertilization on these soils and on the less rolling soils, making it less practical to grow cultivated crops and more advisable to keep the soils under a grass sod. As a consequence, the corn, small grain, and hay rotation should not be applied on these soils. The small grain and hay rotation as now practiced, though somewhat unbalanced, is about as satisfactory as any. Oats, barley, and winter wheat are the best grains for this group of soils. Alfalfa

is the most desirable legume to grow for hay, as with this crop it is possible to leave the land in a hay crop for two or more years in succession, whereas medium-red clover seldom yields a good crop after the first hay season.

The heavier soils of this group furnish good permanent bluegrass pasture, but during continued dry weather this grass dries up rather rapidly. The clovers are more drought resistant and furnish more and better feed during the summer if they are properly cared for.

When cultivated crops are grown on the less rolling soils, a large proportion of the manure will ordinarily be used on these soils. It is apparent also that more of the fertility of the manure is lost when applied to the rolling or steep land than when it is utilized on the more level soils. However, it is as necessary to fertilize the hilly farming soils as it is to fertilize the soils that are producing cultivated crops. In addition to barnyard manure, superphosphate and lime should be used. From 250 to 300 pounds of 16 per cent superphosphate to the acre should be applied for the small grain that serves as a nurse crop for the legume hay, as by so doing both the small grain and the hay seeding are benefited. The pulverized limestone should be applied well before the legume hay crop is sown, preferably after plowing of the ground in the previous fall.

The fifth group of soils includes Boone fine sand and Sparta fine sand, with its gently rolling phase. The best areas of these soils can be farmed with some success, but a diligent plan of soil improvement must be adopted. The water-holding capacity of these soils is low, and their supplies of organic matter and essential plant-food elements are very small. Organic matter should be added by the use of barnyard manure and by the growing and turning under of green-manure crops. Barnyard manure should be supplemented by lime and by fertilizers having high phosphorus and potash content.

Crop rotation is the basis on which to build the fertility program. Experiments have shown that a rotation of corn, rye, and clover is the best for these soils. Mammoth clover produces good crops most consistently, but where both hay and green manure must be included in the rotation mammoth clover is not entirely satisfactory because of its inability to produce more than one crop a year and because it seldom yields well the second year. Red clover fits into this rotation well, as the first crop may be cut for hay and the second crop turned under for green manure. When the soil is properly built up, alfalfa can be grown successfully, as this crop lends itself well to the double purpose of hay crop and green-manure crop, and with alfalfa the rotation may be changed to cover a 4-year period consisting of corn, rye, and two years of hay or one of hay and one of pasture. When hay is grown for two succeeding years, the second crop of the second season should be used for green manure. Barnyard manure may be applied for the corn crop or for the new hay seeding. Inasmuch as the green-manure crop is turned under for corn and as most of the leguminous hay crops require a considerable amount of fertility to insure a good stand, it is probably advisable to use the barnyard manure for the hay crop. The manure may be applied at time of seeding or after the nurse crop has been removed.

Liming is of value for red clover and is necessary for sweetclover and alfalfa. The lime should be applied at the rate of 2½ or 3 tons to the acre after the ground has been plowed and before seeding the legume. Soybeans, as an emergency hay crop, do well without lime.

The phosphorus and potash fertilizer may be applied either to the corn or at the time of seeding the legume. If no manure is available at the time of seeding, commercial fertilizer should be applied. Even when manure is used, it is advisable to supplement it with phosphate fertilizer in getting the legume hay crop started.

The sandy soils should have a vegetative cover as much of the time as possible, as these soils blow very readily. If blowing is allowed to start, so much of the fine material will be removed that reclamation of the soil for crop production will be practically impossible. Spring plowing just previous to corn planting is advisable, and seeding rye in the corn at the time it is "laid by" will be found beneficial in preventing soil drifting and in adding organic matter to the soil.

Areas of these sandy soils, which contain an extremely small amount of fine material, are very droughty and are difficult to farm profitably. Such areas should be reforested or allowed to develop a natural vegetation and be left dormant. As demonstrated on the Sparta fine sand in T. 18 N., R. 10 W., spruce and white pine do well on the extremely sandy soils.

The sixth group includes the poorly drained soils. These are the mottled-subsoil phases of Waukesha silt loam and Bertrand silt loam, Wabash silt loam, with its better-drained phase, Genesee silt loam, alluvial soils (undifferentiated), and peat, with its shallow phase.

Wabash silt loam and the alluvial soils (undifferentiated) are unsuitable for agricultural use other than as permanent pasture. Most of these lands are timbered and probably should be left in that condition.

The other four mineral soils of the group are of considerable agricultural value, as they are all very fertile, particularly the two dark-colored soils. The first need of these soils is better drainage, and where they can profitably be drained artificially they fit into the farming system practiced on the fertile well-drained heavy soils. Owing to their low position, however, the frost danger is greater than on the higher soils.

When these soils are farmed without artificial drainage, the crops grown and methods of farming must be given specific attention. Corn ordinarily does well, except for the frost danger, but small grain does not produce well under the poor drainage conditions. Alsike clover and timothy make the best hay crop for these soils. As grazing land the soils are very satisfactory, because the water supply is more constant through the dry midsummer period than it is in the better-drained soils. The best use of this land, therefore, can be obtained by devoting it to hay, grazing, and corn. The corn should be cut for silage if possible, to avoid damage from frost.

Inasmuch as no crops having a high lime requirement are commonly grown, liming ordinarily is not of much benefit. Where the

land is cropped continuously, barnyard manure should be used. It may be found profitable to use a phosphate fertilizer for the corn crop in some places.

Peat and its shallow phase are not commonly cropped. The first and main requirement of this kind of land is drainage improvement. It will also be found advisable, especially on the raw peats, to apply at least a small amount of barnyard manure at the time that the first crop is planted, as, by so doing, bacterial action is started, which results in the breaking down or decomposition of the organic matter. This action liberates or makes available to the plant roots the nitrogen of the peat. Whereas the nitrogen content of peat is high, the lime, phosphorus, and potassium contents are in general low. For corn and hay crops the addition of phosphate and potash is necessary, and for cabbage and onions lime should be applied.

Crop rotation is somewhat restricted on peat. Corn for silage the first year followed by buckwheat or rye seeded with timothy and alsike clover the second year and mixed timothy and alsike clover hay the third year is a good rotation. Where a good grass sod can be developed, peat affords good grazing if the land is firm enough not to "punch up" from the effect of livestock walking over it. It is not advisable to use lowland of any kind for sheep pasture.

SOILS AND THEIR INTERPRETATION

Trempealeau County is in the driftless area of Wisconsin. The parent material underlying most of the soils is sandstone and shale of the Cambrian formation. According to geologists, loess deposits cover much of this formation, and as a consequence there are many places in which loess is apparently, wholly or in part, the parent material of the overlying soil. The lower magnesian limestone is the parent material of the soil occupying the high ridges south of Arcadia.

As regards soil development, Trempealeau County lies within the gray-brown podsolic soil region. The climate of the county is typical of that region, as is also the deciduous hardwood forest growth.

Small irregular prairie areas occur, in which the accumulation of organic matter has developed a very dark brown or nearly black color to a depth ranging from 6 to 10 inches. The coloring effect of the organic matter is noticeable to less degree to a depth of 22 or 24 inches.

Under forested conditions no accumulation of organic matter takes place other than the thin layer of partly decomposed material that is more or less intermixed with the surface soil to a depth of 1½ inches. Under the mixing effect of cultivation, this small amount of organic matter is in many places sufficient to darken slightly the surface soil, but under continuous tillage the darker color disappears. Marked oxidation as observed in the deeper soil materials, particularly in Clinton silt loam, is noticeable to a depth of about 70 inches. Below this depth drab or bluish gray is the predominant color. The yellowish-brown, brown, and reddish-brown colors of the solum, or soil and subsoil proper, are owing mainly to the degree of oxidation of the iron.

Leaching has removed the free carbonates of calcium, magnesium, potassium, and sodium. In the deep loessial materials which, at the time of deposition, were probably comparatively high in lime, there are still sufficient carbonates at a depth of 10 feet to cause effervescence when the soil material is treated with dilute hydrochloric acid.

There are two groups of well-developed soils in the county, the dominant group including the gray-brown podsolic soils, and the less conspicuous group, the dark-colored prairie soils. Soils of the Boone, Clinton, Dubuque, and Bertrand series are included in the first group. Boone silt loam, which is a typical mature soil of the region, is essentially a residual soil developed from sandstone and shale. The natural vegetation of deciduous hardwood timber has given rise to the development of the thin layer of organic material that is more or less intermixed with the surface inch or two of soil. Below this is a layer of light-brown or grayish-brown floury smooth silt loam that has a weak platy crumbly structure. This layer is distinctly eluviated, a large amount of the fine material, particularly clay, having been carried downward by percolating water. Below a depth of 8 or 9 inches the soil gradually becomes more brown, heavier textured, and more crumbly. Below a depth of about 14 inches it is yellowish-brown rather hard but crumbly heavy silt loam or light silty clay loam which breaks up into cubical, angular, somewhat resistant, hard fragments ranging from one-fourth to 2 inches in diameter. In many places the cleavage surfaces of these fragments have a light-gray cast. This layer represents the zone of maximum illuviation or clay content, and the outstanding characteristic is its high content of fine material as compared with the 7 or 8 inch surface layer. The Al_2O_3 and Fe_2O_3 content also are presumably higher in the illuviated layer than in the surface soil. Below a depth of about 22 inches the color gradually becomes lighter yellowish brown and the texture a lighter silt loam. The soil is less compact and in many places contains a noticeable amount of sand. The parent material (shale or sandstone) is reached in most places at a depth of about 36 inches.

Clinton silt loam differs primarily from Boone silt loam in having silt as its underlying material, the soil below a depth of 30 inches being brownish-yellow or grayish-yellow soft smooth slightly crumbly silt loam. This material is leached of its free carbonates to a depth of about 10 feet, but below that depth it invariably effervesces when treated with hydrochloric acid. In some places irregularly shaped nodular aggregations of calcium carbonate, from one-third to three-fourths inch in diameter, are present.

Dubuque silt loam is a residual soil developed from limestone. The surface soil and upper subsoil layer are typical of soils of this group, but the soil material immediately overlying the limestone is brownish-red heavy fragmentary clay.

The Bertrand soils are terrace soils having the typical gray-brown podsolic profile except that the lower substrata consist of comparatively unaltered alluvial silty or sandy material. In many places this material contains free lime carbonate at a depth ranging from 8 to 10 feet.

The Bates, Waukesha, La Crosse, and Sparta soils are included in the second group, or dark prairie soils. The typical profile of soils

of this group is characterized by a dark-brown or nearly black soft friable surface soil which ordinarily extends to a depth ranging from 10 to 15 inches, below which is rich-brown crumbly slightly heavier material. The coloring effect of the organic matter is noticeable in most places to a depth of about 20 inches. The heavier layer, which extends to a depth of about 22 inches, is the zone of accumulation of the fine material. Below a depth of 22 inches the structure becomes less pronounced, the texture is generally lighter, and the color gradually changes to brownish yellow. The reaction of most of the soils of this group is strongly acid.

Bates silt loam, which is the typical well-developed upland prairie soil, is the soil from which the foregoing description was taken. The other soils of this group are developed on terraces. The Waukesha soils, which correspond very closely to the Bates soil, are inclined to be slightly mottled below a depth of 40 inches. The dark-colored phases of the La Crosse soils have sandy or gravelly sandy material below the zone of accumulation of fine earth. The Sparta soils are lighter colored than the Bates or Waukesha, being either prairie or semi-prairie soils, but they are distinctly darker than the gray-brown soils. All the soils of the Sparta series are rather sandy, and as a consequence a well-defined illuviated layer is present in but few places.

The Trempealeau soils, although fairly mature, do not fit into either group of well-developed soils. They may be considered as a variation of the soils of the prairie group. They are well-developed terrace soils occurring along the larger streams of the county and are underlain for the most part by alluvial sandstone parent material. The outstanding characteristic of the Trempealeau soils is the large amount of somewhat red hydrous iron oxide occurring throughout the upper 2 feet of the soil. The 8 or 10 inch surface layer is dark chocolate brown or light reddish brown and is friable, but below a depth of 10 inches the texture becomes slightly heavier and the structure more compact. The material has a more red cast than in the surface soil, owing apparently to the higher content of organic matter in the surface soil. Below a depth ranging from 18 to 24 inches the texture changes rapidly to light fine sandy loam or loamy sand, and the red coloring rapidly disappears with depth. At a depth of about 40 inches the material is pale reddish-yellow or yellow loose fine sand or sand, splotched or streaked vertically with darker iron stains. In some localities the content of iron oxide in the upper 22 inches of soil is so high that ferruginous scaly fragments, ranging from one-fourth to 3 inches in length, occur.

Development of the imperfectly developed soils has been retarded mainly because of poor drainage, but the surface relief has affected the development of some of the steep and rolling soil phases. Where the slope has markedly affected the soil profile the surface soil is shallower and less distinctly grayish brown and the illuviated zone is nearer the surface, but nevertheless is well developed.

The poorly drained soils include the Wabash and Genesee soils, the mottled-subsoil phases of the Waukesha and Bertrand silt loams, the alluvial soils (undifferentiated), and peat. These soils differ from each other primarily in color, degree of drainage, and maturity. The mottled-subsoil phases of Waukesha silt loam and Bertrand silt loam occur on old terraces and have not been subjected to recent

flooding or deposition of new material. They are the most mature of the poorly drained, imperfectly developed soils. The profiles of these two soils are identical, except that the Bertrand soil has a light-brown surface soil whereas the Waukesha has a dark-brown or nearly black surface soil. Both soils lack the floury characteristic of the mature silt loam soils. Below the 14-inch surface layer mottlings of yellow, gray, and iron brown are in evidence, and the plasticity and compactness increase slightly. The intensity of the mottling generally increases to a depth of about 44 inches, where gray becomes the dominant color. In many places iron-brown stains and iron concretions occur in this horizon. At a depth of about 60 inches the color becomes dull gray or bluish gray, but the texture remains heavy silt loam.

The profiles of the first-bottom soils correspond in a general way to the foregoing description, but have a wider variation. These soils are essentially recent alluvial soils. The lower subsoil layers, as a rule, are sandy, and in many places are well-defined layers of recently deposited alluvial material differing sharply from each other in color, texture, and organic-matter content. In places where the various horizons of the profile are extremely different or where the soil characteristics change within short distances, the material has been classed as alluvial soils (undifferentiated).

The soil material of the poorly drained imperfectly developed soils is derived from the surrounding upland areas. A great part of the deep silt is undoubtedly water transported, some may be loessial, and the remainder is residual silt from limestone and shale. The sandy material is water-transported material weathered from sandstone.

The dark color of the Wabash soil is caused by the incorporation of decomposed organic matter, which is present in wet timbered soils as well as in prairie soils, and is owing to preservation under poor drainage conditions rather than necessarily to prairie vegetation.

In areas where the water table is so high as to allow no oxidation of the surface material, the organic matter accumulates in an undecomposed condition. This material is called peat. The natural vegetation and the height of the water table determine to a great extent the character of the organic accumulation. In areas where marsh grasses or sedges have predominated, felty fibrous peat has developed. If the water table is comparatively low or is low at intervals partial oxidation weakens the structure of the material and develops a darker color, and under such conditions the feltiness or toughness is not so marked and a looseness or finely divided condition develops. Where the peat is made up of woody material, a soft smooth somewhat granular mass results.

SUMMARY

Trempealeau County is in the west-central part of Wisconsin about 125 miles north of the Illinois State line. Its area is 745 square miles.

With the exception of the level Mississippi River terrace, the relief, for the most part, is that of an area of steep or moderate slopes and narrow ridges separated by several rather wide, open valleys. Drainage is good except on the first-bottom land along the streams.

The 1930 census gives the population of the county as 23,910, all classed as rural. Arcadia is the largest town, and Whitehall is the county seat.

Farm tenancy is slowly increasing. However, only about 18 per cent of the farms are rented. Transportation facilities are good. Four railroads afford ready outlet for all farm produce, and surfaced highways and improved roads completely ramify the county. Rural mail delivery is provided to all sections.

The climate is characterized by comparatively long, cold winters, prolonged spring and fall seasons, and short but warm summers. It is favorable to general farming and particularly to dairying.

Of the soils of the county 4 soil series, including 9 soil types and 8 soil phases, belong to the mature gray-brown podsolic group. The soils of the Boone series are residual soils developed from sandstone and shale, the Dubuque soil is residual soil developed from limestone, the Clinton soils are derived from loessial silt, and the Bertrand soils are well-drained soils developed from old alluvium. Boone silt loam, with its rolling phase, is the most widespread and the most important soil of the county.

The northern prairie group of soils is represented by 4 soil types and 6 soil phases. Bates silt loam is a dark-colored well-drained residual soil developed from shale and loess, the Waukesha soils are well-drained prairie soils underlain by old silty alluvium, the dark-colored phases of the La Crosse soils are underlain by very sandy alluvium on stream terraces, and the Sparta soils are well-drained, very sandy, semiprairie soils.

The Trempealeau soils appear to be a variation of the prairie soils of the stream terraces, and are featured by an exceptionally high content of iron in the upper 2 feet of the soil profile.

The group of imperfectly developed soils includes principally poorly drained soils. The Waukesha and Wabash soils are dark colored, whereas soils of the Bertrand and Genesee series are light colored. The undifferentiated first-bottom land is variable. Peat includes the organic soils. Rough broken land has little if any soil developed on it.

Dairy farming, supplemented by hog, poultry, and sheep raising and one or two cash crops, is the predominant farming industry. The principal dairy product is butter. The main cash crops are peas for canning, tobacco, cucumbers for pickling, and wheat

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U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
HENRY G. KNIGHT, CHIEF
A. G. McCALL, CHIEF, SOIL INVESTIGATIONS
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
TREMPEALEAU COUNTY
WISCONSIN

WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY
ERNEST F. BEAN, DIRECTOR
UNIVERSITY OF WISCONSIN COLLEGE OF AGRICULTURE
H. L. RUSSELL, DEAN
A. R. WHITSON, IN CHARGE SOIL SURVEY

LEGEND

Bates silt loam (Ba)	Dubuque silt loam (Du)
Bertrand fine sandy loam (By)	Genesee silt loam (Ge)
Bertrand loam (Be)	La Crosse sandy loam, Dark-colored phase (Lr)
Bertrand silt loam (Br)	La Crosse fine sandy loam, Dark-colored phase (L)
Bv Mottled-subsoil phase	La Crosse loam, Dark-colored phase (Lm)
Boone fine sand (Bs)	La Crosse silt loam, Dark-colored phase (Ls)
Boone fine sandy loam (B)	Sparta fine sand (Sf)
Steep phase	Gently rolling phase
Level phase	Sparta sandy loam (Sy)
Boone loam (Bm)	Trempealeau sandy loam (Ty)
Steep phase	Trempealeau fine sandy loam (T)
Level phase	Trempealeau loam (Tl)
Boone silt loam (Bl)	Trempealeau silt loam (Ts)
Rolling phase	Wabash silt loam (W)
Level phase	Better-drained phase
Clinton silt loam (Cs)	Waukesha silt loam (Ws)
Steep phase	Mottled-subsoil phase
Alluvial soils (Undifferentiated) (A)	Peat (P)
Rough broken land (Rb)	Shallow phase

CONVENTIONAL SIGNS

CULTURE (Printed in black)
- City or Village, Roads Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort
- Secondary roads and Trails
- Railroads: Steam and Electric
- Bridges, Ferry
- R.R. crossings, Tunnel
- Fort, Dam
- School or Church, Cemeteries

CULTURE (Printed in black)
- Mine or Quarry, Mine dumps, Made land
- Shaft, Entrance, Rock cut-crop and Triangulation station
- Steep and Gravelly areas
- Soil boundaries
- State Boundary lines
- County Boundary lines
- U.S. township and section lines

DRAINAGE (Printed in blue)
- Streams
- Lakes, Ponds, Intermittent lakes
- Intermittent streams
- Springs, Canals and Ditches, Flumes
- Swamp, Salt marshes
- Submerged marsh, Tidal flats

Mark Baldwin, Inspector, District 1.
Soils surveyed by M. J. Edwards, in charge, E. H. Bailey and W. J. Geib, U. S. Department of Agriculture, and J. F. Fudge, Burel Butman and Harold Cook, Wisconsin Geological and Natural History Survey.

BASE MAP FROM U. S. GEOLOGICAL SURVEY SHEETS

Scale 1:62500
1 0 1 2 3 4 5 Miles
1 0 1 2 3 4 5 6 7 8 9 Kilometers

WILLIAMS & HEINTZ CO., WASH., D.C.

Field Operations
Bureau of Chemistry and Soils
1927

[PUBLIC RESOLUTION—No. 9]

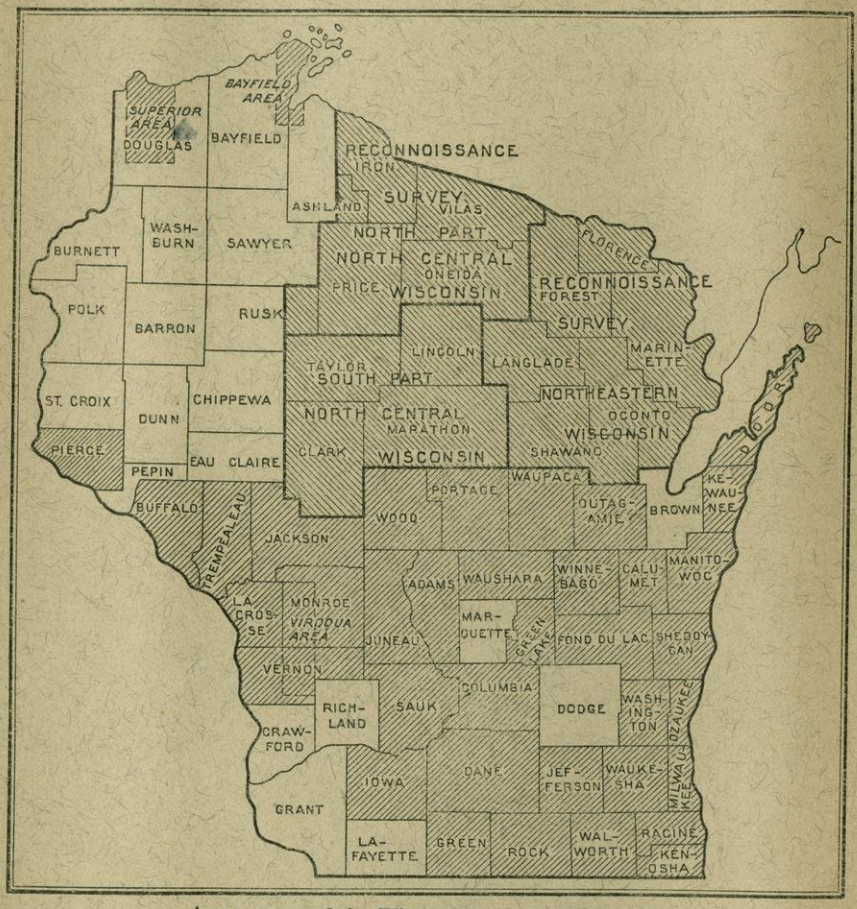
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in Wisconsin, shown by shading

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