

Issued July 15, 1912.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY, E. A. BIRGE, DIRECTOR; COLLEGE OF AGRICULTURE, UNIVERSITY OF WISCONSIN, H. L. RUSSELL, DEAN; A. R. WHITSON, IN CHARGE SOIL SURVEY.

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SOIL SURVEY OF THE BAYFIELD AREA,  
WISCONSIN.

BY

GUSTAVUS B. MAYNADIER AND W. J. GEIB, OF THE U. S. DEPARTMENT OF AGRICULTURE, AND LEROY SCHOENMANN, AND F. L. MUSBACK, OF THE WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY.

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[Advance Sheets—Field Operations of the Bureau of Soils, 1910.]



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1912.

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## LETTER OF TRANSMITTAL.

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS,  
*Washington, D. C., November 11, 1911.*

SIR: I have the honor to submit for publication as advance sheets of Field Operations for 1910, as authorized by law, the report and map covering a soil survey of the Bayfield area, Wisconsin.

This work was urgently requested by the Commercial Club of Bayfield and bore the indorsement of Hon. John J. Jenkins, within whose district the area lies. The bureau was assisted in the survey by the State, under a cooperative arrangement with the University of Wisconsin.

Very respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

Hon. JAMES WILSON,  
*Secretary of Agriculture.*

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### MAP.

Soil map, Bayfield sheet, Wisconsin.



# SOIL SURVEY OF THE BAYFIELD AREA, WISCONSIN.

By **GUSTAVUS B. MAYNADIER** and **W. J. GEIB**, of the United States Department of Agriculture, and **LEROY SCHOENMANN**, **F. L. MUSBACK**, of the Wisconsin Geological and Natural History Survey.

## DESCRIPTION OF THE AREA.

The Bayfield area, covering 329 square miles, or 210,560 acres, includes portions of Bayfield and Ashland Counties, Wis. It covers that part of Bayfield County lying east of the ninety-first meridian of longitude and north of 46° 30' north latitude, together with that part of Ashland County included in Tps. 47 and 48, R. 4 W. on the mainland and the entire group of the Apostle Islands. This area is situated in the extreme northwestern part of the State, close to the western extremity of Lake Superior; and the surveyed portion of the Bayfield Peninsula, together with the adjacent islands, constitutes the most northerly land in Wisconsin.

In the region comprising this area and the adjacent country were the earliest white settlements in this section, exploration parties under Radisson and Groseilliers having visited it as early as 1661. Trading posts were early established to facilitate intercourse with the Indians at various points in this region, one of which, on the shores of Chequamegon Bay, being called La Pointe. This post, subsequently removed from the mainland to Madeline Island and famil-

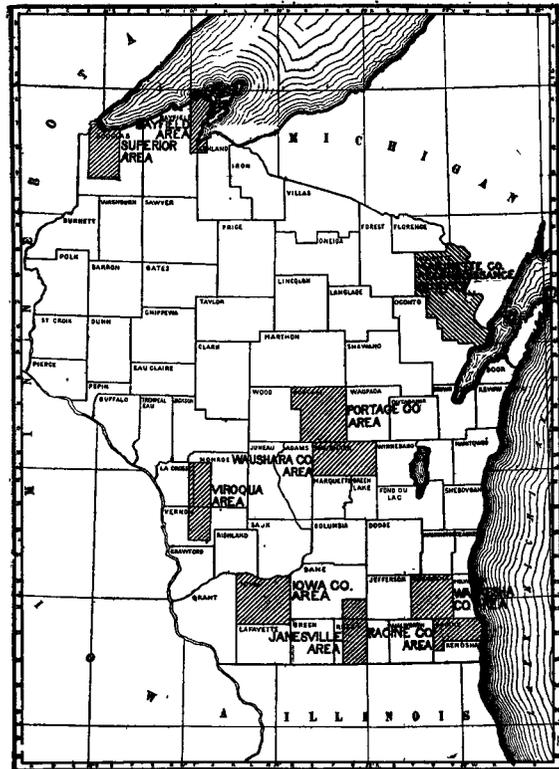


FIG. 1.—Sketch map showing location of the Bayfield area, Wisconsin.

ially known as the Old Mission, has become famous by its association with the memories of Allouez and Marquette. The agricultural development of this country until very recently has, however, been slow, notwithstanding the fact of its early exploration. The great wealth of its forests, which first attracted attention, and the subsequent discovery of the mineral resources of northern Wisconsin were the inducements that brought about most of the development which has taken place. This whole region was originally peopled by the various branches of the Chippewa Indian Nations, which are now represented by but few individuals.

The earliest white immigration was from other portions of the then Northwest Territory, of which this region was a part, and from Canada, the latter settlers being mainly of French extraction. More recently the immigrants have been largely Scandinavians and Germans.

That portion of the Bayfield Peninsula included within this area is of a very rolling and almost rugged character, possessing but few level areas, none of which are of any great extent. It is distinctly a region of hills and valleys. The slopes of the former, however, are usually not steep enough to prevent cultivation, though in many of the latter the drainage is inadequate. The elevations rise at once from the shore line on the east in a sharp, terracelike ascent, while on the north the shore line is characterized by a continuous line of precipitous bluffs of red sandstone or red clay from 10 to 50 feet in height, from which the rise is very sharp, elevations of from 200 to even 300 feet being found at distances of from a few hundred feet to about a mile from the shore line in the northern portion of the peninsula. Proceeding southward the shore line loses much of its ruggedness and the land along the shore assumes a more gently rolling character, that bordering on Chequamegon Bay being low and level for a considerable distance inland. Some of this low-lying land along the shore is at times very wet and where not actually swampy is unsuitable for the production of the general farm crops, being well adapted, however, for grazing and for growing grass for hay. An area of this kind is found adjacent to the Ashland County line. That part of Ashland County located on the mainland and included in this area lies mainly to the south of the city of Ashland. It extends from the lake front in a series of gentle rises and level stretches, reaching its maximum elevation in the southeastern part of the area, forming a gently rolling plain somewhat dissected by depressed streams and gullies.

The surface features of the Apostle Islands are somewhat varied. The shore line of practically all consists of bluffs from 20 to 100 feet high, with here and there a few sand beaches, from which there is a gradual rise toward the center. Stockton, Ironwood, Michigan, Cat,

and Sand Islands are somewhat saucer shaped, their interiors being slightly depressed or at least nearly flat. The topography is usually gently rolling or with a gradual slope from the bluffs along the lake to the interior. Oak Island is the highest and most rugged, reaching an elevation of 420 feet above the lake. This is higher than any of the mainland within a few miles of the lake shore. The elevation of the other islands ranges from 20 to 150 feet above the lake.

In the northern part of the Bayfield Peninsula numbers of small streams, together with Sand and Raspberry Rivers, afford an excellent system of surface drainage for much of this country. In areas of Superior clay considerable erosion has taken place along these stream courses. The sandy loam, however, permitting the passage of the water downward, rather than tending to create surface flow, is not so greatly affected. By reason of the rolling character of the surface there are many depressions in this section in which the drainage from the adjoining hillsides collects and from which it can escape but slowly, resulting in the formation of swampy spots. These are of frequent occurrence, but are usually of small individual extent. At present but little attempt has been made to drain the greater number of these areas, though as agricultural development progresses they will doubtless all be reclaimed.

South of Ashland the slope is generally northeastward, the drainage being effected through the White River and other streams, into which many small streams find their way. Owing to its nearly level topography and to the impervious character of the soil and subsoil, much of the land lying south of the city is but poorly drained. The soil in this region is so retentive of moisture and storm waters run off so slowly that as agriculture develops it will be necessary to install drainage systems.

Until quite recently this whole area was a pinery of great value. White pine was the most valuable species found in the original forest, as well as one of the most abundant. Norway pine, hemlock, white and black spruces, balsam fir, white cedar, and tamarack were also abundant. Deciduous and hardwood species were represented by birch, elm, oak, maple, basswood, aspen, hickory, and ash. Most of the available timber has been removed, and the areas of stump land are now overgrown with a dense seedling growth, chiefly of birch and aspen. When the original growth of the valuable white pine was removed no adult seed-producing trees were left standing; consequently there has been no reseedling. Had sufficient trees been left for this purpose there would now be a thrifty stand of young pines that in time would overcome the intruding birches and poplars and reclothe these lands with a forest as valuable as that which has been so destructively removed. Moreover, the conditions provided by the undergrowth of birch, poplar, and other deciduous

species are admirably adapted to the protection of the tender ever-green seedlings. Much valuable time would have been gained in the reforestation of the lands of this region had such a precaution been taken, looking toward the future use of those lands that for various reasons are but little fitted for agricultural development.

A very small proportion of this area is cleared, the greater part being covered with the dense growth that sprang up when the timber was removed, and is still occupied by the stumps that mark the location of the former extensive pineries. The cost of clearing and preparing these lands is considerable, yet the development that has taken place up to the present time indicates that satisfactory returns may be expected from capital judiciously invested in farming in this region.

Convenient transportation by rail and water puts all sections of this area in close communication with outside points as well as those places located within its limits. The Northern Pacific, Minneapolis, St. Paul & Sault Ste. Marie (Wisconsin Central), and Chicago & Northwestern Railway systems all enter this area, giving rapid transportation facilities to Duluth, St. Paul, Minneapolis, Milwaukee, and Chicago, as well as to the many smaller towns of the State and to the rapidly growing places in the iron and copper country. Besides the trains, daily boats ply between Ashland, Bayfield, and Washburn, and a line also connects Bayfield with Duluth, running three boats weekly each way.

The chief city of the area is Ashland, a place of about 12,000 population. It is the shipping point of large quantities of iron ore and has ore and coal docks of great capacity. Here also are extensive lumber mills, a blast furnace, and a wood-alcohol works. It is supplied with electric lights and a street railway and has waterworks and a sewerage system. There are churches of various denominations and many graded schools. The high school is an imposing building, said to be equal in both equipment and structure to any in the State. The city has wide streets, on which are located many good business blocks, banks, hotels, and residences. The wooden sidewalks of a generation ago are being replaced with cement, and much asphalt paving is being done.

Washburn, the next town in point of size, has a population of about 4,000. It is the county seat of Bayfield County, and is a brisk and thriving town, possessing good graded and high school buildings, numerous churches, a newspaper, banks, and retail business houses. Large sawmills and extensive lumber docks are located here. It is connected by rail and ferry with Ashland.

Bayfield has long been known as a resort for hay-fever sufferers, being one of the few places where victims of that malady obtain immunity from their sufferings. It is a picturesquely located hill-

side town of about 2,000 population, situated near the northern end of the peninsula, directly overlooking the Apostle Islands. It has extensive lumber interests and sawmills. Many hundreds of tons of Lake Superior whitefish, trout, herring, etc., are shipped from this point annually. It is connected with points outside of the area by the Chicago & Northwestern Railway system, and by that route and by ferry with Ashland. Frequent communication is kept up with Madeline Island, 2 miles off the mainland, and others of the Apostle Islands. It has numerous graded schools, a fine high school, a public library, and churches of many denominations, as well as good retail stores, and banking and hotel facilities. Bayfield is the center of a highly promising fruit-raising section and a large area of small fruits, apples, and cherries is being developed, the direct result of the highly satisfactory yields and quality of the products obtained in this vicinity.

#### CLIMATE.

Protected by the Kettle Range and other hills from the cold northerly to westerly winds that sweep over the vast snow-covered prairie regions of both the Canadian and American Northwest, and benefited by the ameliorating influence of Lake Superior, a considerable part of the Bayfield area is comparatively free from the long periods of intense cold that frequently occur in localities less favorably situated, though located farther south. The winters are, however, long and the snowfall heavy.

In this section the ground rarely if ever freezes to any great depth, the heavy mantle of snow that falls soon after the winter season sets in serving to protect it; and while the soil becomes sufficiently cold to render all vegetation completely dormant, it is yet in a condition to break forth in rapid development as soon as the growing season begins. Late frosts, or the occurrence of frosts after spring fairly opens, are unknown, and the growing season, though short, is a period of rapid and uninterrupted development of all sorts of vegetation. The number of hours of sunshine each day during the growing season is greater in this region than for points farther south, and this accounts in part for the rapid growth. These conditions are also especially marked on the islands, where the lake influence is at its maximum, and notwithstanding spring does not open as early as on the mainland, the growing season is maintained longer in the fall. Lacking the protection afforded the northern part of the area, the vicinity of Ashland is somewhat colder in winter than the Bayfield neighborhood, though the snowfall is as heavy as in that section. The summers throughout the whole area are warm and pleasant, extremely high temperatures being of comparatively rare occurrence.

The following table has been compiled from the Weather Bureau records taken at the station at Ashland, Wis. The records of precipitation cover a period of 19 years and the temperature records 16 years.

*Precipitation and temperature at Ashland, Wis.*

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Precipitation:													
Mean for 19 years.....	1.14	1.23	1.53	2.11	3.30	3.43	4.07	3.14	3.13	2.84	1.53	1.21	28.66
Temperature:													
Mean for 16 years.....	14.8	13.6	2.37	39.6	50.5	61.4	68.0	67.1	60.4	47.8	31.7	20.4	41.6
Absolute maximum.....	58	55	60	83	89	98	104	97	99	94	67	55	104
Absolute minimum.....	-31	-33	-20	6	21	25	42	37	28	13	-13	-22	-33

The average date of the first killing frost in the fall at Ashland is September 21, and the average date of the last killing frost in the spring is May 14. This gives an average growing season of 130 days for Ashland and the immediate vicinity.

It will be observed from the table above that the mean annual precipitation is 28.66 inches, and that this is especially well distributed throughout the growing season, when it is most needed. The mean annual temperature at Ashland is 41.6°, the maximum 104° and the minimum -33°. The extremes of temperature are infrequent and of short duration.

Conditions on the Bayfield Peninsula differ somewhat from those at Ashland, though the Weather Bureau has no official station in the area except the one above mentioned. From the most reliable data obtainable, however, it is found that the average date of the last killing frost in the spring on the Bayfield Peninsula is May 10 and the average date of the first killing frost in the fall is October 1. This gives a period of about 140 to 145 days free from killing frosts.

The paragraphs following are taken from a bulletin of the University of Wisconsin Agricultural Experiment Station, entitled "The Climate of Wisconsin." The "Superior Shore" referred to is one of eight climatic divisions recognized in this bulletin as existing in Wisconsin. All of the Bayfield area is included within this division.

The Superior Shore is a narrow belt adjoining Lake Superior, of unknown width, though it is unlikely that the lake influence extends farther inland than 25 miles, and apparently in places, as a factor of horticultural value, it does not exceed 5 miles. There also appear to be great variations within this belt, the southeast slope at Bayfield being warmer and having a growing season apparently much longer than the northwest slope at Herbster, which is farther west along the shore of Lake Superior. The Herbster record is so short, however, as to be of little value. This belt, at least the region around Chequamegon

Bay, is characterized by cool summers, with frequent northeast winds off the lake and a mean temperature (64°) like that of the coast of Maine or the Puget Sound region; pleasant, prolonged autumns (46°) similar to those of the Berkshire Hills of Massachusetts, or eastern Washington; cold continuous winters, having about the same mean winter temperature (15°) as the central portion of Wisconsin, Aroostook County, Me., the Green Mountains of Vermont, southern Minnesota, or northern Montana; and cool, retarded springs (37°) resembling the Adirondacks and the Red River Valley. Generally, on about three winter mornings the temperature drops to 20° below zero or lower, while on an average of 5 days in summer it reaches 90° or more. Sudden changes in temperature occur in this section, due to shifts in the direction of the wind. In summer a storm coming up the Mississippi Valley causes a hot, dry wind from the south, which, descending from the highlands, sweeps down upon the lake shore with some of the severity of a bora in Switzerland or a chinook wind of the Western States. The temperature may rise to over 100°, and then, with the passing of the storm center to the east, a reverse breeze off the lake sets in, reducing the temperature even below 50°, and is usually accompanied by rain. In winter reverse effects follow this change in wind, the land breeze being cold and the lake breeze comparatively warm.

The length of the average growing season varies from probably 150 days on the Apostle Islands, Madeline being the warmest, to an average of 130 days on the mainland near the water, diminishing probably to 115 days 10 miles inland. However, the records in this region, which apply to any specific locality outside of the immediate vicinity of the Weather Bureau station at Ashland, are so few and short that estimates of the length of the growing season are merely approximate. The islands have a growing season similar to that of the St. Lawrence Valley, northern Iowa, or eastern Colorado, but a much colder summer temperature (about 60°), while a belt 10 miles inland, though it has a short growing season similar to that of central Maine, the Catskills, central North Dakota, or Montana, has a mean summer temperature probably 8° warmer than the islands.

The rainfall on this northern slope, owing to the lessened evaporation and the fact that a larger proportion comes in the summer and fall, is more effective than in the southern part of the State; but the occasional wet, windy northeasters, lasting sometimes a couple of days, are very disagreeable. On the whole, this region resembles the coast of Maine in both climate and scenery, though clear and free from fogs in summer and colder and drier in winter, covered with a deep blanket of snow from the 1st of December to the 1st of April.

#### AGRICULTURE.

It was not until after the timber had been removed and a few scattered acres brought under cultivation that the great fertility of these lands was recognized. Wherever the land was cleared, grain, grass, and garden crops flourished, the luxuriance of their growth being limited only by their adaptation to the soil types upon which they grew. Garden patches around the lumber camps located on the sandy loam areas produced fine potatoes, turnips, cabbage, and other garden truck, though given but the most meager and unskilled care. Where the clay soil predominated the seed scattered from the forage brought in to feed the camp stock soon covered the land with a

thrifty growth of the cultivated grasses and clover. Relieved from the depressing influence of the forest shade, raspberries and blackberries spread over large areas. Thus nature demonstrated in her own way a method of utilizing this soil by the labor of man and protested against its abandonment by him after he had robbed it of the fruits of her labors achieved without his assistance.

There are at present but few well-developed farms in that portion of the area lying to the north and northwest of Bayfield. The average size of such farms as do exist is from 10 to 30 acres. The type of farming followed on these has of necessity been general, no attempt having been made at specialization until recently.

In the last few years the tendency has been toward the raising of small fruits, together with apples and cherries. In this particular section where the sandy loam predominates conditions all combine to make these endeavors successful. The adaptation of the soil can not be questioned and the climatic conditions are highly favorable. The luxuriant growth of grasses and clover here has induced some to venture into dairy farming, mostly in a small way. No creameries or cheese factories have been established in this neighborhood, as the amount of milk produced is small and is easily disposed of as whole milk or dairy butter in the cities of Bayfield and Washburn.

In the southern portion of the area, in the vicinity of Ashland, markedly different conditions exist, and the distribution of different types of farming with reference to soil types is admirably illustrated by the conditions existing in this area. Just as the adaptation of the sandy soils in the vicinity of Bayfield has resulted in the production of special crops, so the advancement of dairying and stock raising has followed on the Superior clay in the southern part of the area. In this section the greater portion of this soil type is devoted to grazing and the production of grass for hay, to which it is especially well fitted. The city of Ashland provides a good market for milk and butter, and many dairy herds are being established. The number of these that are headed by purebred sires and the fine class of buildings provided for their housing indicates the success of this branch of agricultural industry in this vicinity. Where not consumed on the farms, hay is the chief marketable crop, and while much of the land in its present state is well suited for its production, it is advisable to grow hay only in connection with a regular crop rotation such as is suggested under the discussion of the Superior clay. Moreover, the ready market for dairy products in Ashland and the adaptation of soil to grass and clover combine to make this type of farming profitable without requiring the installation of extensive drainage systems. In many fields the efforts in this direction are confined to constructing broad open ditches just sufficient to remove the surface water that accumulates from the melting snows and heavy rains.

Under proper methods of cultivation and rotation excellent crops of wheat, peas, turnips, rutabagas, and potatoes are raised. Several large droves of fine hogs are to be seen on farms in this section, the breeds most prominent being Berkshire and Poland China, and some farmers were observed to be pasturing both sheep and steers. The divers varieties of stock kept and the thrifty appearance of the surroundings indicate that stock raising in this section need not be confined to any one branch and testifies to the profitableness of the business as a whole. This is as it should be in a section where on much of the soil such magnificent crops of clover, timothy, alfalfa, and pasture grasses can be grown. While somewhat far north for corn to ripen, good silage crops can readily be produced, and efforts are being made to perfect some new varieties that can and do mature in this section. As much as 50 bushels per acre of one of these varieties was recently harvested on a farm in this section of the State.

Except on Sand and on Madeline Islands no agricultural development has been undertaken on any of the islands of the Apostle group. Sand Island has recently become the scene of some activity in small-fruit production, with every prospect of success. Some general farming is followed on Madeline Island, together with a number of small ventures in fruit growing, and an experimental orchard has been established on it by the State of Wisconsin. On the remainder of the islands much timber is still standing, although in most cases the more valuable has been removed. A native cherry of fair quality, which is said to have been originally introduced into this region by the early Jesuit missionaries, abounds on Michigan and others of the islands.

The predominating type of soil on the Apostle Islands is Superior sandy loam, and this is more uniform in its development than on the mainland. It is the opinion of horticulturists that the islands are as well adapted to fruit growing as the mainland. Clover, peas, potatoes, oats, and wheat are being successfully raised on Madeline and Sand Islands, and general farming and dairying will no doubt be developed along with the fruit industry. The spring season is a little later on the islands, but the modifying influence of the lake makes the date of the first killing frost in the fall somewhat later than on the mainland. It is not probable that extensive development will take place upon the islands as a whole until values on the mainland reach a higher point. The only objection to the agricultural development of the islands is their inaccessibility.

#### FRUIT GROWING.

The part of this area especially adapted to fruit culture is located on the Bayfield Peninsula adjacent to the shore of Lake Superior and

Chequamegon Bay and extending inland probably for a distance of from 3 to 5 miles. In this section the Superior sandy loam is the most extensive soil type and the one best suited to fruit culture.

In the vicinity of Washburn the type, Superior sandy loam, is much more limited in extent than in the northern part of the Bayfield Peninsula. The areas found, however, are equally well adapted to the development of the fruit industry. The Superior clay, which is the predominating type within 5 miles of Washburn, is somewhat lighter in texture and more rolling than the same type as found in the southern part of the survey. Its texture and topography insure better drainage than on the heavier phase and where not eroded it is better adapted to general farming and fruit growing. Many good orchard sites are to be found on the clay in this vicinity and several orchards have already been put out with success.

As is the case with all specialized industries, a number of factors must be in accord to insure success. Applied to fruit culture, soil, climate, location, and selection of proper varieties are of equal importance in determining the ultimate outcome of the industry. Failure to recognize the importance of even one of these factors may and often does lay the foundation for eventual failure, in spite of a highly promising appearance at the outset. While it is not intended to mean that fruit can not be raised in all parts of this area, it is distinctly to be understood that the conditions existing in some parts of this particular section are much more favorable than are those in other portions of the survey having somewhat different surroundings. On the Bayfield Peninsula are to be found a far greater number of desirable orchard sites than can be found in the more level regions to the south, and other conditions exist that provide almost certain immunity from late frosts in spring. On the islands practically these same conditions exist, and all of them will, when cleared, doubtless prove desirable locations for fruit culture. As might be expected, the winds from the lake are the warmest winds of the winter and the coolest breezes of summer. The temperature of both winter and summer is thus considerably and beneficially affected by the lake's influence.

Fruit growing has been carried on in the neighborhood of Bayfield for over 30 years, so that in spite of the fact that orcharding has but lately been considered as a business, the results of these previous small ventures remove such enterprises from the realm of experiment and go far toward assuring success when they are properly conducted.

No factor perhaps is more important than the selection of varieties to which both soil and climate are suitable, and for best results selection should be confined to those which although doing well elsewhere seem to be particularly suited to the soil and climate of this region.

The following list is not a catalogue of all varieties of fruits adapted to the environment afforded by this area, but embraces only such varieties as past experience has shown to be particularly suited to this locality and to the islands.

#### APPLES.

Less than half a century ago the idea was prevalent that apples could not be made a commercial success in the Northwest. To-day, however, there are hundreds of bearing orchards throughout this territory yielding tremendous crops of magnificent fruit which brings the highest prices in the markets of the world.

The conclusion first reached was the result of trying to introduce into this region the old standard varieties of the East, so long grown on soils and under climatic conditions entirely different from those of the newer region. None of these varieties, however, found the environment provided by the new location sufficiently congenial to enable them to uphold their reputation, which had been established under such very different surroundings. It was hoped that the introduction by the United States Department of Agriculture of a large number of varieties imported from Russia would solve the problem, and that by this means the Northwest could be supplied with varieties that would prove entirely suitable. After careful test, however, it was found that while some valuable sorts were obtained from this source, as a rule the Russian varieties were too early and none proved to be entirely suitable for winter keeping. This brought to the front some of our horticulturists who had been experimenting by making crosses and raising seedlings in an endeavor to produce varieties which should combine hardiness and quality. This work has resulted in the production of some varieties in which are combined the best qualities of the old familiar varieties of the East with those of the introduced Russian sorts, and as a result of this achievement of American horticultural science, successful apple growing in the Northwest is now an accomplished fact. Among these the best known is Wealthy, originated by the late Peter M. Gideon, which since its introduction in 1861 has been the best known variety in this region. Of more recent origin is the Patten, or more familiarly Patten's Greening, which was introduced in 1885 by its originator, Charles G. Patten, of Charles City, Iowa. Having a hardiness of constitution able to withstand the rigors of a climate too severe for most varieties, its fruit, borne on trees of a vigorous and productive character, possesses better keeping qualities than most of the hardy sorts. Okabena, also of American origin, is another variety suitable for this area. University is a variety which gives promise of being well suited to this region, but because of the short period during which it has been

grown no more specific statement can be made concerning it at the present time.

McIntosh, a particularly choice apple of Canadian origin, is recommended for trial in the Bayfield region. This variety has not been tested extensively in this section, and exposed locations should be avoided in the selection of sites upon which to plant it. Duchess and Yellow Transparent, of Russian origin, can be successfully grown throughout this area, the former, indeed, having long been the standard of hardiness in many sections where the winter seasons are more severe than here, and it is one of the favorite varieties now being grown in this region.

Martha and Transcendent are crab apples possessing many good qualities and suitable for cultivation in this area, and Whitney, a hybrid, has proved to be the most desirable of its class. While, of course, there are many other varieties of apples, crabs, and hybrids that would perhaps do well in this area, those mentioned are believed to be peculiarly suited to the environment, and are varieties of established commercial reputation.

#### PLUMS.

While plum culture may acquire an important place in the horticulture of the Bayfield area, this fruit has been grown for so short a time that a specific statement concerning the varieties best adapted to this region would not be justifiable at present. It appears, however, from the experience acquired to date that the native varieties of plums will be the ones best suited to the conditions of soil and climate existing in the area surveyed.

#### CHERRIES.

Cherries have been grown successfully in this area for years. On many of the Apostle Islands the "Mission" cherry, as it is called, has been known for a long time and has become quite fully naturalized. It is supposed to have been introduced by the early French settlers. As the cherry will grow only on a soil that is well drained and free from constant moisture, it is especially adapted to cultivation on the rolling areas of sandy loam in the Bayfield district, and should by no means be planted on the moist, heavy clay. By reason of their superior hardiness the Early Richmond and Montmorency are the only cherries recommended for this area, the climate being too severe for the Bigarreau or Heart varieties.

#### APRICOTS.

As far as could be ascertained the growing of apricots has not been attempted in this section, the impression being that this fruit

is not sufficiently hardy. While this is true of many sorts, it yet remains a fact that there are many varieties of Russian origin that succeed where the other varieties can not be grown. Among the desirable sorts of this class, many of which will withstand a temperature of 30° below zero, which are recommended for trial, are Alexis, the fruit of which is large and attractive, being a rich yellow with red cheek; Superb, a golden yellow variety of large size, excellent quality, and very hardy and productive; and Budd, a late variety with large white fruit having a blush or red cheek, and perhaps the best of the late varieties for this region.

#### SMALL FRUITS.

Small-fruit cultivation has been uniformly successful throughout this area wherever undertaken. A careful consideration of the merits of many varieties of this class of fruits, together with a study of the soil and other conditions under which they are to be produced, leads to the selection of the following list of varieties suitable for cultivation in this area:

Of the red raspberries, the Marlboro, Cuthbert, and Miller are all desirable varieties, especially the last named. Among the black raspberries, or "black caps," none are better suited for this section than Gregg, Older, and Winona. Eldorado has proved a highly desirable blackberry on the more sandy soils of this region, producing fine crops of excellent fruit. Snyder is also one of the very best blackberries for the north, being second in hardiness only to Stone's Hardy, itself a very prolific sort, of good quality, although the fruit is somewhat smaller than the Snyder. Wachusett, or as sometimes called Wachusett Thornless, is a variety of somewhat doubtful hardiness for this section; nevertheless it is worthy of trial upon the clay soils to which it is equally adapted as to the sandy types. This fact alone is deemed sufficient to warrant its mention as a variety likely to prove valuable in portions of this area.

The English varieties of gooseberries, while possessing great merit, have been found to be very much subject to mildew in certain localities and for this area it does not seem wise to recommend them. Varieties derived from native species, although bearing somewhat smaller fruit than many of the British sorts, will be found preferable. Among the best sorts for this area are the Industry, which with good care rivals the English varieties in size, and the Houghton, Pearl, and Red Jacket, which are vigorous growers, free from tendency to mildew, and perfectly hardy in this area.

Currants can be grown in this area without difficulty, and are to be seen in many gardens and dooryards. For commercial culture

the Cherry, Red Dutch, and Fay's Prolific, or Fay, are desirable red varieties, and White Imperial and White Grape are popular white varieties.

While soil suitable for strawberry culture is to be found in all portions of this area, the region immediately around Bayfield presents a combination of soil and climate resulting in more favorable general conditions than exist in any other part of the area. The sandy loam, extensively developed in this neighborhood, is an ideal strawberry soil, and the protection afforded by the heavy mantle of snow that covers the ground during the winter months renders mulching unnecessary. Moreover, this natural protective covering remains as long as its protection is needed and disappears when no longer required.

At present the varieties most extensively grown are Senator Dunlap and Warfield. So well are these suited to the conditions in this section that it seems almost unnecessary to mention any of the others, though doubtless some of them would, if tried, prove quite equal to these. Especially is this true of those parts of the area where the soil becomes more clayey, for in the development of varieties of this fruit many good sorts have been produced that thrive in a variety of soils. Besides the Senator Dunlap and Warfield, the Bederwood, Haverland, and Glen Mary are considered to be worthy of trial on the sandy loam soils of this area. On the denser phases of the sandy loam and on the moderately heavy clay, Bubach, Jessie, Marie, and Sample will no doubt prove highly satisfactory. For this type of soil in more southern localities Gandy is unexcelled, and if not too late in its season would prove itself highly profitable. It is without doubt unsurpassed in keeping and shipping qualities.

#### SOILS.

The soils of the Bayfield area are of glacial and lacustrine origin. The glacial material consists of a heterogeneous mass of stones, sand, silt, and clay, and is known to geologists as belonging to the late Wisconsin stage of glaciation. This mass of material, forming the local soils of the present day, was brought into the area from the northeast over the country now occupied by Lake Superior. The depth of the material varies greatly, ranging from a few feet to several hundred feet. The hills in the vicinity of Bayfield, as well as the Kettle Range, are largely derived from this drift. Since its deposition a great amount of erosion has taken place, serving to accentuate the rough topography prevailing over part of the area.

Coming from Canadian shores, as the glacier did, a part of the deposit, and especially the coarser particles, is very different from the rock on which it rests, and covers quite a wide range of mineral-

ogical material. A considerable percentage of the drift, however, is of local origin and consists of the ground-up particles derived from the underlying red Potsdam sandstone. Many of the stones and boulders of foreign origin are striated or scratched with deep grooves.

The greater portion of this drift occurs as a mixed mass of different-sized particles, ranging from the finer grains of sand, with some silt and clay, to boulders. This intimate amalgamation of material was due to the grinding and mixing action of the glacier in its passage over rock surfaces, and the transportation of the material to the point of deposition. In this work of mechanical transportation the glacier was aided by streams that poured forth from beneath its southern edge. So great in extent was this mass of material and so powerful were the agents of distribution that the soils thus formed cover not only a large part of the Bayfield area, but much of the entire State as well.

The lacustrine material, or what might be more properly classed as glacio-lacustrine, was probably deposited prior to the advent and retreat of the late Wisconsin glacier when the lake stood at a much higher level than at present. The beds of heavy red clay which were thus formed were later modified somewhat by the advance of the ice sheet. In places the clay was picked up by the ice or pushed along and mixed with the material already carried by the glacier. It is this modification by glacial action which accounts, in part at least, for the presence of pebbles and some boulders in the clay on the Bayfield Peninsula and in the vicinity of Washburn, for the more uneven topography in these localities, and also for the mixture of clay and sand which is found in some places as the subsoil of the Superior sandy loam. The level topography and the almost entire lack of pebbles and boulders south of Ashland indicates that the clay beds there were not influenced to so great an extent by glacial action.

The names of the several types of soil mapped in the area, together with their actual and relative extent, are given in the following table:

*Areas of different soils.*

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Superior clay .....	112,576	53.4	Beach sand .....	1,792	0.9
Superior sandy loam .....	81,344	38.6	Superior silt loam .....	1,472	.7
Coloma gravelly sand .....	8,128	3.9	Genesee loam .....	320	.2
Marsh (containing areas of swamp) .....	4,928	2.3	Total .....	210,560	.....

## SUPERIOR CLAY.

This type of soil, one of the most extensive in the area, is a heavy, compact clay of pinkish-red to light chocolate red color, with no apparent difference in color or texture between the soil and subsoil. After being properly cultivated for a few years the soil appears to become lighter in texture and looser in structure, and to approach a brown color. This is due to mellowing effect of cultivation and to the incorporation of organic matter. When wet it is very adhesive and plastic; in drying it cracks on the surface and both soil and subsoil have a tendency to break into cubical blocks or grains.

The surface frequently has a covering of from 1 inch to 3 inches of grayish silty material, from which the clay particles have doubtless been removed, and with which is incorporated varying quantities of organic matter. In many places, however, this covering has been entirely eroded away. Small areas of sand, forming a thin layer over the clay, are sometimes found, but areas of this character are usually of too limited extent to be indicated on the map. Small depressions or flat areas of poor drainage and locally known as swamps are found. Most of these patches may be readily drained when cleared, and as the soil differs from the better-drained areas chiefly by having a higher organic matter content, and as the patches are of small extent, they have not been separated.

In both soil and subsoil are sometimes found fragments of rocks and rounded pebbles, with an occasional boulder. These are most common in that portion of the type lying near Washburn and farther north on the Bayfield Peninsula where the clay is more closely associated with the moraine, and where it has been somewhat modified by glacial action. This modification doubtless accounts for the texture being slightly lighter in these localities than it is in the southern part of the area.

The type is a lacustrine deposit laid down probably prior to the Late Wisconsin stage of glaciation and later influenced in varying degrees by the ice sheet. In this area it occurs chiefly on the nearly level plains in the southern part and as a more rolling bench along a portion of the northern and eastern shore line. On some of the islands and in the northern portion of the area its position on the slopes seems to indicate that it was at one time overlain by a covering of the sandy material now found on the higher elevations, but which has since been removed. This type is highly susceptible to stream erosion and when found occupying even slightly rolling plains it has frequently become deeply gullied along the stream courses.

The Superior clay is very retentive of moisture, and the impervious character of the subsoil, together with its generally level topography, makes the problem of drainage a highly important one. Much of

the type in this area, in its natural condition, is very deficient in this respect, and its surroundings are such as to present difficulties in establishing an adequate drainage system. Tiles are found to work well, notwithstanding the seemingly impervious nature of the subsoil. Reliance is at present chiefly put in open ditches, so arranged as to remove quickly the surface water, and but little tile draining has been done in this area. Experience has shown the system of shallow surface drains to be very effective, and since such drains can be readily and cheaply constructed, they are recommended for general use at the present time. On the level tracts tile drains are necessary, and on some of the gently rolling or sloping land, though not absolutely essential, they are beneficial. Where the type is more highly developed and the financial condition of the landowners will permit, tile drains should be installed where drainage is the most deficient.

Where favorably located it is a strong soil and is eminently suited to the production of grasses and clover for mowing as well as for pasturage. In order to render this type more open and porous, and better to effect the ventilation and aeration of it, the use of coarse stable manure or the plowing under of green manuring crops is to be recommended. Wherever such a course has been followed a marked improvement has resulted in every instance. Good crops of wheat, peas, turnips, rutabagas, and potatoes have been obtained in the second year following such treatment.

From the results obtained on the experiment-station farm near Ashland it appears that the best way to subdue and improve this type is to practice thorough cultivation and follow a definite crop rotation, plowing under a crop of clover occasionally. A rotation which has given good results consists of small grain—wheat, rye, oats, or barley. The first year seeded with clover and a little timothy. The second year clover, the first cutting being for hay and the second left for seed. The third year, mixed clover and timothy. The sod is manured either before plowing in the fall or on the plowed field during the winter. The fourth year a cultivated crop should be grown. Potatoes, mangels, turnips, and corn have been grown with success. Corn for silage can be grown on all of the type. Some corn has been matured and very satisfactory yields secured. Peas do very well, and yields of 33 bushels per acre have been secured. Wheat has yielded from 25 to 32 bushels per acre on the station farm, and potatoes average 150 bushels, with a maximum yield of 320 bushels per acre. While good yields of potatoes are secured the soil is somewhat heavy and rather difficult to handle for this crop. Clover does very well, and some alfalfa has been successfully grown on well-drained areas of small extent.

After a few years of proper cultivation this soil becomes much more loamy and more easily worked. The type is well adapted to

general farming and dairying, and development is now well under way along these lines, especially in the vicinity of Ashland and southwest of Washburn.

Uncleared, cut-over land of this type can be bought for \$12 to \$25 an acre. Farms of similar soil, cultivated and improved, in Fond du Lac County can not be bought for less than \$100 an acre.

The original growth of white pine and other conifers has been entirely removed, and on the uncultivated portions of this type in this area there has sprung up a thrifty growth of aspen or poplar.

The following table shows the average results of mechanical analyses of the Superior clay, both soil and subsoil:

*Mechanical analyses of Superior clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
22197, 22199.....	Soil.....	0.6	2.8	4.7	11.6	12.6	31.3	36.4
22198, 22200.....	Subsoil.....	.9	3.9	6.0	13.9	14.2	29.8	31.3

The following sample contained more than one-half of 1 per cent of calcium carbonate (CaCO<sub>3</sub>): No. 22200, 12 per cent.

#### SUPERIOR SILT LOAM.

The Superior silt loam, to a depth of about 12 inches, consists of a reddish to chocolate colored very fine sandy or silt loam, underlain by silt or very fine sandy loam. But little difference in color exists between soil and subsoil, which latter merges at an increased depth into stiff red or brown clay. This type is a lacustrine deposit of glacial material, but has been considerably reworked. It occupies an intermediate elevation between the Superior clay and Superior sandy loam. The depth to which its surface and intermediate layers have been laid down over the red clay is extremely variable. This type is recognized solely by the percentage of silt present in both soil and subsoil, and by the absence of rock fragments and gravel so commonly met with in the Superior clay.

It is a good grass and clover soil and well adapted to all crops usually grown on the Superior clay and requires much the same method of treatment as that type. Like the Superior clay, its most profitable use would probably be in connection with dairying as pasture or mowing lands for the production of hay, both grass and clover doing well on it. Following applications of stable manure or green crops plowed under to supply organic matter so much needed by this type, marked increases in these crops are obtained. Such treatment also is necessary if root crops of any kind are to be grown on it. On one farm in the area it has been recently planted to strawberries, but it is too soon to determine its fitness for their production. Much of the type in this area would be greatly improved by drainage, no

matter for what purpose it is to be used. The original timber growth of hemlock, spruce, and pine has been nearly all removed and is now succeeded by gray birch and poplar.

The following table gives the results of mechanical analyses of soil and subsoil of the Superior silt loam:

*Mechanical analyses of Superior silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
22191.....	Soil.....	0.4	0.9	0.8	2.0	1.6	82.1	12.2
22192.....	Subsoil.....	.0	.0	.0	1.0	4.6	67.1	27.4

SUPERIOR SANDY LOAM.

Where typically developed the surface soil of the Superior sandy loam, to a depth of 12 to 18 inches, consists of a gray to brownish sand or light sandy loam of fine to medium texture, usually becoming somewhat loamy with increased depth. At 18 to 24 inches it passes into a stiff, tenacious red clay. Occasionally at the lower depths the clay subsoil is interstratified with layers of fine sand and pockets of sand are sometimes found. The subsoil is very similar to the material forming the Superior clay, and where exposed in road cuts or by stream erosion it exhibits the same tendency to break up into cubical particles and to crack and check. A characteristic of the type is the presence on the surface of rounded stones and boulders, the latter in places in such quantities as to interfere with cultivation.

Areas of this type, as described, occur in the vicinity of Bayfield and along the north shore of the Bayfield Peninsula. The greater proportion of the soil on the Apostle Islands is also typical. There are, however, areas of considerable extent on the mainland where the soil varies considerably from the description given above. The most important difference is that the clay subsoil is not always within 3 feet of the surface and in a number of places it undoubtedly lies more than 6 feet below the surface. The surface soil in such places consists of a medium to fine loamy sand which usually grades into a loose, incoherent yellow or brownish sand of medium texture. A small quantity of gravel is sometimes found upon the surface and also in the lower subsoil. On account of the irregularity of these variations, the fact that the clay may be found coming to the surface in places throughout the deep sand areas, and considering that the country is largely undeveloped cut-over land, thickly grown up with brush which makes it very difficult to get over, separation of the several types could not be satisfactorily made.

In topography this type is gently rolling to hilly. On some of the islands and also on a portion of the mainland it occupies gentle

slopes, but much of it is steep, though never too steep to be cultivated or put in orchards.

In origin the material composing the Superior sandy loam is derived from two sources. The sand, gravel, and bowlders are all of glacial origin, while the underlying clay is lacustrine material which has been influenced more or less by glacial action.

The Superior sandy loam is confined chiefly to the north half of the area and to the Apostle Islands, though there are a few scattered areas in the southern part of the survey.

The original timber growth consisted of pine, hemlock, maple, birch, and spruce. All of the pine and the best of the other timber has been removed. The second growth consists chiefly of birch and poplar. The clearing of the underbrush and the removal of the stumps is a difficult task and requires a great deal of labor. The cost of clearing and getting the land ready for the plow varies from \$30 to \$75 per acre.

This type, where typically developed, is the most productive and most desirable soil in the area. As a rule it possesses good surface and internal drainage, is easily tilled, and is a warm, responsive soil. It is the predominance of this type in the vicinity of Bayfield that has earned for that place its reputation as a fruit-producing center.

The Superior sandy loam is especially adapted to the production of small fruit and truck crops. Apples and cherries also do well when the location is suitable. Good crops of clover, timothy, potatoes, peas, and root crops are obtained. Corn for silage can be readily grown and some has been matured. Alfalfa has been successfully grown. The greatest returns from this type are secured from strawberries and bush fruits which come on the market after berries from other sections are gone and when there is a good demand.

Land values are gradually increasing, as a result of the development of the fruit industry. Ten years ago most of the land in the vicinity of Bayfield could have been bought for \$5 an acre or less. At present the areas suitable for orchards sell for \$25 to \$50 an acre and even more than this if especially well located.

The following table shows the average results of mechanical analyses of the soil and subsoil of the Superior sandy loam:

*Mechanical analyses of Superior sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
22181, 22185.....	Soil.....	2.8	14.3	20.4	25.5	14.7	14.1	8.1
22182, 22186.....	Subsoil.....	1.4	6.4	8.9	14.6	11.2	23.3	34.2

The following samples contained more than one-half of 1 per cent of calcium carbonate (CaCO<sub>3</sub>): No. 22181, 12.6 per cent; No. 22182, 5.1 per cent.

## COLOMA GRAVELLY SAND.

The Coloma gravelly sand is a yellow to reddish or chocolate-colored, loose, incoherent sand, ranging from medium to coarse texture, underlain by light-red or brownish-red sand of much the same character and texture as the surface layer. Frequently the surface inch or two is of light to dark gray color, sometimes approaching black, as a result of the presence of organic matter and weathering. Both soil and subsoil carry a large percentage of rock fragments and gravel. These are of various materials among which have been recognized red, brown, and gray sandstone, granite, and other crystalline rocks, quartz, agate, and amorphous igneous rocks. Boulders are of frequent occurrence both on the surface and in the soil and subsoil.

This type generally occupies the higher elevations, though occasionally it is found protruding into the valleys. As found in this area the type forms a series of rounded knolls or hills, forming a part of the Kettle Range. This soil type is of glacial origin and probably represents but partly assorted morainic material. No very definite distinction can be observed between the soil and subsoil. It is but slightly developed and is less productive than any of the other types, with the exception of the Beach sand. It is suggested that the steepest slopes of the Coloma gravelly sand should be reforested.

The original growth was pine, which has been practically all removed, and in its place there has sprung up a somewhat sparse and unthrifty growth of birch, with an occasional poplar. The undergrowth is sumac and huckleberry with a ground covering of wintergreen and other low growing or creeping species. In the low-lying, damp localities some hemlock, maple, and black alder are to be found growing upon it.

The following table gives the results of mechanical analyses of the soil and subsoil of the Coloma gravelly sand:

*Mechanical analyses of Coloma gravelly sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
22177.....	Soil.....	24.2	50.7	15.8	4.4	2.4	1.7	0.7
22178.....	Subsoil.....	10.7	52.3	20.7	9.3	1.6	1.5	3.2

## GENESEE LOAM.

The Genesee loam is very limited in extent and subject to considerable variation. It consists of alluvial material which has been washed down from the higher lands and deposited by the streams in times of overflow. The type consists of a brown loam or sandy loam 12 to 16 inches deep, underlain by a sand or sandy loam.

Pockets of silt and clay are found in places, and the variations are so numerous that it is impracticable to separate and indicate them on the soil map.

Only one area of this type was mapped. This lies along the Sioux River, north of Washburn. Here the type is under cultivation and produces good crops of hay, potatoes, and fodder corn. Part of it is subject to annual overflow, but the water does not cover the land long enough to prevent its being cultivated.

Small areas of this type occur along some of the other streams in the survey, but they were too small to be shown in the map.

#### MARSH (CONTAINING AREAS OF SWAMP).

Marshy spots, in their present condition entirely unsuited for cultivation, are found in a number of places throughout the area. Those at the mouth of Sand, Raspberry, and Sioux Rivers and the largest areas on Madeline Island consist chiefly of Peat which is but slightly decomposed. These places are very wet throughout the year and it would be difficult to drain them, as they are but little above the level of Lake Superior. The small area  $2\frac{1}{2}$  miles northwest of Bayfield is also Peat. The Marsh west of Ashland has a mucky peat covering for a few inches or a foot and is underlain with clay. The higher portions of it can be used for cutting hay, but most of it is too wet and low to be reclaimed, except by the construction of an expensive drainage system.

There are a number of low-lying areas throughout the Superior clay where the drainage is poor and where water stands part of the year. While these places are sometimes referred to as Swamp they should not be so considered, for as soon as the land is cleared they will drain out sufficiently to be cultivated, and the soil itself does not differ materially from the Superior clay. Areas of this kind are to be found on Sand, Stockton, Michigan, Cat, and Ironwood Islands.

The areas mapped as Marsh include only those which are in a wet, soggy condition constantly and which can not be reclaimed at all, or only by the installation of expensive drainage systems.

#### BEACH SAND.

Comparatively little Beach sand occurs in the area. Areas are found only in sheltered bays along the main shore and chiefly along the south and west shores of the islands, which are somewhat protected from severe wave action. The north and east shore of the islands and most of the mainland consists of rocky walls.

The Beach sand consists chiefly of quartz sand and some rounded gravel derived from the rocks that cover the lake bottom. Some of the material is carried down by the streams from the sandy regions and some is washed from bluffs by the waves. Long Island

consists entirely of Beach sand. The other areas are narrow strips along the shore. Where most extensively developed the sand occurs as a low ridge from 2 to 3 feet high. At the mouth of Sand River there are two such ridges between the Marsh and the lake front. The oldest portions of the Beach formation supports a slight growth of sand cherries, a wild vetch, and some blueberries.

#### SUMMARY.

The Bayfield area covers parts of Bayfield and Ashland Counties, Wis., including the Apostle Islands. The survey comprises the most northerly land in Wisconsin. The northern part of the survey is of a rolling, almost rugged, character, rising sharply from the lake shore with but few level areas, none of which are large.

The shore lines of both mainland and islands are bold and precipitous; very little beach formation has taken place. In the southern part of the area the land assumes a more level character, especially south of the city of Ashland. Owing to the rolling character of the land in the northern part of the area the surface drainage is generally good; in the near-by level stretches in the southern part drainage is less efficient. Many wet spots occur throughout the whole area, owing either to the impervious nature of the subsoil or to the topography of the surrounding country. The problem of drainage is, therefore, an important one.

The entire area was formerly covered with pine forests, but has been extensively cut over. It is now covered with a dense growth of birch, poplar, and other deciduous species, which, together with the pine stumps, makes clearing expensive.

Convenient transportation facilities by rail and water connect the various points within the area and afford access to the markets of Chicago, St. Paul, Minneapolis, and other large cities. Ashland is the largest city and principal local market in the area. Good local markets are also to be found in Washburn and Bayfield.

Agricultural development has just begun. At present general farming is the prevailing type of agriculture throughout the area, but local conditions are inducing specialization along certain lines. In the vicinity of Bayfield conditions especially favorable for fruit production exist, and the acreage devoted to the production of apples, cherries, and small fruits is steadily increasing. South of Ashland, which affords a ready market for dairy products, the soil is especially well adapted to the production of grass and other forage crops, and in this section much attention is being paid to dairying and live stock.

The winters are long and severe and the snowfall heavy. The presence of the snow throughout the cold period usually prevents the ground freezing to any great depth. This is especially true in the

neighborhood of Bayfield, where strawberries and other small fruits are grown without mulching. Ashland, though situated somewhat south of Bayfield, does not receive the full benefits of the influence of Lake Superior, and is uniformly somewhat colder during the winter months than the latter place. Late frosts in spring are quite unknown throughout the area, and the growing period is rapid and uninterrupted throughout the season.

The soils of this area are all of glacial or lacustrine origin, being either deposits from the waters during interglacial periods or formed of the morainic material that marks the limits of ice advance.

The Superior clay, a red, dense, impervious clay of lacustrine origin, is an extensive type, especially adapted to grass and grain crops, dairying, and stock raising. When rendered less dense by cultivation and the introduction of organic matter, preferably in the form of coarse manure, it yields good crops of wheat, peas, turnips, rutabagas, potatoes, and other root crops. Lighter phases may be used for fruits.

The Superior sandy loam is extensively developed in the vicinity of Bayfield, and is especially well adapted to small fruits, potatoes, and to such varieties of apples, cherries, etc., as are suited to the local climate. The sandy material forming the surface layer is glacial material; the stiff red clay may be lacustrine or lacustrine modified by glacial reworking. Though strewn with small rocks and bowlders it is generally a well-drained, easily tilled, warm, productive soil.

The Superior silt loam is similar in many respects to the Superior clay and its crop adaptation is much the same, where sufficiently level to be cultivated. It is of lacustrine origin.

The Coloma gravelly sand is the least important of the extensive types found in the area. It is a poor agricultural soil, being loose, incoherent, and highly susceptible to drought. The Coloma gravelly sand as found in this area is an accumulation of true morainic material, and forms a series of rounded knolls or hills, locally known as the Kettle Range. The steep slopes should be reforested.

The Genesee loam consists of alluvial material, is first bottom land, and is subject to annual overflow. Only a small area is mapped.

Beach sand occurs as narrow strips along the shore in sheltered coves on the mainland and around the Apostle Islands. It is of limited extent and of no agricultural value.

Marsh (containing areas of Swamp) is found at the mouth of some of the streams, on a few of the islands, and in depressed areas throughout various parts of the survey.

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