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STATE OF WISCONSIN
EXECUTIVE COUNCIL

No. 1

Madison, Wisconsin

June, 1934

(3)

Land Economic Inventory

of

The State of Wisconsin

JUNEAU COUNTY

LIBRARY
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UNIVERSITY OF WISCONSIN
MADISON

By

JOHN S. BORDNER, *in charge*

H. R. ALDRICH, *geologist*

WILLIAM W. MORRIS, *forester*

JOHN H. STEENIS, *associate*

(1) Wis

(2) *Division of Land Economic Inventory*

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LEO T. CROWLEY, *Chairman*
Executive Council

January 28, 1915, at the po
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Division of Land Economic Inventory

Cooperating Agencies

We are indebted to the following for assistance given us in the preparation of this bulletin:

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N. C. Fassett, Botany Department, University of Wisconsin
Wm. F. Grimmer, Game Superintendent, Conservation Department
Earl Hilburn, Draftsman and Engineer, Wis. Land Inventory
Neil Hotchkiss, U. S. Biological Survey, Washington, D. C.
C. Juday, Natural History Survey
Aldo Leopold, Consulting Forester in Game Management
Otto W. Lund, Superintendent of Schools, Juneau County
H. W. Mac Kenzie, Chief Game Warden, Conservation Department
John O. Moreland, Secretary, Rod and Gun Club, Hayward, Wis.
F. T. Thwaites, Geology Department, University of Wisconsin.
Harry Truman, Professor of Botany, Beloit College, Beloit, Wis.
George Wagner, Zoology Department, University of Wisconsin
Sergius Wilde, Soils Department, University of Wisconsin
The Botany Department of University of Wisconsin
The State Conservation Department
The Wisconsin Geological and Natural History Survey
The Wisconsin Historical Library
The Wisconsin National Guard
The Wisconsin Department of Public Instruction

For Cover and Land use Township Plats : Write Land Economic Inventory of Executive Council, Room 411 W., Capitol, Madison, Wisconsin.

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LAND ECONOMIC INVENTORY OF THE STATE OF WISCONSIN

JUNEAU COUNTY

INTRODUCTION

A social economy that offers the greatest economic security to the population of any geographic region can only be attained by a careful analysis of its potential possibilities for honest effort and an adequate return to maintain family and community life and governmental functions. A well planned land use policy based upon scientific findings is therefore basic to such an economy. A planless policy results in hardship and frequently a decadent social order, where that which is good becomes perverted into evil. True con-

PLATE I

servation, therefore, begins with the conservation of human life, and is reflected in the preservation of environmental resources.

Nature has been kind to the people of Juneau county in that it has furnished them a land base adapted to varied uses, reaching from that of intensive land culture by the cranberry grower, and the splendid general and dairy farm practices, to the uses for forest and wild life. Developing this diversified adaptation of its land requires patience and vision on the part of the people of the county and should be based on a careful study of the land inventory report. It is hoped that schools and community clubs will use the report freely in arriving at a better understanding of the county's potential possibilities.

JUNEAU COUNTY

Location

Juneau county is located in south central Wisconsin, about 50 miles due south of the geographic center of the state. It lies in two of the major physiographic provinces of the State, the Central Sand Plain and the Western Upland. (See Plate I, page 5.)

Transportation

Rail and motor transport connect Juneau county with such primary markets as the twin cities to the northwest, the industrial cities on the Lake Michigan waterfront to the east and south, and the less remote cities and towns with extensive wood-working industries on the Wisconsin and Fox Rivers.

Elevations

The highest and lowest elevations are about 1350 and 850 feet indicating a maximum relief of about 500 feet. The higher elevations are concentrated in the southwest, the north and east having an average elevation of slightly above 900 feet. Details of physiography are discussed in the following paragraphs.

PRIMARY LAND DIVISIONS

Juneau county is divided into three major land divisions or provinces determined by its geological past. These are (1) the Northern or Sand Plain Province, (2) the Intermediate Province and (3) the Southern or Upland Province.

The Northern or Sand Plain Province

Fully 60% of the county lies in this low-lying plain sloping southward at the rate of about 4 feet to the mile. Locally the underlying sandstone rises gradually above the plain in low mounds, frequently to become exposed on their summits, or it juts abruptly above the plain in isolated crags. With the exception of the southern part, this province is monotonous and depressing.

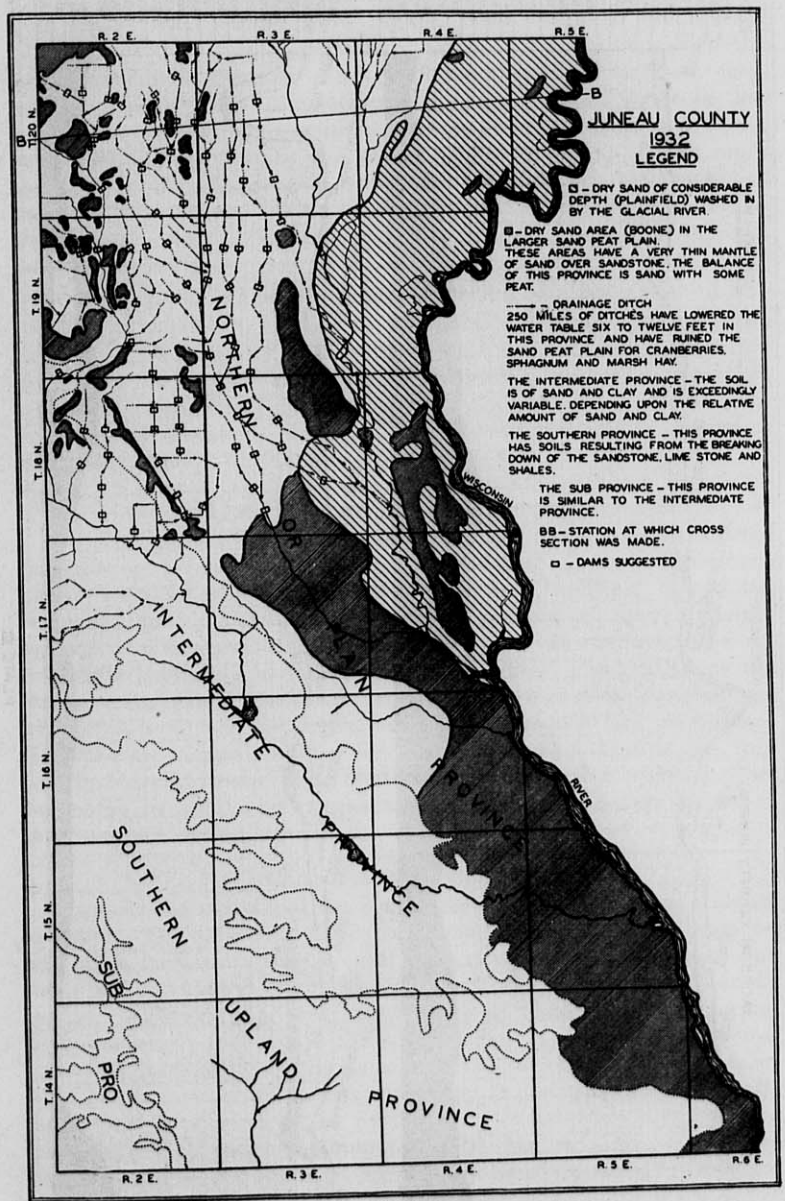
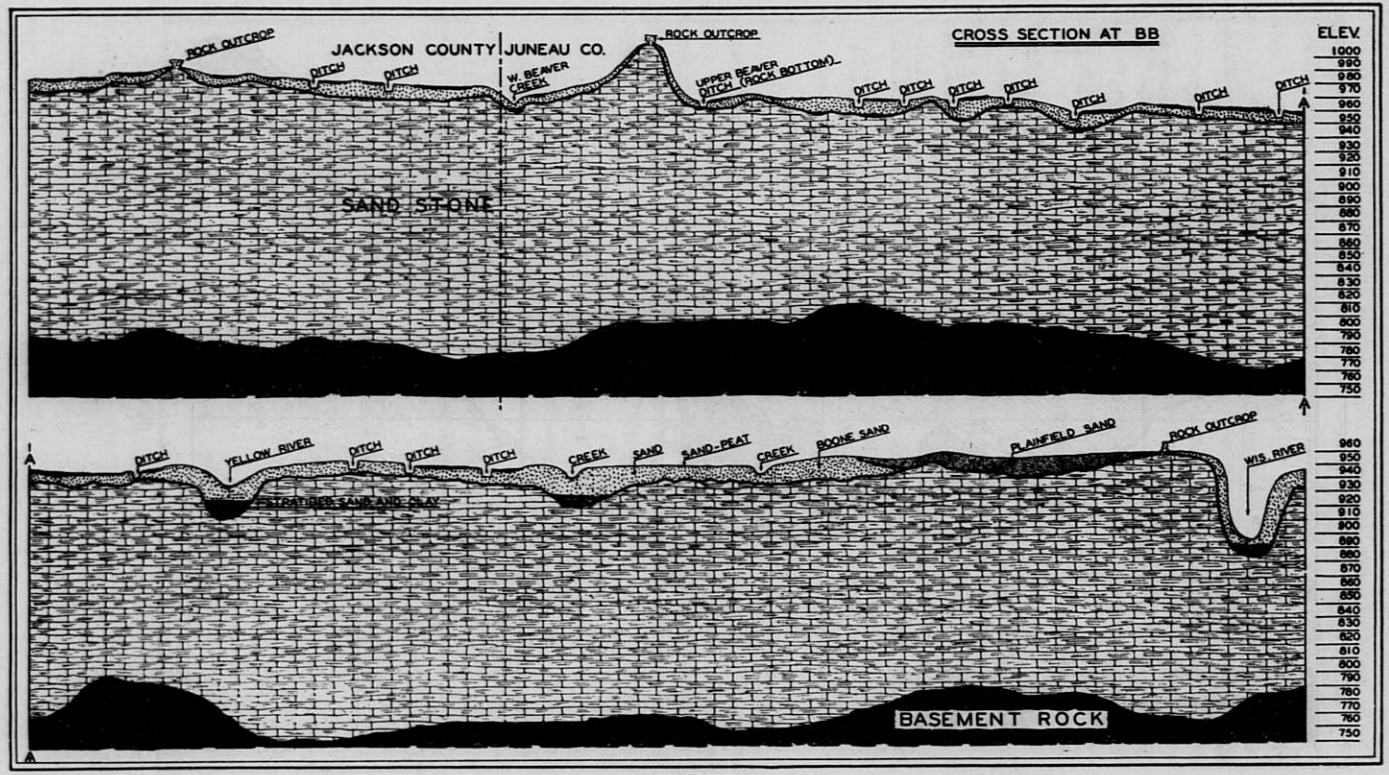

R.2 E.
R.3 E.
R.4 E.
R.5 E.
R.6 E.
T.20 N.
T.19 N.
T.18 N.
T.17 N.
T.16 N.
T.15 N.
T.14 N.
B
B
JUNEAU COUNTY
1932
LEGEND
- DRY SAND OF CONSIDERABLE DEPTH (PLAINFIELD) WASHED IN BY THE GLACIAL RIVER.
- DRY SAND AREA (BOONE) IN THE LARGER SAND PEAT PLAIN. THESE AREAS HAVE A VERY THIN MANTLE OF SAND OVER SANDSTONE. THE BALANCE OF THIS PROVINCE IS SAND WITH SOME PEAT.
——→ - DRAINAGE DITCH
250 MILES OF DITCHES HAVE LOWERED THE WATER TABLE SIX TO TWELVE FEET IN THIS PROVINCE AND HAVE RUINED THE SAND PEAT PLAIN FOR CRANBERRIES, SPHAGNUM AND MARSH HAY.
THE INTERMEDIATE PROVINCE - THE SOIL IS OF SAND AND CLAY AND IS EXCEEDINGLY VARIABLE, DEPENDING UPON THE RELATIVE AMOUNT OF SAND AND CLAY.
THE SOUTHERN PROVINCE - THIS PROVINCE HAS SOILS RESULTING FROM THE BREAKING DOWN OF THE SANDSTONE, LIME STONE AND SHALES.
THE SUB PROVINCE - THIS PROVINCE IS SIMILAR TO THE INTERMEDIATE PROVINCE.
BB - STATION AT WHICH CROSS SECTION WAS MADE.
- DAMS SUGGESTED
NORTHERN
WISCONSIN
RIVER
INTERMEDIATE
PROVINCE
SOUTHERN
SUB
PROVINCE
UPLAND
PROVINCE

PLATE II


CROSS SECTION AT BB
ELEV.
JACKSON COUNTY
JUNEAU CO.
ROCK OUTCROP
ROCK OUTCROP
DITCH
DITCH
W. BEAVER CREEK
UPPER BEAVER DITCH (ROCK BOTTOM)
DITCH
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DITCH
DITCH
SAND STONE
A
A
DITCH
YELLOW RIVER
DITCH
DITCH
DITCH
CREEK
SAND
SAND-PEAT
CREEK
BOONE SAND
PLAINFIELD SAND
ROCK OUTCROP
WIS. RIVER
STRATIFIED SAND AND CLAY
BASEMENT ROCK
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990
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790
780
770
760
750

PLATE III

The Present Aspect of the Landscape in this Province

In shallow sags sedges grow rankly, small shrunken fire scarred remnants of their former domains. Aspen saplings shimmer in the sun around their margins. Jack pine and scraggy dwarf oak compete for sustenance on the low swells. Harsh ground cover is thin and varies in details detectable only by trained botanists. Loose, ashen-gray sands shift in the wind. Across country, stretch more than 250 miles of straight white ribs of sand on the banks of partially dry ditches. With blind perfection, the sole resource of the region — water — has been drained. (See Plates II and III, pages 7 and 8.)

The Intermediate Province

The intermediate province to the south, although partly plain, presents a far different aspect. Its northern boundaries are sharply marked by an abrupt change from very poor to superior vegetation, which reflects a clay soil, or a mixture of clay with sand and generally more abundant moisture. The Lemonweir River meanders sluggishly through this area.

The Southern Upland Province

The southern province is a rough, intricately and deeply dissected limestone and sandstone upland about 300 feet above the northern plain. Here on ridges and spurs are fine soils, splendid farms, and remnant stands of hardwoods. The steep, rock-walled narrow ravines are cool and damp and are grown to mixtures of hardwood and occasionally hemlock simulating northern forests. The Valley of the Baraboo River and the lower reaches of its major branches are wider, flat-bottomed, and their walls are commonly less precipitous. Here too are extensive tilled lands and pastures. This is the subprovince of the map. (See Plate II, page 7.) The contrasts between the two major provinces are many and are deeply rooted in their natural history.

Origin of the Physiography

Formerly the surface of the county had lain at a uniformly higher elevation. The sandstones and limestones of the southern province, and other formations now present only in counties to the south and west, had extended to the north far beyond the boundaries of Juneau county. Although commonly referred to as flat-lying, these formations are gently inclined to the south and west, and stream erosion, operating incessantly in the same direction through vast periods of time, has been wearing them away. They are still retreating in this direction. To the north, in northeastern Wood county, they have long since been entirely eliminated. Between that region and the north margin of the southern province of Juneau county, the general slope is relatively smooth and only sandstones remain on the series of alternating limestones, shales, and sandstones, hundreds of feet thick. The abrupt change of conditions at the north margin of the southern province of Juneau county is due to the presence there of a much more resistant formation at about a 1060 foot elevation.

This formation has temporarily protected the weaker sandstone below and has slowed up the process of destruction. Erosion working at the foot of the cliffs undermines them, propagating the cliff conditions and causing the resistant over-hanging beds to fall. The many bluffs, crags, and rocks scattered over the plain, but most numerous toward the south, are like the stragglers of a routed army. They have been cut off and surrounded, and all stages of their inevitable extermination may be seen. These general physiographic conditions have existed for geological periods. The most recent event in the history of the region is the glacial episode.

The Glacial Episode and Glacial Lake Wisconsin

The entire county escaped glaciation although ice fields overrode the greater part of the state. They failed by miles to invade Juneau county, halting some 10 miles to the north, 12 to 20 miles to the east, and about 4 miles to the southeast. Accordingly, there can be no morainic deposits in the county. However, melt waters from these ice fronts flowed into the county and produced certain effects. Moreover, the eastern ice-front joined the Baraboo Range not far to the southeast, forming a dam across the natural drainage way and impounding waters which rose to an elevation of about 980 feet and flooded fully 75% of the county. All the northern and intermediate provinces were flooded excepting the higher of the small scattered uplands and isolated crags, which existed as islands. This vast body of water is known as Glacial Lake Wisconsin. The southern province, with elevations rising to above 1300 feet, presented an irregular shore line with bold headlands and island fringes alternating with narrow embayments of the lake. The Baraboo Valley and its major branches thus inundated constitutes a small distinct subprovince, in the southwestern part of the county. (See Plate IV, page 11.)

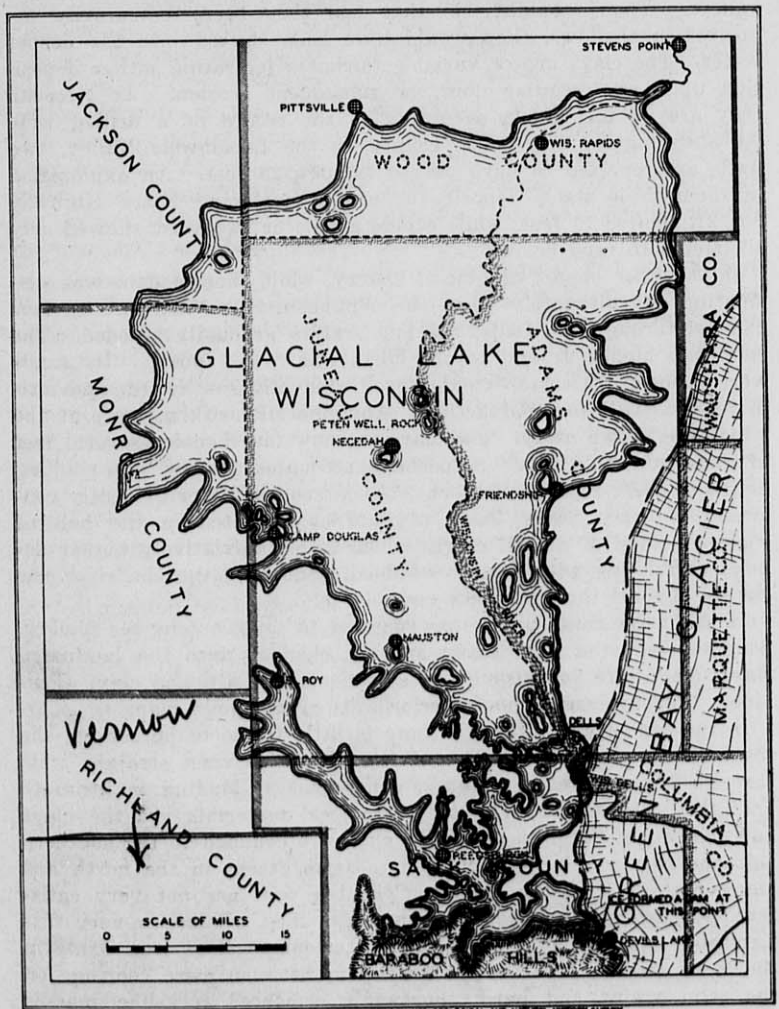
The surface of the northern province before flooding was evidently not greatly different from conditions existing today. The topography was mild with possibly a greater number of prominent islands. One distinct difference was the presence of deeper valleys along the present Lemonweir and Yellow rivers. Deposits of clay here are indications of deeper water in the glacial lake and drilled wells show loose filling to considerable depths. A well at Necedah shows a depth of 198 feet including 70 feet of clay. Others at Mauston show 30 to 100 feet of fill, chiefly sand. At Shennington, just over the line in Monroe county, two wells are reported to have passed through 26 feet of the laminated clay.

The surface materials of this northern province are mainly sands with minor amounts of chert. The latter represents the persistent, insoluble residue from the limestone that once covered this region. The sand is mainly residual from sandstone like that now seen in Cranberry and Petenwell rocks, the Hog Island Bluff, and the hills northeast of Mather. These residual materials are the Boone sands of the soils map. The areas of undifferentiated soils are essentially the same though they may have been shifted by the wind action and

mixed with organic matter in the lower marshy tracts. At the present time much of the organic matter has been destroyed by fire. The Plainfield sands in the east represent the same with an admixture of igneous sands washed in by the Wisconsin River in late glacial time.

The glacial lake caused two main effects. Its waves probably under-cut the base of the higher mounds causing rock fall and a steepening of the cliffs. Lower mounds entirely submerged were probably smoothed by currents and waves which shifted the sands.

MAP OF GLACIAL LAKE WISCONSIN



NOTE: DATA USED IN MAKING THIS MAP WAS TAKEN FROM BULLETINS XVI AND XXXVI BY WIS. GEOLOGICAL AND NATURAL HISTORY SURVEY.

PLATE IV

The general surface was more or less billowy with dunes of all sizes, and these were smoothed over by the lake. The second effect was the deposition of fine rock flour and clay material contributed by melt waters flowing into the lake from the ice fields. These ice fields had traversed the eastern counties that contain limestone of which they had accumulated considerable loads. Since the ice front lay some distance away, only the finer materials were carried into Juneau county. The only trace of these is found along the Lemonweir and Yellow rivers. Reference has been made to the probable presence of deeper valleys along the pre-glacial courses of these streams. The clays have not been found anywhere outside these valleys. The probability is that had they been temporarily deposited in shallows, they would have been shifted into the deeper water. The clays are of variable thickness indicating either deposition upon an irregular floor, or subsequent erosion. At Necedah they are 70 feet thick, according to the record of a drilled well. At Shennington, in Monroe county, in the Lemonweir Valley, two wells are reported to have passed through 28 feet. An exploration in them to locate a deposit for use in surfacing State Highway No. 21, showed 13 feet, while others a mile or two west showed only six feet with sand below.

In the later stages of glacial history, while the ice dam was dissipating and ultimately when the Wisconsin River had cut its new channel through the Dells, the lake waters gradually receded. The relatively higher ground to the north was first exposed. Its sands were probably to some extent moved gradually southward, and ultimately exposed to wind action. Any fine silt within reach of the winds was blown away. The clays are now found under several feet of sand, and this cover is perhaps accounted for by the shifting action of these receding waters. The Wisconsin River evidently continued to carry heavy loads of sand as indicated in the belt of Plainfield sand of glacial origin which forms a relatively higher deposit correlating with periods of flood. Subsequently, the river has cut its channel through these deposits.

In still later time, the Lemonweir and to some extent the Yellow, have removed the sand cover and cut channels into the laminated clays. There are various mixtures of fine sand, silt, and clay. Combined, they represent the Superior soils of the soils map.

In the sand plain, although there is little traffic to be served, the town roads, and State Highway No. 21, which runs straight west through Necedah, have required some kind of binding material to hold the loose sands. The only two local materials are the clays and deposits of bog iron ore. The clays are confined to the southern belt and bog ores have been used to some extent in the north and along part of Highway No. 21. The bog ores are not very satisfactory, particularly in dry weather, for they produce a very disagreeable dust. They are essentially cementations of iron oxide in the loose sand. There are all gradations between mere coatings on the sand grains and hard, thoroughly cemented rock-like masses comparable to the sandstones of the higher areas.

The origin of the ores is simple. A ground water carries ferrous iron in solution probably as the bicarbonate. At the water-table atmospheric oxygen comes in contact, oxidizes the iron and causes precipitation of hydrated iron oxide. Interesting observations were made in the Valley of the Yellow River, on the north line of Section 11, T. 19, R. 3 E. A hole was dug through a hard rock-like deposit just below the surface. Below this were loose sands extending down to the water-table. At the latter horizon the sands were mixed with slimy deposits of yellow limonite. The purpose of the work was to examine the relative acidity conditions through the soil profile. The yellow deposit was strongly acid. The sands both above and below the water-table were neutral or slightly alkaline. Similar results had been obtained elsewhere and the explanation seems to be that the carbonic acid set free by the oxidation of the ferrous carbonate, although a weak acid, gives the observed acid reaction.

The ultimate of the iron in the ground water is not so clear. The sands certainly contain too little iron to account for deposits. They are nearly pure silica. The cements of the sandstones of the region are reported to contain iron carbonate, however, and the leeching of this by the solutions produced by the decaying peat in the marshy tracts, is a possible source of iron.

It is interesting to note that the yellow deposit just described on Yellow River lies two or three feet below the upper crust. This region has been rather thoroughly drained by ditches which dropped the ground-water level rather suddenly. The two deposits of bog ore are separated by about four feet of loose sands.

It is of further interest to note that the deposits farthest northeast, therefore on higher ground, are most commonly the deep red variety and fairly loose. The present ground water-table is 6 to 12 feet below the surface, suggesting that these bog ores were deposited very soon after the withdrawal of the lake. Since that time the deposit of hydrous limonite has become dehydrated, and the volume shrinkage has reduced the mass to the granular state.

Cementation by iron oxide is observable to some extent throughout the plain province. Many holes were dug throughout the province, however, and the deposits rich enough to be called bog ores seem to be more abundant between the Yellow and Wisconsin rivers. None of any note were found very far west of the Yellow.

GEOLOGICAL ORIGIN

The Southern or Upland Province

The dissected upland province was probably very much like its present condition in glacial times. It, of course, stood above the level of Glacial Lake Wisconsin. Its surface materials also are mainly of residual origin. The rock formations, as indicated in discussing the origin of the provinces, are flat-lying sandstones, shales and limestone. The highest elevations are slightly above 1300 feet. At this elevation and down to about 1275 feet occurs Lower Magnesian limestone. Its areas are small. The surface material here

is a tough, heavy clay with blocks and fragments of chert. These represent the insolubles from which the lime and magnesia have been leeched. The limestone had once extended completely across the county but has been reduced by erosion to these small, irregularly shaped areas. On nearby lower ground are scattered blocks of chert. The chert pebbles found commonly on the plain to the north are of this origin.

On lower ground, down to between 1000 and 1050 feet, depending on location, the higher formations are sandstones, more or less shaly and at the top slightly dolomitic; and below them are thin-bedded shaly sandstones also containing some lime and dolomite. On the higher ground in this interval the surface material is mainly sand, Boone of the soils map, and originating, of course, in the break-up of the higher sandstones. Conical rock hills are not uncommon. In the lower range, surface materials are silt, and fine sandy silt mixtures. These are Knox loams of the soils map. They occur over the greater area of the high ground in this province, and are the primary agricultural soils. Rock exposures show thin-bedded sandstone and yellowish shales with a sprinkling throughout of dark green sand. Some thin beds are almost pure concentrates of the green sand. In many of the rock exposures, pits have been dug by the highway engineers to get material for surfacing the roads. The sides of these pits show a gradation upwards from rock to fine textured loams containing fragments of thin-bedded sandstone. To some extent, therefore, these surface materials are of residual origin. There has been no removal of residual material by the glacial method and the fine texture of the soil correlates well with the fine sands and shale matter in the formations of the interval. They are coextensive with the spurs and ridges just above the cliffs of sandstones. However, the fact that wind blown material, loess, is abundant farther west on these uplands, indicates that some of the finer constituents of these soils were of loessial origin.

At the edge of the upland spurs and ridges, occurring at about the 1060 foot elevation along the north side, but at a lower elevation to the southwest, there occurs a change in the rock. The green sand disappears and the shales have disappeared. A hard brownish red sandstone and a red shale occur at this position sloping precipitously over yellowish sandstone cliffs. The ravines are commonly V shaped in their upper ends and the loose material is generally sand. In the lower reaches the bottoms widen out and are flat with stratified silty and fine sandy soils. These lower reaches were covered by the glacial lake. Their stratified silts and clays are analgous to those along the Lemonweir. At Wonewoc they are 54 feet deep.

The sandstones that form the walls of the ravines extend down to considerable depth, and of course are continuous under the northern province. The various crags and mounds such as Mile Bluff, Sheep Pasture Bluff, Petenwell, and Cranberry rocks and the many low sandstone exposures are residuals of these formations. The greatest depth to which they are known to extend is to the 463 foot eleva-

tion in a well near Wisconsin Dells. With the highest point some 1275 feet, the maximum thickness of sandstone was about 812 feet. The base of the sandstones was an irregular surface so that at the few points where it has been located there is a considerable variation in elevation. Thus at Necedah it lies at 620 feet, at Wonewoc it is about 480 feet, and in sections 13 and 14 of T. 18 N., R. 3 E., in the vicinity of Necedah Mound, it lies at about 720 feet. The sandstone formerly covered Necedah Mound, and at that point it was about 190 feet thick.

Intermediate Province

The contact between the two major provinces is not sharp. Instead, there is a zone of variable width which is outlined on the map as an intermediate province. It is low and plain-like, particularly along its north side, although along the south there are low sandstone areas of greater relief resembling the southern province. It was covered by the glacial lake. Its surface materials are generally finer textured than those dominating the plain, and they are therefore transported materials. Where frost action has not been extreme, they show stratification indicating deposition in the glacial lake. They include the laminated clays along the Lemonweir and various mixtures of clay, fine sand, and silts. Three agencies have to be considered when accounting for their origin, washing from the fine sand and silt areas on the upland, wave and current action bringing fine suspensions from the ice front to the east, and the wind. The clays are reported to contain a considerable amount of lime carbonate which would strongly suggest derivation of that fraction from the east. The silts of the upland, in part possibly wind blown, are the most immediate sources and the direct contribution of wind blown material from farther west is also a possibility.

Basement Rock

The basement rock of the entire county, i. e. the rock below the sandstones is but slightly known, but has been struck in drilled wells as indicated in other connections. It is exposed only in Necedah Mound which is quartzite. A similar rock was struck at Wonewoc. Four diamond drill holes put down many years ago in the vicinity of Necedah Mound to test the possibility that there might be iron formation, struck quartzite, diorite, and granite. These few points indicate that the basement rock is mainly igneous with some areas of quartzite and lies at considerable depth below the sand rock still remaining.

LAND ADAPTATION

The adaptation of Juneau county land depends upon markets, climate and soil.

Markets

The market for such primary products as were produced by the northern province in its natural condition, viz., cranberries, blue berries, sphagnum moss, and forest products has continued rela-

tively good. In fact the berry and sphagnum moss market has never been over stocked and the nearby paper mills and woodworking industries are cognizant to the fact that back yard forests save the enormous expense of transporting pulp and lumber from Canada and the Pacific Coast. Standard agricultural production in the southern part of the county is also assured of a market comparable to that of any agricultural county of Wisconsin. (See Plate I for distances to Principal Markets, page 5.)

Climate

Since water is all important in using the northern plain for the production of natural products as well as some agricultural produce, precipitation records have been checked for this region. These records also apply in a more general manner to the remainder of the county.

The records show the average rainfall for Mather for the past 28 years is 32.10 inches. Going backward from 1933 the annual rainfall was 23.78 inches, 1932 — 27.88, 1931 — 27 inches, 1930 — 26.40 inches, 1929 — 32.10 inches, 1928 — 34.10 inches, 1927 — 30.60 inches, 1926 — 34.40 inches, 1925 — 35.14 inches, 1924 — 34.30 inches, 1923 — 23.30 inches, 1922 — 30.40 inches, and 1921 — 21.20 inches. The average precipitation at Meadow Valley for the last forty years was 29.42 inches, with an approximate variation from year to year the same as at Mather. Meadow Valley records 27.57 inches for 1932 and 23.78 for 1933.

Excessive Evaporation and Excessive Drainage. Drying Winds.

Drying winds dissipate moisture very rapidly over the northern plain. This condition is intensified by increasing dryness due to heat radiation.

Drying winds are associated directly with the entire number of clear days. The figures selected for comparison for this region are the clear and cloudy days of June, July, August and September. A comparison of the years 1926-1932 inclusive follow:

Table I

	32		31		30		29		28		27		26	
	Clear	Cloudy	Clear	Cloudy	Clear	Cloudy	Clear	Cloudy	Clear	Cloudy	Clear	Cloudy	Clear	Cloudy
June	14	4	13	7	13	8	14	7	9	12	15	6	13	8
July	18	4	19	3	19	4	18	4	15	7	14	7	14	8
August	14	6	14	8	18	4	16	6	16	7	17	5	13	10
September	20	4	15	8	17	6	13	9	14	8	10	13	7	16
	66	18	61	26	67	22	61	26	54	34	56	29	47	42

These figures show that the percentage of clear days per year for these months for the years 1929-32 inclusive, much higher than for the years 1926-1928 inclusive, and the percentage of cloudy days much lower. With few exceptions the prevailing winds were westerly, sometimes northwest but generally southwest winds. These figures indicate greater evaporation for the years 1929-1932 inclusive. All

the factors contributory to increasing dryness, resulted in making the 1930 peat and forest fire in this region difficult to check. The long continued burning of peat beds added to the loss of additional ground water, and reduced the sponge of peat and especially the sphagnum peat. This sponge as it exists now is relatively small as compared with the conditions prior to the fire. This fire also destroyed much and in some cases all of the forest cover of the sand islands.

Drainage Ditches

The drainage ditches of the plains region exceed a combined total of more than 250 miles. (See Plate II, page 7.)

The rapid run-off of the precipitation has been probably the largest contributing factor to the present low level of the ground water table particularly in the region of the cranberry marshes in Jackson and Juneau counties, and generally for the entire plain. In other words from the standpoint of drainage engineering the ditches are very efficient. From the standpoint of water conservation for those engaged in the growing of cranberries and sphagnum moss, the ditches are ruinous. The implication of the old adage "you can not eat your cake and have it too" applies here, for water which escapes either into the atmosphere or through the ditches, does not remain in the ground to replenish the water in the cranberry reservoirs and sphagnum marshes.

These factors contributing to the general dryness of the area, i. e. causing excessive evaporation and excessive drainage, have lowered the ground water table of the plain on an average of 8 to 12 feet. The climatic change is reflected in the change of ground cover for everywhere prairie flora is taking the place of the native marsh and forest land cover, though the average total precipitation and frost free period has remained relatively the same.

The southern highland province has a longer frost free season due to its higher elevation.

The nature of the soil, under-lying rock and lack of artificial drainage all help in conserving moisture in this province.

Soils

The physiographic provinces bound the soil types in a general manner, — sand and some peat in the northern, sand and clay in the intermediate and loams in the southern highlands. (See Plate II, page 7.) There are two types of sandy soils in the northern province — one of the Boone series, resulting largely from the breaking down of local sandstone, and the other the Plainfield series, somewhat coarser in texture and of greater depth, deposited by the glacial river which poured in this area from the glacier to the east and north. The Plainfield series are drier, i. e. the ground water table has always, in recent time, been at a considerable depth below the surface. The Boone sands are much more shallow and prior to the construction of the drainage ditches were always more or less

water-logged except in the southeastern part of the northern plain. The ground water table in the extensive flat areas was near the surface which resulted in the production of some almost pure peat soils.

Artificial drainage has reduced these Boone sands and sand peat mixtures, to a dryness comparable to the Plainfield sands and their fertility is lower than that of Plainfield sands. A strip of land bordering the Wisconsin and Yellow Rivers contains more alluvial material of finer texture and agriculture on this land has lasted longer than on the balance of the province. Practically all the abandoned farm land of the county is in this northern province which is a very decisive index that this province is non-agricultural.

The Intermediate Province contains a great deal of alluvial material as well as lake clays. These water transported ingredients of the soils in this province are mixed in varying degrees with the materials derived from the local rock, largely sandstone. The soil series of this province are known as the Superior series, due to their similarity to the soils along Lake Superior. These soils are fairly well adapted to farm use, though the poorer phases are very similar and scarcely more productive than the sand and peat soils of the northern province.

The soils of the Southern Highland Province are primarily of the Knox series. All are well drained and relatively fertile and all but the steep phases are adapted for farm use. The steep phases should be kept under forest cover and where barren reforested.

A detailed report on the soils of Juneau county is found in Wisconsin Geological and Natural History Survey Bulletin — "Soil Survey of Juneau County." A report of the forest possibilities of the sandy and poorly drained soils of central Wisconsin by Dr. Sergius A. Wilde may be found in a similar bulletin "Soil Survey of Monroe County."

A more efficient utilization of land can only obtain if its adaptation, based upon the markets, climate and soil is duly heeded. For example, an effort to develop the northern plain for general agricultural use would not have been successful even if markets for farm produce had continued relatively good because the soil and climate are wholly unsuited to such a use. The vast drainage projects were therefore ill advised because they not only failed to accomplish their intended purpose but ruined the land for cranberries, sphagnum moss, marsh hay and forests.

SOCIAL AND ECONOMIC TRENDS IN LAND USE

The social and economic trends within the major physiographic provinces of Juneau county are shown very clearly by the following:

(a) The present status of land cover.

(b) The present ownership of the land.

The complete analysis of the land cover is tabulated in Table II, between pages 18 and 19.

TABLE II. JUNEAU COUNTY COVER CLASSIFICATION IN ACRES – BY TOWNSHIPS AND BY TYPES.

DESC.						SWAMP FOREST LAND																								PINE FOREST L											
						SPRUCE			LARCH						CEDAR			STREAM BOTTOM												JACK PINE									NORWAY PIN					
						0-3		3-6	0-3			3-6			0-6		6-9	0-6			6-9			9-12			12-18		0-3			3-6			6-9			0-3			3-6		
TOWNSHIP	RANGE	WATER	LEATHER LEAF	MARSH	TAG ALDER	M	M	P	G	M	P	G	M	P	M	P	P	G	M	P	G	M	P	G	M	P	P	G	M	P	G	M	P	G	M	P	M	P	G	M	P	G
14 N	2 E			130	221														15	420																					
14 N	3 E																		120			55																		30		
14 N	4 E		20	381	223					45				35									165																12		
14 N	5 E	115		455	138					7										75									308	10	35	208				113					
14 N	6 E			175	62																	10										65	302						30		
15 N	2 E				123																										27						5		50	144	
15 N	3 E	250		185	277				8			5	7					15	25			10									97	28		7			78		155		66
15 N	4 E			221	521					3			5						112			13	25		310	465			7			327	212		20	3					
15 N	5 E			645	70					60	5		113	40						228		1,180	27		150				143	570	155	476	175		170	698			198	53	30
16 N	2 E			129	355																							56			95	150							143	95	50
16 N	3 E			905	840							68	83				20	277		107		195	353					142	786	25	127	233	43		100					252	
16 N	4 E			1,417	292						57							70			178							135	1,065	506	38	1,684	641		39	90					
16 N	5 E			25														153	25		128									45	3	498	77								
17 N	2 E	142		607	2,140				7			5									50	963		13	15			92	305	85	197	678	324	3	36	122	5		35		17	
17 N	3 E			1,078	330	25							40					68		8					586			343	1,172	494	977	1,578	391	45	78	343					
17 N	4 E	34		99	166											40			738	40	55	1,053			250	126		255	1,670	687	217	2,654	936		70	285					
18 N	2 E		50	2,659	2,002					3					305		105	25	264	20	70	20		75					370	677		677	421		55					204	
18 N	3 E		33	712	929													93	23		50	12				90		235	1,749	857	462	1,540	1,134		70					10	
18 N	4 E	25		8	15													78	30			547	47		348	70	85	413	1,831	115	429	1,728	361			100					
19 N	2 E	13	11	751	1,458																							219	1,819	1,571		2,170	1,914		125	105					
19 N	3 E			1,299	533								13									517			1604			210	1,565	1,643	743	1,834	1,139								
19 N	4 E	34		39	99													58		56	135	255	102					256	203	596	639	1,267	770								
20 N	2 E			2,415	2,459		138																						361	627		525	701			10	30			35	
20 N	3 E		7	2,118	1,582			13											89		265	742	3		32			34	595	563		2,029	1,314					700		117	32	
20 N	4 E				65																							747	425	2,267	493	2,433	3,319		275	40					
20 N	5 E	5		10	122																								128			572	265		75	67					
TOT. BY DENSITY						25	138	13	15	118	62	78	261	75	305	40	125	837	1,441	954	931	5,572	722	88	2,709	1,337	85	3,137	14,502	11,338	4,734	23,354	14,439	55	1,113	1,976	113	705	35	735	842	14
TOT. BY TYPES		618	121	16,463	15,022	176			609						470			14,676										74,648									5,794					
% BY TYPES		0.1	0.0	3.2	3.0	0.0			0.1						0.1			2.9										14.7									1.1					

AND BY TYPES.

ABBREVIATIONS : G – GOOD M – MEDIUM P – POOR.

PINE FOREST LAND																												SUITABLE FOR PINE AND SPRUCE																					
JACK PINE							NORWAY PINE									WHITE PINE												OAK																					
3–6			6–9				0–3		3–6			6–9			9–12	0–3			3–6			6–9			9–12	12–18		0–3			3–6			6–9			9–12			12–18								
G	M	P	G	M	P	M	P	G	M	P	G	M	P	P	G	M	P	G	M	P	G	M	P	M	P	M	G	M	P	G	M	P	G	M	P	G	M	P	G	M	P	G	M	P	G	M	P	G
																	25		35	233		5		87	134	265	259	1,404	240	278	1,590	233		113	237		15	25										
									30								55	392						95	723	13	649	2,415	363	330	2,718	805		203	420			110										
									12			13	51											50	668	103	212	1,192	416	1,570	2,214	1,077	314	839	374		212	8										
0	35	208				113											25					35					583	539	468	840	2,080	410	596	1,929	326		160	50										
		65	302						30									145	238		35							198	25		380	30		125														
	27							5		50	144		233	42				30			20		75	50			133	302	369	419	1,307	303	1,507	2,653	424	25	270	70	17										
	97	28		7			78			155		66	70	858	45			118			45	204						91	227	30	32	647		576	1,149	135	5	335	95		5								
		327	212		20	3							15															169	866	128	110	1,329	217	134	596	358	63	404	53		35	25						
0	155	476	175		170	698				198	53	30					30	80		123	20						270	554	273	439	1,230	60	30	466			35											
	95	150								143	95	50	739	388								130						95	494	60	242	1,488	83	452	686	817	68	91										
5	127	233	43		100						252		8										20				269	490	81	568	771	88	152	583	145	20	30	68										
6	38	1,684	641		39	90											13							5			132	766	160	130	387	203		45	158		5											8
5	3	498	77																									77		3	130																
5	197	678	324	3	36	122	5		35		17			80		30	60	67			15		50	57		38	38	82	463	116	491	605	439	87	66	71		3	25										1
4	977	1,578	391	45	78	343							45					15					55		65		727	3,646	620	240	293	273	75	210	279		57	96										
7	217	2,654	936		70	285																					117	241	947	70	779	87	90	348	352			90										
7		677	421		55						204			47								2						332	75	62	893	845	32	513	524													4
7	462	1,540	1,134		70						10					258						25					288	978	594		171	854		318	130													3
6	429	1,728	361			100																	75				512	856	32	135	138	10					35										
1		2,170	1,914		125	105												58	115									761	155		784	699		145	264												
8	743	1,834	1,139																									460	282		547	1,025		105	303												
8	639	1,267	770																								537	1,017	2,202	31	507	19															
7		525	701			10	30				35		14	570		75		10			265			97					470	626		431	952		299	1,240		110	35										
6		2,029	1,314					700		117	32								30		4							288	313		444	787		222	14													
7	493	2,433	3,319		275	40																					865	1,835	1,084	139	2,259	257		189	7		7										
		572	265		75	67																					5	414	195		449	16		64	148		494		194	76							
8	4,734	23,354	14,439	55	1,113	1,976	113	705	35	735	842	146	1,137	2,036	45	363	128	157	30	544	1,074	2	340	776	80	158	38	5,107	17,799	9,216	5,071	23,060	8,676	5,909	17,233	7,810	495	3,191	1,613	211	343	168	3					
74,648							5,794									3,690											105,902																				
14.7							1.1									0.7											20.8																				

DIUM P – POOR. TOTAL AREA OF JUNEAU COUNTY 508.505 ACRES

	SUITABLE FOR PINE AND SPRUCE																		WOOD LOTS							OPEN	RECENT BURN	AGR.		ABANDONED	URBAN	TOTAL
	OAK										ASPEN								MIXED HWDS.									CLEARED	PASTURE			
		6–9			9–12			12–18			0–3			3–6			6–9		0–6			6–9			9-12							
	P	G	M	P	G	M	P	G	M	P	G	M	P	G	M	P	M	P	G	M	P	G	M	P	P							
4	240	278	1,590	233		113	237		15	25				3	50				82	15	117		293	40		587		12,734	3,640		435	23,960
5	363	330	2,718	805		203	420			110		35					70		93	45		133	283	453		393		10,863	1,904	8		23,776
2	416	1,570	2,214	1,077	314	839	374		212	8		79		108							14	16	3	5		416		9,690	2.852	83		23,460
0	410	596	1,929	326		160	50				13	483			153	65										245		10,253	1,156	1,309	92	23,274
0	30		125										45													72		1,768	187	10		3,902
7	303	1,507	2,653	424	25	270	70	17				5	13	8	118	22										317	45	10,447	2,746	18	703	23,040
7		576	1,149	135	5	335	95		5		56	135		48	120											132		14,039	1,729	93	808	23,040
9	217	134	596	358	63	404	53		35	25	55	120	29													406		13,568	1,022	366	248	22,560
0	60	30	466			35									112											343	12	5,203	731	1,501		16,698
8	83	452	686	817	68	91					55	46	25		10											142		11,387	1,414	55		20,040
1	88	152	583	145	20	30	68				43	484	174	40	213	126			10							231		8,537	1,111	610	612	20,040
7	203		45	158		5					816	1,456	702	64	130	13							30		30	596	223	5,287	402	834		18,799
0																												975	152	93		2,384
5	439	87	66	71		3	25				127	854	400	57	177	47										1,167		8,175	1,312	253	1,747	23,040
3	273	75	210	279		57	96				40	539	242	207	143	38										936		4,386	285	1,780		22,848
9	87	90	348	352			90					50	40			22										459	902	3,153	165	2,976		20,263
3	845	32	513	524							429	2,694	2,293	22	692	371	30						30			1,487		2,869	628	168		23,040
1	854		318	130							332	1,006	437	5	147	35		143								1,705		3,800	948	2,167	440	22,780
8	10					35						43	20			58				8		3				182		2,321	194	1,491		12,343
34	699		145	264							300	2,229	2,125		362	778										2,675		579	100	675	80	23,040
47	1,025		105	303							425	882	222		348	100										3,342	68	2,413	420	786	20	22,848
07	19											99	118	16	47											218		818	175	2,332		12,645
31	952		299	1,240		110	35				611	2,645	4,167		20	105										4,204	118	194	144	249		24,952
44	787		222	14							264	3,308	1,702		75						19					5,016	112	1,483	141	230		24,687
59	257		189	7		7					133	193	218		3											1,758		2,312	120	2,227	3	23,673
49	16		64	148		494		194	76			21														780		2,692	163	415	3	7,373
60	8,676	5,909	17,233	7,810	495	3,191	1,613	211	343	168	3,699	17,406	12,972	578	2,920	1,780	100	143	185	68	150	152	639	498	30							
	105,902										39,598								1,673							27,809	1,480	149,946	23,841	20,729	5,191	508,505
	20.8										7.8								0.3							5.5	0.3	29.5	4.7	4.1	1.0	100

This shows the following general classification:

Table III

	Acres	Total acres	Total percentage
Forest Land			
Total Forest cover	247,285		
Total open burned or cleared and abandoned	50,018	297,303	58.5
Farm Land			
Cleared Farm Land	149,946		
Pasture	23,841	173,787	34.2
Waste, Marsh and Water			
Total water	618		
Total marsh including cranberry marshes and untimbered swamp	31,606	32,224	6.3
Urban Land			
Townsites	5,191	5,191	1.0
TOTAL	508,505	508,505	100.0

Plate V shows the trend in agriculture by civil towns. This portrays more clearly the exact locations of the more desirable farming areas, as reflected by the percentage of abandonment with relation to the land cleared. It shows clearly the varied conditions for each governmental unit some of which might be advantageously consolidated.

A further grouping of the cleared farm land and farm land cleared and later abandoned follows by provinces. For this classification the northern province shows 40,935 acres of cleared land and 4,964 acres of pasture still in farm use, and 19,005 acres of cleared land no longer in use. The province south of the northern plain shows 109,011 acres of cleared land and 18,877 acres of pasture in farm use, and less than 1724 acres of land cleared but no longer used for farm production. This shows that the northern province which covers approximately two-thirds of the county, has less than 20% in farm use, while the southern provinces which cover approximately one-third of the county have more than 66% in farm use. It is obvious, therefore, that the southern provinces are relatively well occupied for farm use while more than 80% of the northern plains are in other uses or idle. An analysis of 80% of the northern province and approximately 33% of the southern provinces follows:

PRESENT STATUS OF LAND COVER ON LAND NOT USED FOR AGRICULTURE

The total amount of land now growing some type of forest cover in Juneau county is 247,285 acres or 48.6 per cent of the total area. (See Table II, between pages 18 and 19.) Of this 105,902 acres are oak. The forest cover is practically all small, as 189,279 acres are in the 0-6 inch diameter class, 57,161 acres are in the 6-12 inch diameter class, and 845 are in the 12-18 inch diameter class.

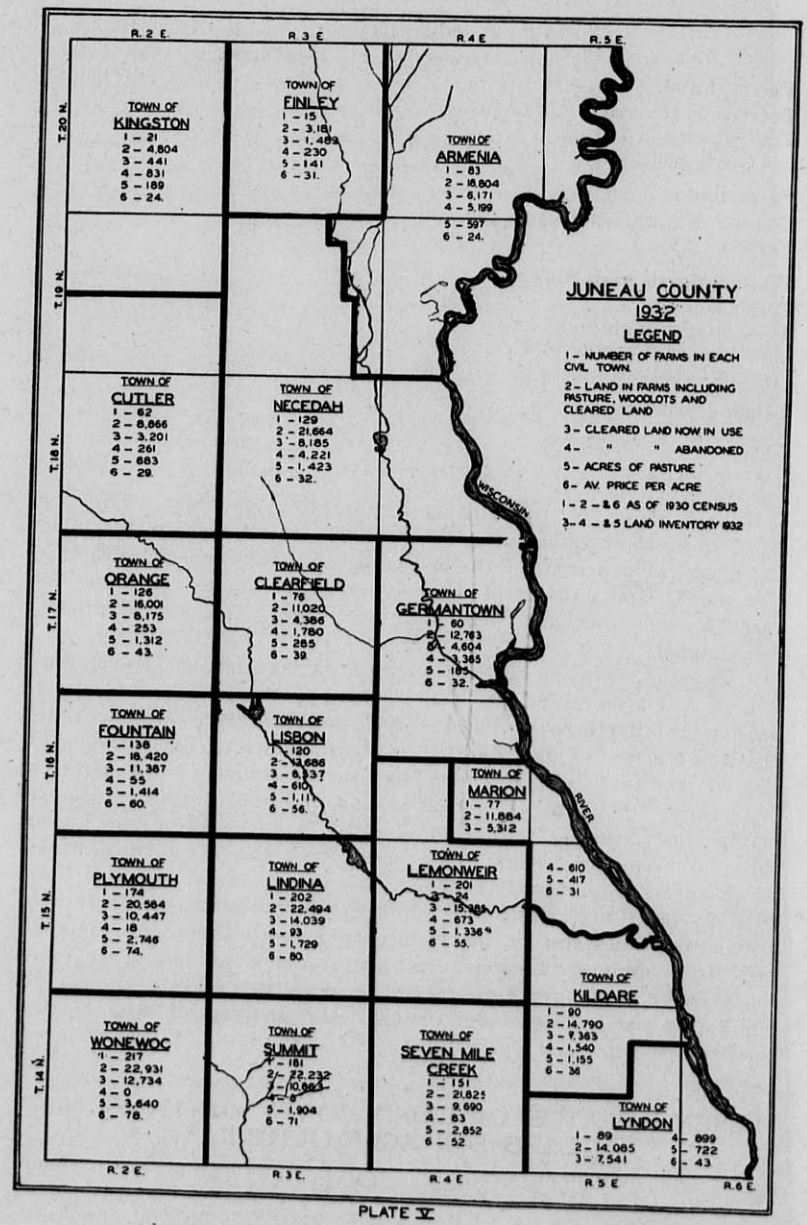

R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.
R. 6 E.
T. 20 N.
T. 19 N.
T. 18 N.
T. 17 N.
T. 16 N.
T. 15 N.
T. 14 N.
TOWN OF KINGSTON
1 - 21
2 - 4,804
3 - 441
4 - 831
5 - 189
6 - 24.
TOWN OF FINLEY
1 - 15
2 - 3,181
3 - 1,483
4 - 230
5 - 141
6 - 31.
TOWN OF ARMENIA
1 - 83
2 - 18,804
3 - 6,171
4 - 5,199
5 - 597
6 - 24.
TOWN OF CUTLER
1 - 62
2 - 8,866
3 - 3,201
4 - 261
5 - 683
6 - 29.
TOWN OF NECEDAH
1 - 129
2 - 21,664
3 - 8,185
4 - 4,221
5 - 1,423
6 - 32.
WISCONSIN RIVER
TOWN OF ORANGE
1 - 126
2 - 16,001
3 - 8,175
4 - 253
5 - 1,312
6 - 43.
TOWN OF CLEARFIELD
1 - 76
2 - 11,020
3 - 4,386
4 - 1,780
5 - 285
6 - 39.
TOWN OF GERMANTOWN
1 - 60
2 - 12,763
3 - 4,604
4 - 3,385
5 - 195
6 - 32.
TOWN OF FOUNTAIN
1 - 138
2 - 18,420
3 - 11,387
4 - 55
5 - 1,414
6 - 60.
TOWN OF LISBON
1 - 120
2 - 13,686
3 - 8,337
4 - 610
5 - 1,111
6 - 56.
TOWN OF MARION
1 - 77
2 - 11,884
3 - 5,312
4 - 610
5 - 417
6 - 31
TOWN OF PLYMOUTH
1 - 174
2 - 20,584
3 - 10,447
4 - 18
5 - 2,746
6 - 74.
TOWN OF LINDINA
1 - 202
2 - 22,494
3 - 14,039
4 - 93
5 - 1,729
6 - 80.
TOWN OF LEMONWEIR
1 - 201
2 - 24
3 - 15,385
4 - 673
5 - 1,336
6 - 55.
TOWN OF KILDARE
1 - 90
2 - 14,790
3 - 9,383
4 - 1,540
5 - 1,155
6 - 36
TOWN OF WONEWOC
1 - 217
2 - 22,931
3 - 12,734
4 - 0
5 - 3,640
6 - 78.
TOWN OF SUMMIT
1 - 181
2 - 22,232
3 - 10,663
4 - 8
5 - 1,904
6 - 71
TOWN OF SEVEN MILE CREEK
1 - 151
2 - 21,825
3 - 9,890
4 - 83
5 - 2,852
6 - 52
TOWN OF LYNDON
1 - 89
2 - 14,085
3 - 7,541
4 - 899
5 - 722
6 - 43
JUNEAU COUNTY
1932
LEGEND
1 - NUMBER OF FARMS IN EACH CIVIL TOWN.
2 - LAND IN FARMS INCLUDING PASTURE, WOODLOTS AND CLEARED LAND
3 - CLEARED LAND NOW IN USE
4 - " " ABANDONED
5 - ACRES OF PASTURE
6 - AV. PRICE PER ACRE
1 - 2 - & 6 AS OF 1930 CENSUS
3 - 4 - & 5 LAND INVENTORY 1932

PLATE V

The total area of the forest cover that is well stocked with some type of tree growth is 31,855 acres, or about 12.9 per cent. The total amount with the medium stocking consists of 135,412 acres, or 54.8 per cent, and 80,015 acres or 32.3 per cent are poorly stocked.

Of the 0-6 inch diameter class of forest growth, 33,869 acres are well stocked, 102,917 acres are medium stocked, and 62,495 acres are poorly stocked. In the 6-12 inch diameter class 7,778 acres are well stocked, 32,144 acres are medium stocked, and 17,269 acres are poorly stocked.

In the 12-18 inch diameter class, 211 acres are well stocked, 381 acres are medium stocked, and 253 acres are poorly stocked.

The Oak Woodlands

The oak of Juneau county consists of 68,929 acres in the 0-6 inch diameter class, 36,251 acres in the 6-12 inch diameter class, and 722 acres in the 12-18 inch diameter class. In the small diameter class, 10,188 acres of this oak are well stocked, 40,849 are medium stocked, and 17,892 acres are poorly stocked. In the 12-18 inch class, 211 acres are well stocked, 343 acres are medium stocked, and 168 acres are poorly stocked.

Forty-seven per cent, or 49,510 acres, is scrub oak growing on inferior soil, 32 per cent, or 33,935 acres consists of a medium grade of oak, and 21 per cent, or 22,457 is a fairly good grade of oak growing on the better soils.

A rough estimate would indicate that there are more than 500,000 cords of oak left in the county divided as follows: 57,600 cords of scrub oak in the northern plain section, 200,000 cords of good quality oak on the better soils, and 250,000 cords of medium grade oak on the intermediate soils.

Graphic Representation of Land Cover

Four graphs have been prepared showing diagrammatically, first, all the land cover types, second, a classification of the forest cover types by species, third, a classification of the forest cover according to sizes, and fourth, the open and poorly stocked areas recommended for forest planting.

Plate VI, page 22 (Classification of total area), shows the county divided into four major groups, two of which, the forest land and the cleared farm land constitute about ninety-three per cent of the county. About seven per cent of the county is open swamp and urban land. This graph also shows the relative area occupied by each type of forest cover but not in all cases by individual species of trees. The amount of crop land and open pasture is also shown.

Plate VII, page 23 (Classification of Forest Cover), shows the area occupied by oak, pine, aspen, ash, elm and mixed hardwoods, cedar, tamarack and spruce. It also shows the relative area oc-

cupied by individual tree species, except for the oak which is divided into grades according to soil. It shows that white and Norway pine occupy at present only 3.8 per cent of the total forested area. This type, together with spruce should eventually replace the aspen type, as well as a large per cent of the poorly stocked oak type, especially the scrub oak.

Plate VIII, page 24 (Classification of Forest Cover according to size), shows that there is practically no large timber left in Juneau county. Of the small growth under six inches in diameter which occupies 76 per cent of the forest cover, more than fifty per cent

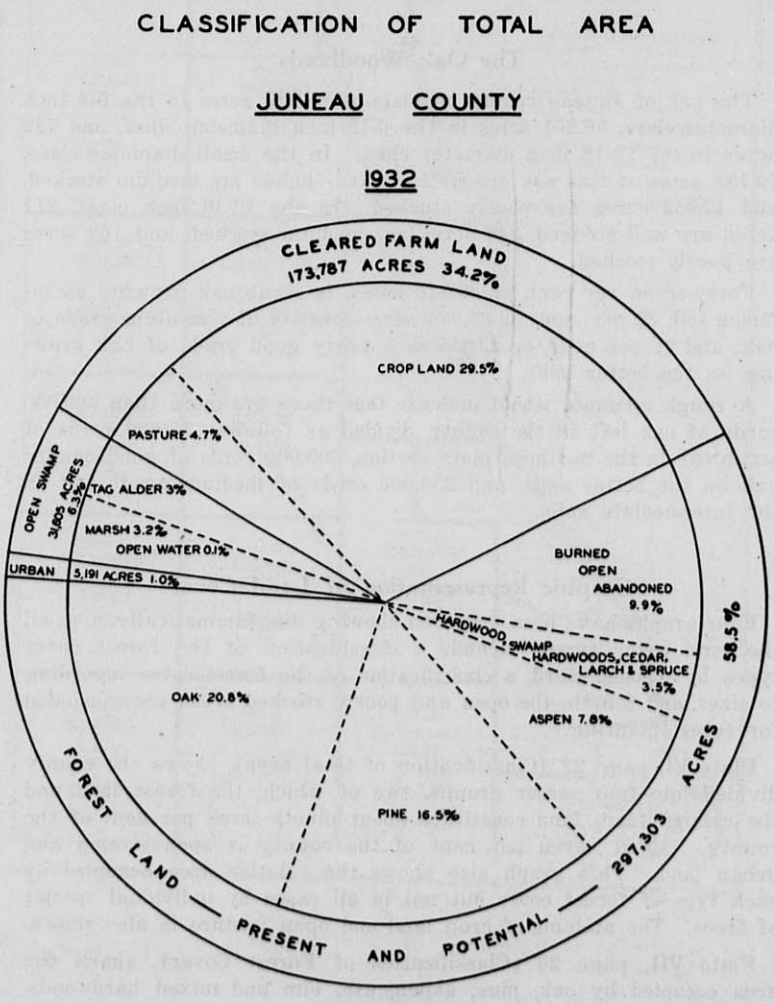


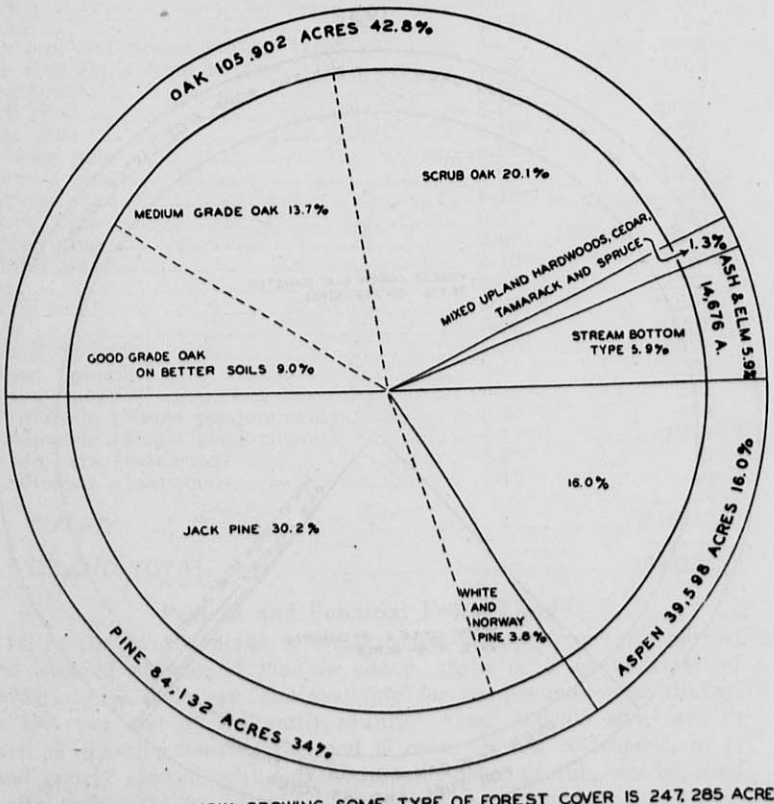
PLATE VI

is young oak and popple that will never grow into any great value. If this land could be converted into stands of pine and spruce, its value would be much greater. Most of the balance of this young growth is jack pine, which grows into a fairly valuable commercial stand in a comparatively short time. The forest cover averaging 6-12 inches in diameter occupies less than a quarter of the entire forested area and the area covered with 12-18 inch trees occupies only a little over a section of land altogether. (See Table II, between pages 18 and 19.)

CLASSIFICATION OF FOREST COVER

JUNEAU COUNTY

1932



THE TOTAL AREA NOW GROWING SOME TYPE OF FOREST COVER IS 247,285 ACRES. 76% OF THIS IS UNDER 6" IN DIAMETER. ONLY 13% IS WELL STOCKED.

PLATE VII

Plate IX, page 26 (Total Wild Land showing possible Forest Planting Areas), gives the relative acreage of the land in immediate need of better forest cover, the land with some cover not in immediate need of planting, and the marsh land. Spruce and pine are recommended for planting the 130,000 acres shown as open, burned, abandoned or poorly stocked. It is interesting to note that less than 10 per cent of the total wild land is well stocked with trees, being practically the same acreage as the untimbered and unproductive marsh land.

CLASSIFICATION OF FOREST COVER ACCORDING TO SIZE.

JUNEAU COUNTY

1932

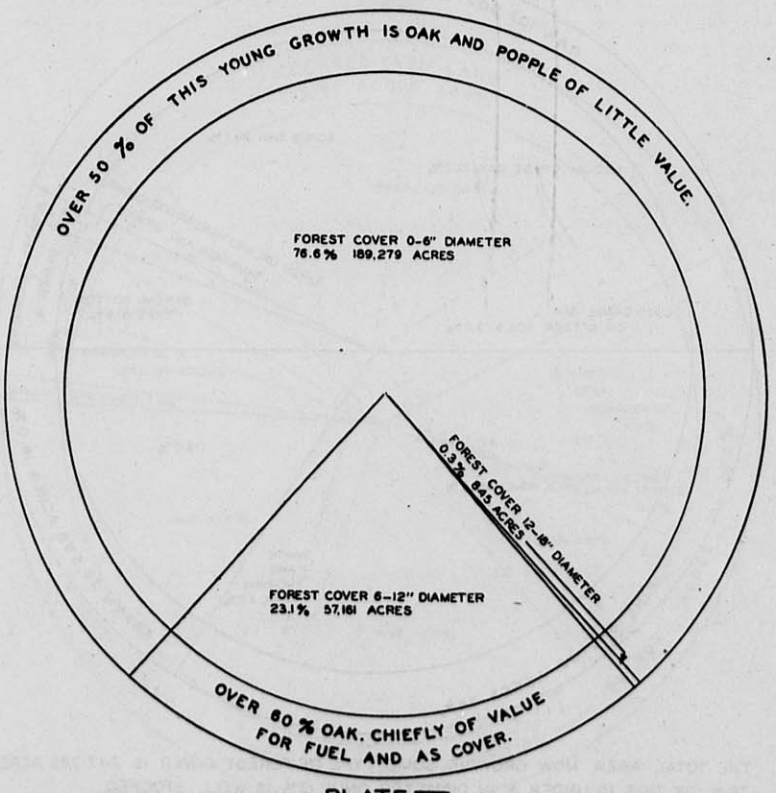


PLATE VIII

Table IV

CLASSIFICATION OF FOREST COVER BY SIZE

(See Plate VIII, page 24)

Forest Cover Types Averaging Over 12 Inches in Diameter:

	Diameter Class	*Acreage*
Ash and elm predominant stream bottom type	12-18″	85
White pine	12-18″	38
Oak	12-18″	722
Total forest types above	12″	845

Forest Cover Types Averaging Under 12 Inches in Diameter:

	Diameter Class	*Acreage*
Spruce	0-3″	25
Spruce	3-6″	151
Larch	0-3″	195
Larch	3-6″	414
Cedar	0-6″	345
Cedar	6-12″	125
Ash and elm stream bottom type	0-6″	3232
Ash and elm stream bottom type	6-12″	11359
Jack pine	0-3″	28977
Jack pine	3-6″	42527
Jack pine	6-12″	3144
Norway pine	0-3″	818
Norway pine	3-6″	1612
Norway pine	6-12″	3364
White pine	0-3″	648
White pine	3-6″	1648
White pine	6-12″	1356
Oak	0-3″	32122
Oak	3-6″	36807
Oak	6-12″	36251
Aspen "popple"	0-3″	34077
Aspen "popple"	3-6″	5278
Aspen "popple"	6-12″	243
Hardwoods (Maple predominant)	0-6″	400
Hardwoods (Maple predominant)	6-12″	1273
Hardwoods (basswood)	0-6″	3
Hardwoods (basswood)	6-12″	46
TOTAL		246440
GRAND TOTAL		247285

Present and Potential Forest Land

If, to the 247,285 acres of forest cover, the open, recently burned and cleared abandoned land is added, there is a grand total of 297,303 acres of forest land available for the production of timber, or 58.5 per cent of the entire county. About 130,000 acres are in need of planting because the land is open, burned, abandoned, or is land poorly stocked with inferior trees. Some of this can be used in its unforested condition for game refuge purposes.

The forest land includes all farm wood lots as well as all timbered areas, and all land with potential possibilities for timber. (See Plate VIII, page 24.) It does not include the wild swamp land of

31,606 acres. According to the present trend in agriculture it is likely that the acreage devoted to farming will continue to decline in the northern plain and that even more land than this will be devoted to forests and game refuges and to the production of cranberries and sphagnum moss.

The whole northern part of the county designated as the northern plain (see Plate II, page 7), should be primarily a forest and game refuge rather than an agricultural area.

White Pine the Important Forest Tree:

White pine has been an important timber tree in Juneau county in the past. The few scattered white pine now found growing in

TOTAL WILD LAND SHOWING POSSIBLE FOREST PLANTING AREA.

JUNEAU COUNTY

1932

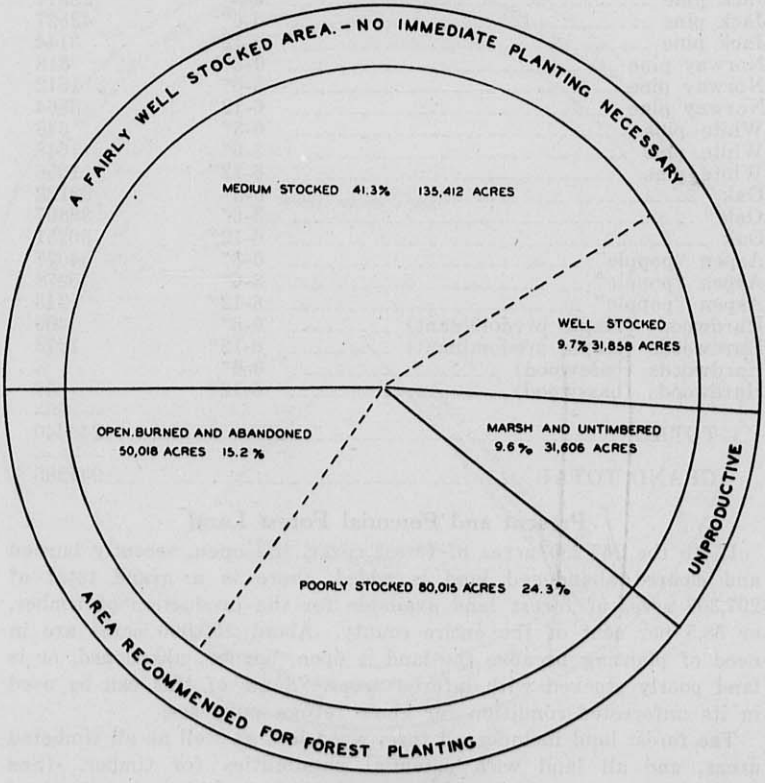


PLATE IX

the northern part of the county have an especially deep green color and indicate a thrifty condition. White and Norway pine, jack pine and Norway spruce would grow well in this region.

Cranberry Culture and Land Use

Wild cranberries and sphagnum moss grew over extensive areas of the northern sand-peat plain prior to drainage. Now the total acreage which can be successfully supplied with an adequate amount of water is limited, because of the general lowering of the water table throughout the entire region. A careful study made in 1932 of the geology of the northern plain and conditions following the construction of the extensive drainage projects disclosed the following:

(a) That sand stone comes relatively close to the surface over most of the area and to the surface in all the major sand islands. (Slight elevations.)

(b) That the ground water table is at present near the bottom and in many cases far below the bottom of the ditches, where before drainage it was near the surface.

(c) That vertical drainage from a practical point of view is limited to the shallow sand and sand peat bed over the sand stone.

(d) That there is nearly twice as much sandy land as shown by the early soil survey because so much of the loose peat has either burned or been carried away by the wind.

(e) That the total evaporation is now much greater than before drainage.

(f) That restoration of the area to a condition comparable to its former status, i. e., its condition before drainage, will require construction of numerous inexpensive regulatory dams with which to again raise the water table to near the surface.

(g) That such a process will reduce rapid drainage and in time create a proper soil condition for the growing of cranberries, sphagnum moss, marsh hay and forest cover, reduce excessive evaporation, and improve an extensive region for waterfowl and upland game birds, furbearing animals and deer.

A structure section of the northern plain running from the Wisconsin River across the towns of Armenia, Finley, Kingston and into the town of Bear Bluff, Jackson County, is shown on Plate III, page 8. This is in part diagrammatic because little is known of the relative depths of sand stone or of the alluvial material in the stream bottoms. It shows very clearly, however, that the general water course within this plain must follow the numerous rock cored sand islands and ridges which all bear slightly east and south. The shallowness of the sand peat plain also shows that water may again be impounded in this plain if rapid run-off is stopped by regulatory dams. The porosity of this sand mass will take care of at least 25% of its volume in water.

The southeasterly flow of water in the earth is slow but sufficiently constant to always keep the water behind the dams relatively fresh.

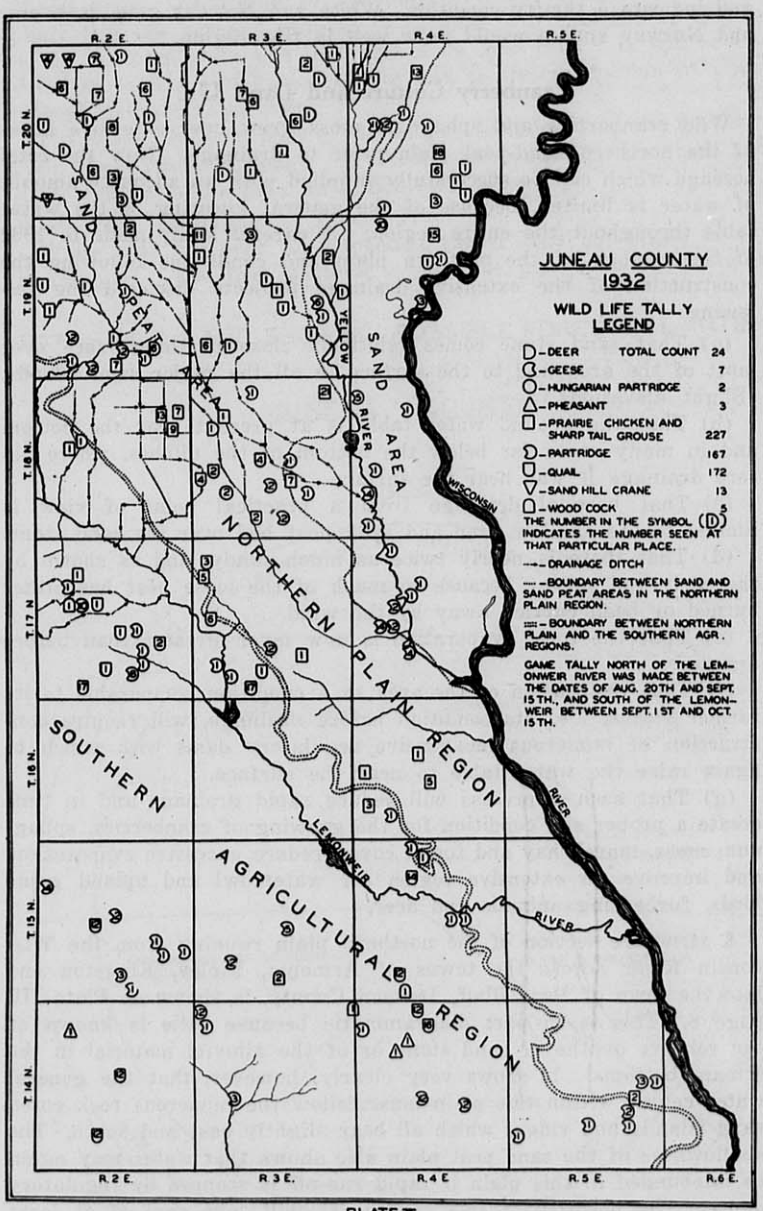

JUNEAU COUNTY
1932
WILD LIFE TALLY
LEGEND
D - DEER TOTAL COUNT 24
G - GEESE 7
O - HUNGARIAN PARTRIDGE 2
△ - PHEASANT 3
□ - PRAIRIE CHICKEN AND SHARP TAIL GROUSE 227
D - PARTRIDGE 167
U - QUAIL 172
▽ - SAND HILL CRANE 13
Ω - WOOD COCK 5
THE NUMBER IN THE SYMBOL (D) INDICATES THE NUMBER SEEN AT THAT PARTICULAR PLACE.
→ - DRAINAGE DITCH
- - - - BOUNDARY BETWEEN SAND AND SAND PEAT AREAS IN THE NORTHERN PLAIN REGION.
:::: - BOUNDARY BETWEEN NORTHERN PLAIN AND THE SOUTHERN AGR. REGIONS.
GAME TALLY NORTH OF THE LEMONWEIR RIVER WAS MADE BETWEEN THE DATES OF AUG. 20TH AND SEPT. 15TH., AND SOUTH OF THE LEMONWEIR BETWEEN SEPT. 1ST AND OCT. 15TH.
R.2 E.
R.3 E.
R.4 E.
R.5 E.
R.6 E.
T.20 N.
T.19 N.
T.18 N.
T.17 N.
T.16 N.
T.15 N.
T.14 N.
SAND PEAT AREA
YELLOW RIVER
SAND AREA
NORTHERN PLAIN REGION
SOUTHERN AGRICULTURAL REGION
WISCONSIN RIVER
LEMONWEIR RIVER

PLATE X

Relative Rapidity of Drainage

Water movement through the sand rock, sand peat earth and the open ditches is comparable to water passing through sieves with different sized meshes. The sand stone sieve would have very minute meshes and water passage would be very slow. The sand peat sieve would have somewhat larger meshes and passage would be considerably faster, and the open ditch sieve would have very large meshes which would offer little resistance to the water in its course to lower levels. Blocking the coarse sieve would tend to hold the water within the soil to a higher ground water level, i. e., a level comparable to pre-drainage conditions and vegetation of that period would again come back. Sphagnum moss on the water saturated earth would soon begin to furnish insulation against heat penetration as would forest mulch on the higher sand islands and excessive evaporation would be reduced. It is obvious from the findings of this investigation that this method of water conservation will bring back to this region increasing potential possibilities for the production of cranberries and sphagnum moss on the lower elevations and forest products on the higher land.

GAME AND LAND USE

One of the attractive features of Wisconsin is its wild life. This is an important fact to consider from an economic as well as from an esthetic viewpoint. The interest in wild life by the hunter and the lover of nature is one of the main factors of the recreational industry. Conservation groups have noted with distress the fact that the hunters are increasing while the hunted are decreasing. It is imperative, therefore, that something should be done to conserve this valuable form of recreation.

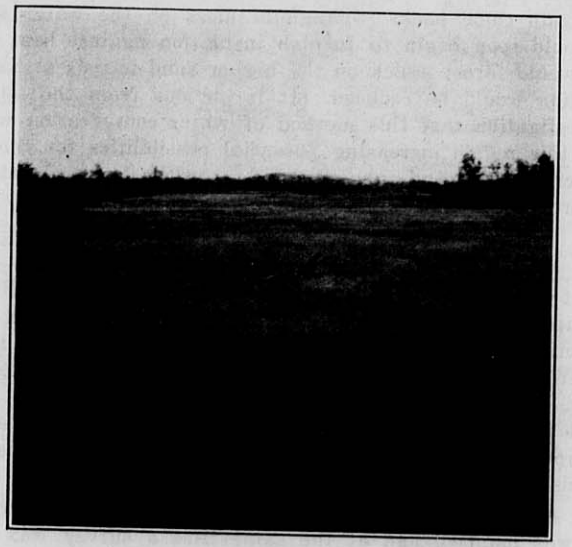
From August 20 to October 15, 1932, the land cover of Juneau county was mapped, and at the same time a survey was made of game and its environment. This was done to serve as a foundation upon which a more effective system of game management could be conducted. As mappers ran their lines at half mile intervals for this survey, they tallied 227 prairie chicken and sharp-tail grouse, 167 partridge, 172 quail, 7 geese, 13 sandhill crane, 5 woodcocks, 2 Hungarian partridge, and 3 pheasants. (See Plate X, page 28.) Rabbits and squirrels were not tallied. No ducks were tallied because mapping in those areas suited for ducks was done before waterfowl migration took place.

The environmental conditions for wild life in Juneau county can be divided into two kinds: the northern plain region which is mostly north of the Lemonweir River and along the Wisconsin River, and the agricultural region mostly south of the Lemonweir River.

The Northern Plain Region

In the past the northern plain region of Juneau county was well populated with game. The drainage of these marsh lands and the unsuccessful attempt to utilize these lands for agriculture have

tended to destroy the natural aptitude this region possessed for game. The repeated burning over of this region has destroyed game birds, nests, food, and cover, as well as mammals, such as deer and fur bearers. In many places the peat has been burned off, leaving pure sand on which a sparse cover of prairie and weed species of plants grow, instead of the more luxurious marsh type of flora. This change of conditions has had a disastrous effect on game. Only remnants of the water-fowl population are left. The upland game birds were more successful in adapting themselves to these changing conditions.



Sandy Peat Plain Northwest of Necedah.

In the northern plain region the game tally was conducted from August 20 to September 16. The plant cover can be classified into types according to adaptability to game. The plant cover types for the northern plain region are discussed in the following paragraphs:

The Grass, Willow, and Popple Seedling Type, covers an area of approximately 42,500 acres. The growth of popple seedlings results from burning over of the peat area. The willow and grass (blue joint grass *Calamagrostis canadensis*) are natural cover. This plant association furnishes excellent cover and desirable food during the spring, summer, and fall period of the year. Based upon the identification of crop contents of the game birds killed in this region, the bird foods are found to be as follows:

Table V

UPLAND GAME BIRD FOODS OF THE GRASS, WILLOW, AND POPPLE SEEDLING TYPE

Common Name	Scientific Name
Bog birch (Leaves, buds)	*Betula pumila* var. *glandulifera*
Wild strawberry (Leaves, fruits)	*Fragaria* spp.
Popple (Leaves, buds, catkins)	*Populus tremuloides*
Dew berry (Leaves, berries)	*Rubus* spp.
Field or sheep sorrel (Leaves)	*Rumex acetosella*
Burdock (Leaves, seeds)	R. spp.
Meadow sweet (Leaves)	*Spirea salicifolia*
Barrens white violet (Leaves)	*Viola lanceolata*
Short horned grasshoppers	*Acridiidae*
Crickets	*Gryllidae*
Other insects	*Insecta*

The Open Type covers an area of approximately 67,000 acres. It includes those regions where there are scattered clumps of brush, trees, and sparse vegetative cover that have little to offer as food and shelter. In these areas are some abandoned farm lands which possess desirable weeds for game birds. Game was usually scarce in these regions.

The Weed Type of cover is scattered through the grass, willow, popple seedling, and open cover as classified by the mappers. Most of these plants are common to the prairies and have migrated into this region since its drainage. Others are of European origin. These plants adapt themselves well to the burned over areas and to abandoned farms. Such plants deserve special consideration because of their year round food value for birds. Though the game tally tended to indicate that these weed patches were not so desirable for prairie game birds as the willow grass type of vegetation, they are, however, of basic importance because many of these plants bear seeds and fruits eaten by game birds during the winter months. Even during times of heavy snows such plants as smart-weed, wild buckwheat, and ragweed bear seeds above the snow. Smart-weed and wild buckwheat, which often predominate the weed patches of the sand peat region, are closely related to the cultivated buckwheat and consequently are a very nutritious bird food. Ragweed is another very important food for prairie game birds in winter. The presence of these species of plants are undoubtedly of particular significance to the prairie chicken. Based on previous reports and from the identification of crop and gizzard contents of prairie game birds the following are the important bird foods found in these weed areas.

Table VI

UPLAND GAME BIRD FOODS OF THE WEED TYPE

Common Name	Scientific Name
Common ragweed (Seeds)	*Ambrosia artemisiifolia*
Stick tight (Seeds)	*Bidens* spp.
Lambs quarters	*Chenopodium album*
Barnyard grass, wild millet (Seeds)	*Echinocholoa crusgalli*
Cultivated buckwheat (Seeds)	*Fagopyrum esculentum*
Wild sunflower (Seeds)	*Heleanthus* spp.
Smart weed (Seeds)	*Polygonum* spp. particularly: *P. Careyi* *P. lapathyfolium* *P. pennsylvanicum*
Arrow-leaved tear-thumb	*P. sagittatum*
False climbing buckwheat (Seeds)	*P. scandens*
Black bind weed (Seeds)	*P. Convolvulus*
Cinquefoil (Leaves)	*Potentilla norvica* var. *hirsuta*
Burdock (Leaves and seeds)	*Rumex* spp.
Field or sheep sorrel (Leaves)	*R. acetosella*
Foxtail (Seeds)	*Seterica glauca*
Night shade (Fruits)	*Solanum nigrum*
Shorthorned grasshoppers	*Acridiidae*
Other insects	*Gryllidae*

The Stream Bottom Type covers an area of approximately 14,000 acres in the county. This type consists of woodland, brush, marsh, and aquatic plant life. This association of types is well adapted to mixed game.

The stream bottom woodland and brush furnish a much desired cover for partridge. The outskirts of these stream regions that adjoin the prairie game bird country also furnish cover and food for prairie birds. Desirable foods of these bottom lands for game birds are listed in the following table:

Table VII

PLANT FOODS FOR UPLAND GAME BIRDS OF THE RIVER BOTTOM TYPE

Common Name	Scientific Name
Sedge (Seeds)	*Carex lupulina*
Sedge (Seeds)	*C. Tuckermani*

Common Name	Scientific Name
Silky dogwood, Kinnikinnik	*Cornus Amomum*
Dogwood	*C. paniculata*
Red-osier dogwood	*C. stolonifera*
Hazelnut (Catkins)	*Corylus americana*
Wild strawberry (Leaves, fruits)	*Fragaria* spp.
Aromatic wintergreen (Berries)	*Gaultheria procumbens*
Michigan holly, black alder (Fruits)	*Ilex verticillata*
Mountain holly (Fruits)	*Nemopanthus mucronata*
Small true Soloman's seal (Fruits)	*Polygonatum biflorum*
Great Soloman's seal (Fruits)	*P. Commutatum*
Smart weed (Seeds)	*Polygonum lapathifolium*
Arrow-leaved tear-thumb (Seeds)	*P. sagittatum*
Poplar, cottonwood, popple (Leaves, buds, catkins)	*Populus deltoides*
Large-tooth aspen, popple (Leaves, buds, catkins)	*P. grandidentata*
Pin cherry (Fruits)	*Prunis pennsylvanica*
Woodbine (Fruits)	*Psedera vitacea*
Choke berry (Berries)	*Pyrus arbutifolia*
Choke berry (Berries)	*P. melanocarpa*
Smooth stem sumac (Seeds)	*Rhus glabra*
Poison ivy, poison oak (Seeds)	*R. toxicodendron*
Burdock (Seeds, leaves)	*Rumex* spp.
Willows (Leaves)	*Salix* spp.
Common elder (Berries)	*Sambucus canadensis*
Red-berried elder (Berries)	*S. pubens*
False spiknard (Fruits)	*Smilacina racemosa*
False Soloman's seal (Fruits)	*S. stellata*
Green brier (Fruits)	*Smilax hispida*
Bitter sweet (Fruits)	*Solanum dulcamara*
Meadow sweet (Leaves)	*Spiraea salicifolia*
Wild raisin (Fruits)	*Viburnum cassinoides*
High-bush cranberry (Fruits)	*V. opulus* var. *americanum*

The river bottoms of meandering streams, particularly the bottoms of the Yellow and Lemonweir rivers with their flowages, sloughs, and oxbows have brush, marsh, and aquatic vegetation that furnish desirable environment for water fowl. Wild rice and coontail in particular are common and are excellent duck foods. Many of the plant foods listed for upland game birds are also valuable for water fowl. The aquatic duck foods are listed in the following table:

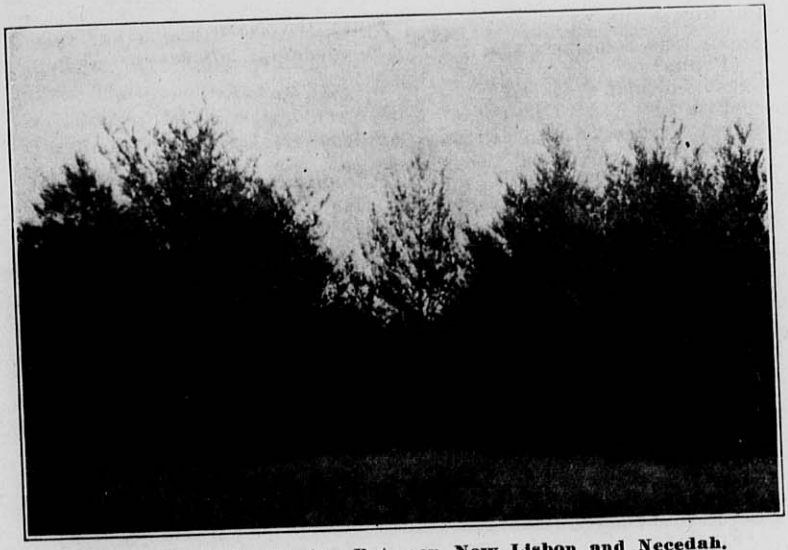
Table VIII

AQUATIC PLANT FOODS FOR DUCKS OF THE RIVER BOTTOMS

Common Name	Scientific Name
Water marigold	*Bidens Beckii*
White water lily	*Castalia tuberosa*
Coontail, hornwort	*Ceratophyllum demersum*
Water-weed, Elodea	*Elodea canadensis*
Duck-weed, duck's meat	*Lemna perpusilla*
Water milfoil	*Myriophyllum spicatum*
Bushy pondweed	*Najas flexilis*
Yellow water lily, cow lily, spatter dock	*Nymphozanthus variegatus*
Water smartweed	*Polygonum natans*
Pondweed, bass weed	*Potamogeton americanus*
	P. amplifolius
Leafy pondweed	*P. epihydrus*
Pondweed, floating brown leaf	*P. natans*
Sago pondweed	*P. pectinatus*
Pondweed	*P. Robbinsii*
	P. zozteriformis
	P. spp.
Water crowfoot	*Ranunculus longirostris*
Wapato, duck potato	*Sagittaria latifolia*
Bur-reed	*Sparganium chlorocarpum*
Duck-weed, duck's meat	*Spirodela polyrhyza*
Wild celery	*Vallisnera americana*
Wild rice, Indian rice, duck oats	*Zizania aquatica* var. *interior*

Other wild game such as rabbits, squirrels, and in the more isolated regions, deer, find the environment of the stream bottoms a good cover. The beaver, mink, and otter are rare even though most of the stream bottom land is well adapted for them. Muskrats are fairly abundant. They are particularly fond of the flowage regions where the dense cover of sedges, wild rice, bulrushes, and cat-tail of the water margins are to their liking. The pad vegetation, such as the yellow and the white water lilies, are their favorite food. They use also the lax flexious pondweeds, coontail and water weed.

The Mixed Brush and Forest Type covers approximately 90,000 acres. The drier sandy regions, particularly along the Wisconsin River, are in part covered by brush and trees of the scrub oak, jack pine type. This type of cover is not so well adapted for game as the more varied and dense brush and tree cover of the sand peat region, where such brush as choke berry, choke cherry, alder, dogwood, bog birch, willow, Michigan holly, and hazelnut are common. The for-



School Forest Plantation Between New Lisbon and Necedah.

ested areas which consist of the different oaks, jack pine, white pine, popple and birch are better adapted for partridge. The correlation of the game tally with cover indicates that the mixed brush and forest area cover of the sand peat soils are also desirable for deer. The upland game bird foods found in this mixed cover type are in many cases those found in the grass and willow type of cover plus the plant foods listed in the following table:

Table IX

UPLAND GAME BIRD FOODS OF MIXED BRUSH AND FOREST TYPE

Common Name	Scientific Name
Juneberry (Fruits)	*Amelanchier* spp.
White birch (Buds)	*Betula papyrifera*
Creeping snow berry (Berries, leaves)	*Chiogenes hispidula*
Red-osier dogwood (Fruits)	*Cornus stolonifera*
Hazelnut (Catkins)	*Corylus americana*
Aromatic wintergreen (Berries)	*Gaultheria procumbens*
Huckleberry (Leaves, berries)	*Gaylussacia braccata*
Michigan holly, black alder (Fruits)	*Ilex verticillata*
Sweet Gale (Buds)	*Myrica Gale*
Mountain holly (Fruits)	*Nemopanthus mucronata*

Common Name	Scientific Name
Small true Soloman's seal (Fruits)	*Polygonatum biflorum*
Great Soloman's seal (Fruits)	*P. sagittatum*
Smart weed (Seeds)	*Polygonum lapathifolium*
Arrow-leaved tear-thumb (Seeds)	*P. sagittatum*
Pin cherry (Fruits)	*Prunis pennsylvanica*
Choke cherry (Fruits)	*P. virginiana*
Choke berry (Fruits)	*Pyrus arbutifolius* *P. melanocarpus*
Oaks (Acorns)	*Quercus* spp.
Dwarfed sumac (Fruits)	*Rhus copallina*
Smooth stem sumac (Friuts)	*R. glabra*
Poison ivy (Fruits)	*R. toxicodendron*
Staghorn sumac (Fruits)	*R. typhina*
Rose (Rose hips)	*Rose* spp.
Elderberry (Fruits)	*Sambucus canadensis*
False spiknard (Berries)	*Smilacina racemosa*
False Soloman's seal (Berries)	*S. stellata*
Velvet-leaved blueberry (Fruits, leaves)	*Vaccinium canadensis*
Early blueberry (Fruits, leaves)	*V. pennsylvanicum*

Game Management

The most efficient utilization of the northern plain region for game implies management. In the peat sand areas where the land is well suited for mixed game, Nature has begun this wild life project by spreading the weed flora. The seeds and fruits of these plants are important foods for the prairie chicken during the winter months. Game management in this region would augment further adaptation of this land for wild life. However, such a project should be a guided one in order to be of mutual advantage for game and for cranberry farming, a highly specialized form of agriculture for which certain parts of this area are well adapted.

Cooperation between game management and cranberry farming should result in mutual benefit to both projects. In this connection there are two fundamental factors to consider:

1. The propagation of wild game should be a guided one in order that it will not produce harmful effect on the cranberry farming. This would result if too many muskrats were allowed to propagate. Since the burrowing activities of this animal destroy the effectiveness of the dikes bordering cranberry marshes, it is imperative therefore,

that the muskrat should not be protected but eradicated from the vicinity of cranberry farms.

2. The impounding of the water by dams, earth plugs, and dikes is important to the cranberry growers so that water will be stored for flooding the cranberry marshes. Such flooded areas will furnish suitable environment for water fowl.

The Improvement of the Environment for Water Fowl

The natural marsh conditions with its scattered ponds, and sloughs which existed before drainage ditches were dug was a very desirable breeding ground for water fowl. The proposed damming and plugging of the drainage ditches would tend to restore this former environment. This fact is well illustrated in those areas where water has been impounded for cranberry farming. Several varieties of ducks have nested in this region. Seven geese were seen early in August 1932 west of Meadow Valley. Five of these were reported to be young birds which had been hatched there that season. Other rare birds such as the sandhill crane were found in these marshy regions.

A dense growth of marsh vegetation would result were the water retained by dams. However, aquatic vegetation would be very slow in coming back. It would be necessary to plant a few essential aquatic duck foods to make this area a better place for water fowl. Before carrying out such a project it is necessary to know whether a suitable environment exists for these plants. The analysis of the water of the streams and ditches for hardness (alkalinity) or softness (acidity) was based on the parts per million of bound carbon dioxide which is the relative amount of carbonates, or lime, in the water.[1] These tests showed that the parts per million of bound carbon dioxide were between 20 and 29. This indicates a medium hard water. Medium hard waters have been observed to be associated with a balance of mineral nutrients which is necessary for an abundant and varied vegetation including most of the aquatic duck foods. Some desirable plants for ducks are:

Table X

Common Name	Scientific Name
Bushy pond weed or water naiad	*Najas flexilis*
Coontail or hornwort	*Ceratophyllum demersum*
Sago pond weed	*Potamogeton pectinatus*
Pondweeds	*P. angustifolius*
	P. amplifolius
	P. natans
	P. spp.
Wild celery	*Valisneria americana*
Wild rice	*Zizania aquatica*

[1]Seyler, C. A.
1894, Chemical News, Volume 70.

Birge, E. A. and Juday, C.
1911, Inland Lakes of Wisconsin, Wisconsin Geological and Natural History Survey Bulletin 22.

Sixth Edition
1925, Standard methods of Water Analysis, American Public Health Association, 370 Seventh Avenue, New York, N. Y.

Wild rice is an excellent food for ducks. Observations also tend to indicate that one of the attractive features of wild rice for ducks is the desirable shelter and cover afforded. In the open water margins bordering wild rice beds other essential duck foods of the submerged long flexious type (coontail) are invariably found.

Wild rice requires an alkaline condition, an exchange of water due to drainage, and fairly constant water level during its growing season. If the water level fluctuates as much as twelve inches, the wild rice will die. Ripe grains of wild rice that have not been roasted can be successfully planted in the autumn. If wild rice is planted in the spring, seed should be obtained from a reliable aquatic nursery because of the difficulty involved in preserving its vitality.

Coon Tail.

Coontail is a very desirable duck food. Young shoots growing from the old stem of this plant are among the first aquatic plant foods to be eaten by ducks, and in the fall when most of the aquatic vegetation has disappeared, this semi-bristled leaved plant is still available. Since this plant does not have roots, though it is often anchored, it can easily be transplanted. Coontail can be found and

gathered in the sloughs and flowages of the river bottoms where it is already quite abundant.

The Improvement of the Environment of the Upland Game Birds

The partridge, which is found in the forested areas is a very hardy bird that lives on a variety of foods. In winter, it eats buds of popple, birch, and of other trees and shrubs.

The sharp-tail grouse and particularly the prairie chicken subsist largely on seeds in winter. Planting of patches of food bearing plants such as buckwheat, wild millet, and corn would, therefore, be of aid to these birds. Though these prairie birds are not so dependent on buds as the partridge, Mr. F. Schmidt has observed that they do eat the buds of white birch and bog birch during the winter months.[2]

Bog birch is already quite common in the willow and mixed brush areas. The introduction of more white birch would also improve prairie game birds conditions.

The mild winters and light snow fall have made it possible for quail to become quite common in the northern part of Juneau county. If such birds are to exist permanently in these parts, sheltered feeding stations should be established. These stations will also be of benefit to the other upland game birds.

The Improvement of the Other Game Conditions

Other game includes deer, rabbits, squirrels, and the fur bearing animals. The number of deer in this region has decreased due to insufficient protection. The rabbits are plentiful. Squirrels are also fairly common in the wooded areas.

Of the fur bearing animals beaver, mink, and otter are rare. Muskrats are quite plentiful in certain regions. The proposed damming back of the water in the drainage ditches would furnish much additional desirable environment for muskrats. However, it is advisable to reinforce earth plugs with iron piling or wire mesh because of the burrowing habits of these animals.

Game Refuge[3]

A refuge for wild life is an essential factor of a game management program because it serves as a suitable place for game propagation, shelter, and as a resting ground. A large game refuge in the northwestern part of Juneau county would be beneficial because it possesses a variety of environmental conditions essential for mixed game. Such a game refuge would be centralized in a populated mixed game country.

The Southern Agricultural Region

The agricultural region with its crop land, pastures, and rugged wood land possesses excellent possibilities for the cooperation of

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[2]Mr. F. Schmidt, formerly associated with the State Conservation Commission, unpublished data.

[3]Leopold, A.
1933, Game Management, Chapter VIII Game Refuges, Page 195, Published by Charles Scribner's Sons, New York, N. Y.

Agricultural Region of Southern Juneau County.

game management with farming. The utilization of wild life as an added agricultural revenue in Wisconsin has been given impetus by the passage of the "Wisconsin Licensed Shooting Preserve Law."[4]

Game birds of this region are mainly partridge and quail. Partridge are fairly common in the wooded areas, while quail find the margin of the woods, the thicket fence lines, and the fields suitable.

The quail deserves special consideration since it is one of the most desirable game birds and because of its economic importance. During spring, summer, and fall it feeds on weed seeds and insects, many of which are very destructive. "One farmer estimates that each Bob-white in his fields is worth at least five dollars a year because of the good it does in destroying insects."[5] Mild winters and light snow fall has made it possible for this bird to become more abundant. The construction of winter feeding stations is necessary if the present number of these birds is to be maintained and increased should more severe weather occur in the future.

THE TREND IN LAND OWNERSHIP AND POPULATION

When land ceases to find a buyer who is willing to pay taxes, it reverts through tax delinquency to public ownership. Two factors are contributory viz., (a) excessive taxes — in this case for drainage and in some instances for schools (b) low productivity. Plate XI, page 41, shows the trend to public ownership in the northern plains province. It also shows the county forest area which has been definitely set off to again revert to wild cover.

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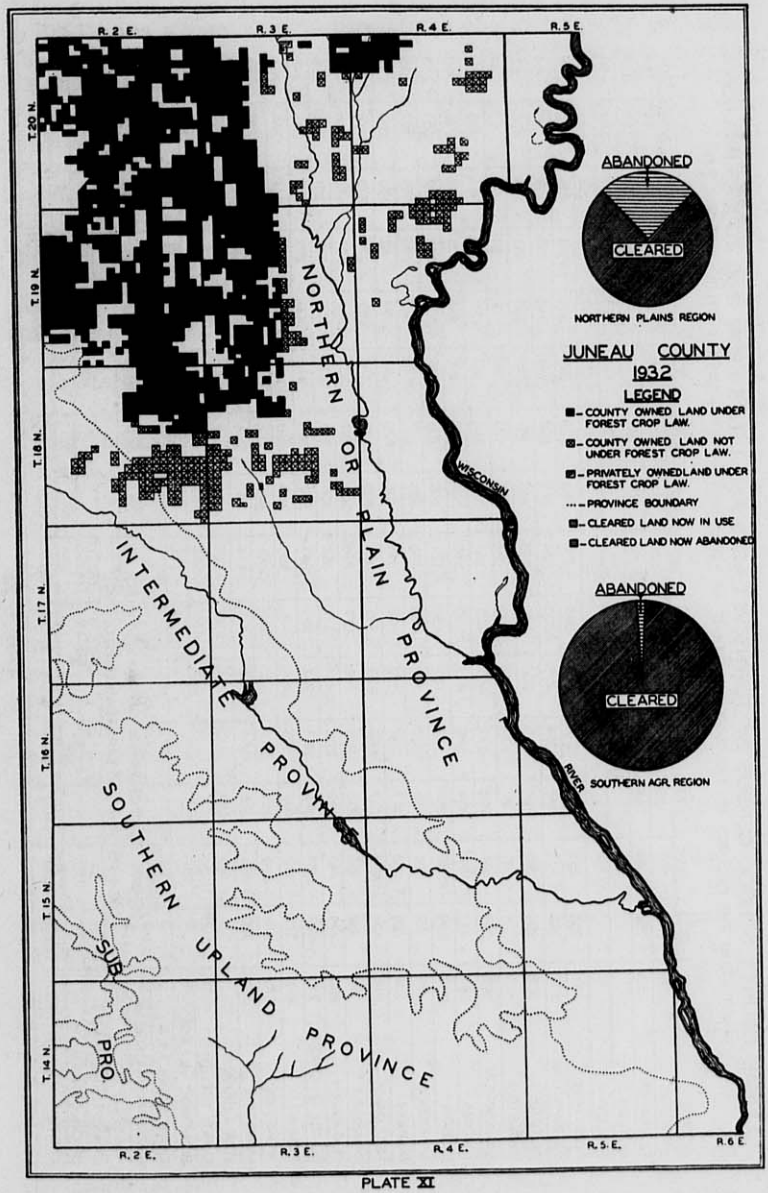
[4]1932, Wisconsin Licensed Shooting Preserve Law, State of Wisconsin Conservation Department, Madison, Wisconsin. Copies of this law with explanation will be mailed upon request from the Conservation Department.

[5]Forbush, E. H.
1927, Birds of Massachusetts and other New England States Part II, Page 11, Massachusetts Department of Agriculture.


R. 2 E.
R. 3 E.
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T. 14 N.
NORTHERN OR PLAIN PROVINCE
INTERMEDIATE PROVINCE
SOUTHERN URLAND PROVINCE
SUB PRO
WISCONSIN RIVER
ABANDONED
CLEARED
NORTHERN PLAINS REGION
JUNEAU COUNTY
1932
LEGEND
- COUNTY OWNED LAND UNDER FOREST CROP LAW.
- COUNTY OWNED LAND NOT UNDER FOREST CROP LAW.
- PRIVATELY OWNED LAND UNDER FOREST CROP LAW.
- PROVINCE BOUNDARY
- CLEARED LAND NOW IN USE
- CLEARED LAND NOW ABANDONED
ABANDONED
CLEARED
SOUTHERN AGR. REGION

PLATE XI

JUNEAU COUNTY SCHOOL CENSUS BY TOWNS, VILLAGES AND CITIES FROM 1866 TO 1933 INCLUSIVE.

TAKEN FROM THE RECORDS OF THE SUPERINTENDENT OF PUBLIC INSTRUCTION – STATE CAPITOL. MADISON. WIS.

TOWNS	1866	1870	1874	1878	1882	1886	1890	1894	1898	1902	1906	1910	1916	1924	1932	1933
ARMENIA	76	70	97	95	92	61	107	105	342	372	328	279	300	246	157	168
CLEARFIELD	53	54	85	96	107	98	99	91	185	207	213	175	184	189	157	158
CUTLER										154	153	125	123	157	103	94
FINLEY										81	73	49	46	55	23	30
FOUNTAIN	181	255	255	258	276	265	266	276	263	324	325	321	(1)245	225	215	207
GERMANTOWN	239	202	153	247	269	210	200	204	240	238	242	242	218	119	93	104
KILDARE	303	299	290	264	235	204	240	278	295	347	(2)223	215	182	134	136	162
KINGSTON				27	34	51	55	67	126	125	90	76	84	70	57	67
LEMONWEIR	348	399	414	468	399	407	403	361	337	357	361	426	377	291	289	304
LINDINA	393	411	492	384	380	413	350	340	339	323	326	332	376	343	274	260
LISBON	547	629	(3)155	157	133	167	134	161	198	231	226	207	174	179	201	185
LYNDON	196	195	142	186	190	191	202	186	195	171	178	166	161	191	167	165
MARION	116	128	120	147	152	163	199	175	196	124	184	169	142	156	129	132
NECEDAH	218	401	508	517	660	823	710	883	805	(3)225	172	205	237	273	233	217
ORANGE	57	82	167	213	210	270	227	268	305	(4)217	238	211	197	172	154	143
PLYMOUTH	260	274	415	489	608	(6)411	316	359	306	315	309	307	272	271	278	258
SEVEN MI. CREEK	275	429	387	395	303	247	210	247	322	358	340	309	297	253	233	241
SUMMIT	222	313	342	409	373	414	416	386	388	410	384	381	360	361	314	282
WONEWOC	278	372	469	213	611	691	433	468	557	528	502	449	(7)421	342	296	348
MAUSTON	295	368	366	378	364	343	419	411	467	544	546	515	448	540	527	474
NEW LISBON (5)			493	430	410	554	295	381	404	347	364	366	381	308	317	318
ELROY CITY (6)						438	455	589	563	543	559	496	442	439	423	390
WONEWOC VILLAGE							170	371	118	314	185	176	211	189	188	195
CAMP DOUGLAS (4)										134	139	121	123	127	113	109
NECEDAH VILLAGE (3)			SCHOOL CENSUS TAKEN SEPARATELY FOR							449	450	497	407	250	221	226
HUSTLER (1)			THE FIRST TIME IN YEARS MARKED (1) (2) ETC.										46	51	36	32
LYNDON STATION (2)											108	112	101	54	97	98
UNION CENTER (7)													59	54	48	46
TOTAL	4,057	4,481	5,350	5,400	5,806	6,204	5,906	6,607	6,951	7,438	7,218	6,927	6,656	6,039	5,360	5,414

TABLE XI

The occupation of the land of Juneau county by the white man came early in the history of the state. A school census dating back to 1866 gives a very clear picture of the ebb and flow of population. The northern plains province shows a very marked decrease in school population since the turn of the century while south of this province, where the land is largely agricultural the school population has remained about the same. The annual cost per pupil is also much lower. (See Table XI, page 42.)

Economic duress has caused numerous schools to close, which usually leads to the consolidation of districts and results in greater efficiency and a lower cost per pupil.

The school map shows several proposed consolidations as suggested by school officials. One includes the four districts in the town of Kingston. Necedah district No. 6 would be annexed to Joint District No. 10; Armenia No. 6 would be annexed to Armenia Joint No. 5; Finley No. 2 would be annexed to Finley No. 1. Other possible changes may be suggested following a careful study of the school map with its enrollment and cost data. (See Plate XII, page 44.)

Conclusions

A land inventory does not infer recommendations other than those implied in the inventory analysis. Summarily these are:

A. Restoration of a higher water table in the northern plains by the construction of regulatory dams in the 250 miles of drainage ditches.

B. The reversion of this region to its natural native cover of forest and marsh vegetation, with limited areas reserved for agriculture and cranberry culture.

C. The establishment of a game refuge primarily for migratory and nesting birds.

D. The utilization of the vast system of dammed drainage ditches for propagation of fish and in some cases for fur bearing animals. Muskrats, however, must be kept away from regulatory dams and cranberry levees.

E. The increase of the natural forest cover on the rough land of the southern provinces.

F. The increase through consolidation of areas of governmental units as town and school districts where it is found that greater governmental efficiency at lower costs may be attained (see Plate XII, page 44).

The inventory data should suggest numerous other changes to the people of the county and particularly to the Town and County Boards because of the fact that ordinances regulating land use are now possible under the laws of Wisconsin, and many counties are availing themselves of the opportunity of zoning their lands for their best uses.

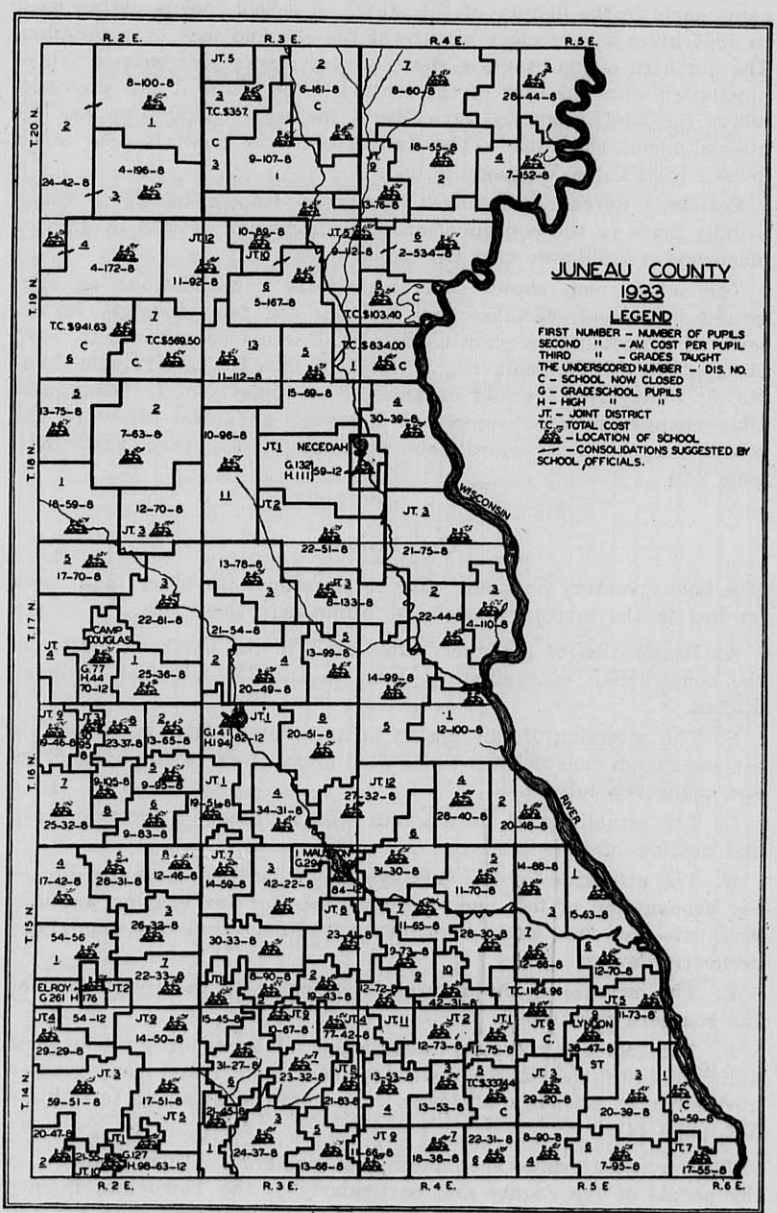
JUNEAU COUNTY
1933
LEGEND
FIRST NUMBER – NUMBER OF PUPILS
SECOND " – AV. COST PER PUPIL
THIRD " – GRADES TAUGHT
THE UNDERSCORED NUMBER – DIS. NO.
C – SCHOOL NOW CLOSED
G – GRADE SCHOOL PUPILS
H – HIGH " "
JT. – JOINT DISTRICT
T.C. – TOTAL COST
– LOCATION OF SCHOOL
– CONSOLIDATIONS SUGGESTED BY SCHOOL OFFICIALS.
WISCONSIN RIVER
CAMP DOUGLAS
NECEDAH
ELROY
LYNDON ST
R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.
R. 6 E.
T. 20 N.
T. 19 N.
T. 18 N.
T. 17 N.
T. 16 N.
T. 15 N.
T. 14 N.

PLATE XII

FLORA OF JUNEAU COUNTY

The character of the timbered areas of the county is described elsewhere in this bulletin so this discussion is limited to a consideration of the vegetation of the broad expanses of prairie and peat soils and the ground cover of the wooded land. The chief element of this flora consists of grasses, some of which are general in their distribution throughout the county, but most of which show preferences as to soil types. The northern and eastern portion of the county is divided roughly into two soil types — sand plain and peat soils. The peat soil varies in the relative proportions of sand and peat and is further classified by the soils expert upon this basis. These peat lands almost wholly occupy the northwest quarter of the county. The sand plains include those soil types designated as Plainfield sand, Boone sand, Superior sand and Dunning sand and occupy a broad strip adjacent to the Wisconsin River with an extension of the Superior sand across the central part of the county to the west county line.

The most conspicuous feature of the sand plain flora is the presence of the prairie triple-awned grass occurring over broad expanses of cleared land in almost pure stands. Two species of the grass were noted, *Aristida basiramea*,[1] dominant in Plainfield sand, and *A. intermedia* which was more plentiful than the first in the Boone sand areas but reached its maximum in Superior sand and sand peat. The upland prairie bluestem,[2] *Andropogon scoparius* var. *frequens*, which occurs throughout the county becomes plentiful in Plainfield sand while its lowland sister species *A. furcatus*, which reaches its maximum in the peat soils, is plentiful in Dunning sand and occurs less frequently on Boone and Plainfield sands. The early flowering Kentucky blue grass, *Poa pratensis*, which is the dominant roadside and pasture grass in the loam soils of the southwestern portion of the county is also a common element of the Plainfield sand flora in spare stands but occurs more sparingly in the Boone sand areas than elsewhere in the county. The Canada blue grass, *Poa compressa* occurs occasionally in Plainfield sand. Timothy is rare in the Plainfield and Boone sand areas but becomes plentiful in Superior sand. Both of these species reach their maximum frequencies in the southwestern part of the county. The fox-tail grass, *Setaria lutescens*, which is plentiful in cultivated soils throughout the county becomes a common weed in the Plainfield and Superior sands. *S. viridis* occurs in similar situations throughout the rest of the county but was not collected in Plainfield sand. Sandbur is plentiful throughout in cultivated soil but most common on Boone sand. The prairie species *Bouteloua hirsuta* was observed only once and that was on Boone sand.

Associated with the above named grasses in the sand plain areas are a number of typical prairie species such as *Aster sericeus;* the

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Note 1. For the sake of accuracy, where there is no common name for the species the scientific name is used.

Note 2. Weaver, J. E., Who's Who Among the Prairie Grasses. Ecology, 1931.

tickseed, *Coreopsis palmata;* the blazing star, *Liatris pycnostachya;* lead plant and the false indigo, *Baptisia bracteata.* The rush, *Juncus interior,* is a common element of the flora, and the ragweed, *Ambrosia psilostachya,* especially noxious because of its long deeply buried runners, is well established in cultivated soil. Plants occurring in similar situations but of general distribution in the North Central states are represented by *Polygonella articulata;* the golden rod, *Solidago rigida;* hazelnut; the blazing star, *Liatris scariosa;* the horse mint, *Monarda punctata* and dewberry, the last being common in Dunning sand. A typically eastern species occurring in the area is the flax, *Linum medium,* while *Amaranthus blitoides* and white sage are representatives of a more westerly flora.

Attention was especially paid to the ground cover of the jack pine and scrub oak areas in an effort to discover significant differences which might be useful indicators as to the most economical utilization of the soil. In a jack pine stand the ground cover was found to consist largely of bearberry; two species of blueberry; the red root, *Ceanothus ovatus;* hazelnut and sedges. Flowering spurge and *Coreopsis palmata* were also present. All of these species with the exception of Bearberry occurred sparingly and fruited poorly or not at all. In a recently burned jack pine area the above species were all present with the additional prairie bluestems, indian grass, pinweeds and frostweeds, all fruiting freely beneath the open tree growth which consisted of oak sprouts. A scrub oak stand showed a similar ground cover with a stronger development of the prairie flora, the prairie June grass, *Koeleria cristata* becoming dominant. Jack pine seedlings were plentiful in the scrub oak cover. It seems evident that jack pine originally grew on the scrub oak areas but the oak has arisen due to burning, and, serving as cover to the jack pine seedlings the area will eventually return to jack pine unless further interrupted by fire. In the absence of scrub oak cover, seedlings of jack pine occur sparingly in Plainfield sand but are found in much heavier stands in the moister Boone and Dunning sands.

The moister peat soils of the northwestern part of the county are characterized by broad meadows of the blue joint, *Calamagrostis canadensis* var. *typica,* which in the sand plain areas occurred only in ditches and sparingly on shaded soil. In wetter conditions it gives way to sedge (*Carex* spp.) with wool grass, and where deep burning has exposed the underlying sand it is replaced by heavy stands of hair grass, *Agrostis hyemalis.* In Kingston where a severe burn occurred in 1930 it is not uncommon to see the blue joint and hair grass together, the latter occurring on the bare sand between the hummocks of peat which are covered with the former. The barnyard grass, *Echinochloa muricata,* has also become well established in this region as have tickseed sunflower and several species of knotweeds, *Polygonum pennsylvanicum, P. lapathifolium, P. Careyi, P. Hydropiper, P. Convolvulus* and *P. scandens,* all valuable sources of food for game birds. Also occurring plentifully in the area are beard grass and Indian grass. Slough grass is plentiful in low lying

places and especially so along drainage and roadside ditches, while wild oat grass which occurs in spare stands along wood edges and fence rows throughout becomes plentiful in sand peat in the northern part of the county. The dropseed, *Muhlenbergia uniflora*, occurs occasionally in moist sands and becomes plentiful as a weed in the commercial cranberry marshes.

Spiraea salicifolia and the pink flowered *Spiraea tomentosa* are common on the peat soils while the collections of the prairie gentian, *Gentiana puberula*, and the northern species, *Gentiana linearis* var. *latifolia* are notable because of their rarity in the region. *Gerardia tenuifolia* is plentiful along the roadsides and bristly sarsaparilla occurs occasionally although it is more common in rocky situations as on the buttes along the Wisconsin River. Fireweed, *Epilobium angustifolium*, is plentiful over the burned area and E. coloratum, willow herb, is common in moist situations. Relics of a time when these peat lands were forested are found in the species *Clintonia borealis*, bunchberry, twisted stalk, Canada mayflower, star flower, red raspberry, the spinulose shield fern, cinnamon fern and royal fern.

The bottomlands of the rivers and streams crossing the county offer a wide variety in their flora. Here are found the brome grasses, *Bromus ciliatus*, *B. Kalmii* and *B. purgans*. Rattlesnake grass, *Glyceria canadensis*, and its more rare sister species *G. grandis* are found not only in the creek bottoms but also along ditches throughout. *Muhlenbergia foliosa* was observed only in wooded river bottoms while *M. racemosa* is plentiful in spare stands on moist soils throughout. The bent grass, *Agrostis perennans*, commonly seen in moist soil was only occasionally seen in Boone sand areas but was common in moist soil elsewhere. The last two species were not observed in the Plainfield sand area. More rarely occurring species confined to the river bottoms are rice cut grass, white grass, dropseed *(Sporobolus heterolepis)*, wood reed grass and *Brachyelytrum erectum*. Two species of wild rice are plentiful in heavy stands in the Lemonweir River and similar situations, the broader leaved species, *Zizania aquatica*, being more common than the narrower leaved var. *angustifolia*.

Characteristic also of the bottomlands are mild water pepper; lance-leaved lousewort; the loosestrifes, *Lysimachia terrestris* and *L. quadrifolia;* the false loosestrife, *Ludwigia polycarpa;* cardinal flower; closed gentian; water hemlock; marsh speedwell and the sedge, *Carex lupulina*. Black alder, the dogwoods and the arrow-woods are the common shrubs of the bottoms. The sumacs, staghorn, smooth and winged, are not confined to the river bottoms but are found in favorable situations throughout the county.

Among the grasses cultivated in the county are sorghum, fox-tail millet, sudan grass and Japanese barnyard millet. The last is freely escaping in the vicinity of New Lisbon and possibly hybridizing with wild species of *Echinochloa* there. The occurrence of timothy as a meadow grass has already been mentioned. In the loam soils of the southwestern portion of the county red top is

common in low pastures, and is an important element in meadows in the sand peat soils west of Necedah. *Panicum Praecocius* is also a common pasture grass and P. sphaerocarpon was observed to grow plentifully with it in Superior sand.

Another group of grasses is composed of those which occur as common field and roadside weeds throughout the county. This group includes *Agropyron*, or quack grass, of which the species *Agropyron caninum* and *A Smithii* are the most common representatives. The finger grass, *Digitaria humifusa*, is common throughout on roadsides and *D. sanguinalis* is occasional in similar situations on the moister richer soils. The barnyard grass, *Echinochloa crus-galli*, is plentiful throughout on roadsides and as a weed in cultivated ground, while another species, *E. muricata* var. *microstachya*, occurs along the Lemonweir and on creek banks near Elroy. Several species of *Eragrostis* appear in a variety of situations. *E. pectinacea* is a common roadside weed throughout. *E. cilianensis* becomes plentiful in Plainfield sand while *E. spectabilis* is the more common species in Boone sand. *E. Frankii* occurs in cultivated soil in the southwest part of the county. Squirrel-tail grass is not common but appears occasionally in the better soils. Old witch grass, *Panicum capillare*, is a common field and roadside weed throughout while the dropseed, *Sporobolus vaginaeflorus*, is plentiful on roadsides in the west and south portions. Occasional stands of another dropseed, *S. cryptandrous*, occur on sand banks and road cuttings. Wild rye is represented in the county by four species of *Elymus* of which *E. diversiglumis* is occasional along shaded roadsides near Elroy and *E. robustus* appears occasionally throughout the county. Other grasses appearing more rarely are wild oat, *Avena fatua*, which was collected in Germantown and Armenia, and *Phalaris arundinacea*, the reed canary grass, which was collected in Cutler. Fescue occurs occasionally and the reed, *Phragmites communis*, was observed once in the northern part of the county; it may occur elsewhere.

Three factors commonly operate in the extension of prairie over any area, these are drainage, fire and cultivation, of which the last is probably the most important. In Juneau county the clearing, cultivation and eventual abandonment of the land has given rise to the broad expanses of prairie in the sand plains of the eastern part of the county while drainage has been conducive to the development of prairie environment and a prairie flora in the peat and sand-peat areas of the west. In both instances these factors have been followed by fire which has materially assisted in the establishing of the prairie conditions. In event of the elimination of the first two of these factors over the areas in which they operate and the control of the third, it seems evident from a consideration of apparent tendencies in the vegetation just described that the forest flora will reassert itself and again become the dominant flora on large areas now given over to prairie.

Appendix to Bulletin

THE COMING OF THE WHITE MAN TO WHAT IS NOW JUNEAU COUNTY

The onward trek of the white man in his migration westward across the continent first brought him in numbers into what is now Juneau county about 1850. Traders and those seeking fine pine had come somewhat earlier but the actual settlement by those seeking permanent homes started close to the middle of the last century. The county, formerly a part of Adams county, was organized in 1856. Eleven hundred ballots were cast at the first county election.

Indian Treaties

That portion of Juneau county south of the Lemonweir River belonged to the Winnebago Indian tribe, and north of this river to the Menomonee tribe. The Winnebagoes relinquished their claim in 1836 in a treaty signed with the United States government at Fort Winnebago. This part of the county was, therefore, opened to the white man earlier than that portion north which was released by the Menomonee tribe twelve years later in the treaty of Poygan Lake.

First Comers

Mr. John T. Kingston after whom the town of Kingston is named, first visited the county in 1836. His mission was scouting for fine pine timber. He traveled up the Lemonweir to about the present site of Mauston. Mr. Kingston, however, never engaged in the lumber business on the Lemonweir, but in 1848 became one of the first operators on the Yellow River. The first logging camp of Mr. Kingston and his associates was built in the winter of 1848 at a point about twelve miles up the river from Necedah. They built a saw mill where Necedah is now located and sawed their first logs into lumber the next year. At this point in 1851 those same operators built the first steam saw mill in the county to mill the fine pine of the Yellow River Valley.

Others who came early in 1838 and remained were Amasco Wilson, C. B. Smith and R. V. Allen. These men located in the southeastern corner of the county near Rocky Glen through which Highway 12 now passes. Four years later, Mr. Wilson, with a Mr. Armstrong and J. H. Findlay, built the first saw mill where New Lisbon is now located. Five years later Andrew Dunn built a saw mill four miles farther up the river near Lone Rock.

In 1836, a man by the name of La Ronde, established a trading post on the present site of Mauston. Six years later a saw mill was built at this point which became the property of General M. M. Maughs of Galena, Wisconsin, after whom Mauston (first spelled Maughston) was named.

The Early Scouts

Many, who first came as woodsmen or mill workers, returned from time to time to their former homes and reported the possibilities

for farming in the Valley of the Lemonweir and the uplands south, and by 1850 the migration for actual land occupancy superceded the former interest of those who came for timber. Some followed the Baraboo River into the present towns of Wonewoc and Plymouth. Others followed the Indian trails from Baraboo and the county to the southeast. These trails converged into one trail somewhere near the present towns of Lyndon and Seven Mile Creek, then followed a northwesterly course up the Lemonweir. These trails seldom followed the higher rugged country and early pioneers, therefore, experienced many hardships when their covered wagons and oxen became stuck in some of the numerous sloughs.

Migration From Whence

The social unrest throughout the white man's world and the urge to seek new land gave Juneau county settlers who came from a wide territory, ranging from Maine to Illinois. Others came from Scotland, Ireland, England and the continent of Europe. Men came with their families. Others came and established themselves and then returned for their families. Two men from the Baraboo Valley settlement walked 150 miles to Milwaukee, were married there, and then with their wives, walked back to their homesteads. One of three Scotch boys by the name of Trainer, who settled on the Lemonweir, returned to Scotland and brought back his Scotch "lassie" whom he had left behind in coming to America. People came from all walks of life. Captain S. T. Hanson, a navigator on the Great Lakes, decided to try farming and settled near Mauston in the Stewart neighborhood in 1853.

Settlement

Settlement started almost simultaneously in those localities which are now Wonewoc, Plymouth, Lyndon, Kildare, Seven Mile Creek, Lemonweir, Lindina and Lisbon towns. Leadership and community development were obviously more marked in some settlements and these naturally progressed most rapidly. The outstanding early community development in the Lemonweir Valley was east and south of the present site of Mauston. Later came the communities west and north. A relatively early start was also made near New Lisbon in what was known as the Webster neighborhood.

Neighborhoods outstanding in the early fifties were the Stewart and Fossbinder communities between Mauston and Lyndon Station. Seven Mile Creek, Webster, Fowler's Prairie and the Potter settlements were equally outstanding in these early days.

The leaders in these various communities were surely endowed with a zealous fervor common to the early pioneers. A Mrs. Powers is said to have carried her infant child forty miles to have it baptized and then forty miles back to her pioneer cabin. That these early settlers had vision and desire for a better life is also obvious from the fact that in every one of these early communities, schools and churches were at once established, frequently at great sacrifice. For example, Mr. J. T. Hanson relates that when a certain Mr.

Green, who built the first St. Bridget's Catholic Church west of Lyndon Station, found that he lacked a bunch of shingles to complete the job and that there was no more money with which to buy shingles, he traded his new hat for the shingles and finished the job. Later, St. Bridget's Catholic Church was moved to its present site in the town of Seven Mile Creek.

Temperance was also one of the early issues among the new settlers, for the first secret order founded in 1855 was the Sons of Temperance.

The Pioneer Teachers and Preachers

George P. Kenyon was the first person to teach school in New Lisbon while Reverend Knapp was the first preacher in this community. Miss Emily Fowler was the first teacher at Fowler's Prairie School; Miss Lydia Nourse was the first teacher in the Fossbinder Community. As many of the new-comers with strong religious convictions settled in this Fossbinder neighborhood, it soon received the name of "Preachers' Rest." Reverend Wm. C. Armstrong, who came as the first mission preacher, sent out by the Methodist church, preached here, as he did later in the other growing communities. Larmon E. Saxton and Lucinda A. Crawford were the first teachers in the Seven Mile Creek School and the Reverend Father Gardner of Sauk City held the first services in St. Bridget's Catholic Church. The school organized in the Stewart neighborhood was taught during the first year by Miss Emeline Cole.

Early Industries

The lumbering industry has already been mentioned. Its function was wholly destructive as far as natural resources are concerned. A very important industry as far as the self sufficiency of a pioneer country is concerned, is milling. On at least two occasions prior to 1855, a famine in the rapidly growing communities, south of the Lemonweir was barely averted by the heroic trek overland under the most adverse conditions, to the mills at Beaver Dam for flour. By 1855 considerable grain was being produced, and that year, Newell Dustin built and started operating the first grist mill on the site of the present Lemonweir Village. The next grist mill was built on the Baraboo at Elroy in 1860. A brick yard was first opened by Mr. Wm. T. Ellsworth near Mauston in 1854.

Honey, Game and Wild Fruits

The abundance of game, grouse, wild ducks and geese helped greatly in supplying food for the early settlers. Wild honey was also very abundant in the region south of the Lemonweir. A bee hunter by the name of Zach Sheldon is reported to have gathered eight barrels of strained honey in four weeks during the fall of 1850. Cranberries were brought to settlers by the Winnebago Indians. Mr. Kingston reports having purchased great quantities of cranberries from the Indians in 1849. These berries came from the northwestern sand peat plain.

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