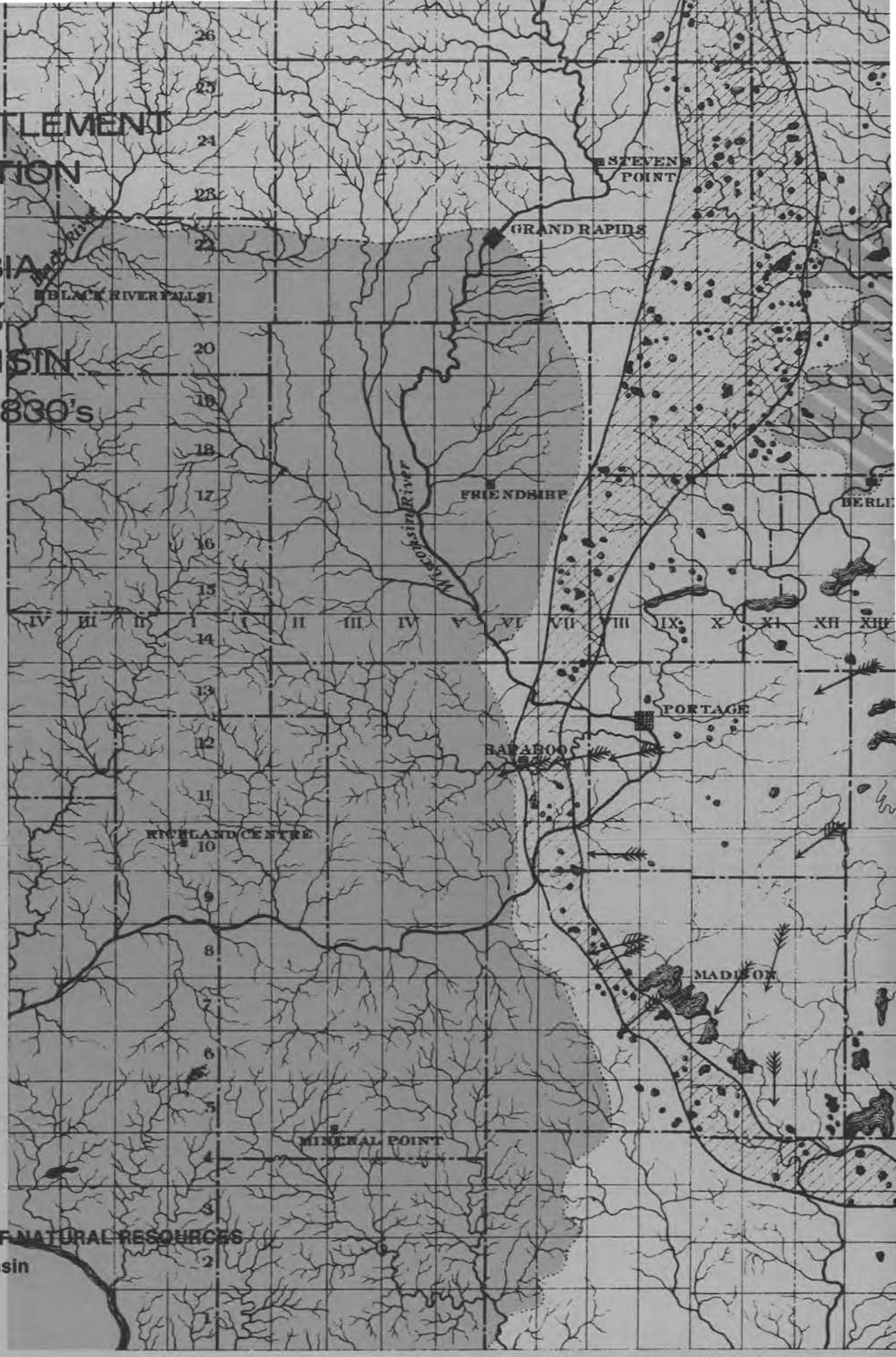
THE PRESETTLEMENT VEGETATION OF COLUMBIA COUNTY, WISCONSIN IN THE 1830's



Technical Bulletin Number 90

DEPARTMENT OF NATURAL RESOURCES
Madison, Wisconsin

1976

COVER: *Map of southcentral Wisconsin including Columbia County, showing the glacial drift and other Quaternary deposits. Plate 25A opposite p. 608 in* Geology of Wisconsin *Vol. 2, 1877.*

PREFACE

In this publication, the presettlement plant community types of Columbia County, Wisconsin, are documented. Their composition, distribution and extent as they existed in the 1830's are described from the data accumulated during the original land survey of the county. Six plant community groups delineated within the county in decreasing order of occurrence are: savanna, prairie, upland oak forest, marsh, floodplain forest, and tamarack swamp. Further analysis of savanna and upland oak forest groups utilizing soils information for the county resulted in the identification of three additional plant community types which occurred over droughty sands: black oak savanna, black oak forest, and xeric sand prairie. A composite map of the 9 plant community types which characterized the presettlement landscape of Columbia County appears on the centerfold of this publication.

The nature and occurrence of the presettlement plant community types in the county are correlated with such factors as glacial history, bedrock geology, topography, soils and the occurrence and frequency of wild fires. Observations of historical importance from the first surveyors, early geologists, pioneers, and explorers regarding the plant communities and the factors pertinent to their creation and maintenance are freely quoted.

Many naturalists have utilized the original land survey records in documenting the nature of the landscape prior to white settlement with its accompanying agriculture, industrialization and urbanization. A summary of publications using the original land survey records to map the presettlement vegetation for the state as a whole, and for counties or regions within Wisconsin is provided.

The original land survey divided the county into townships 6 miles square and further divided each township into 36 sections, each 1 mile square. It was a system to inventory the land as well as permanently locate reference points on the survey grid to facilitate orderly disposal of property. Retrieval of ecological data from the survey records is incidental to their purpose; however, the records do provide an overview of certain features of the landscape. Some plant community types such as fens, cedar glades, low prairie, sedge meadow, and cliffs, although known from the county, could not be delineated from the records. The limitations of the land survey records, including taxonomic problems encountered with oaks, are briefly discussed.

THE PRESETTLEMENT VEGETATION OF COLUMBIA COUNTY, WISCONSIN IN THE 1830's

by
William Tans

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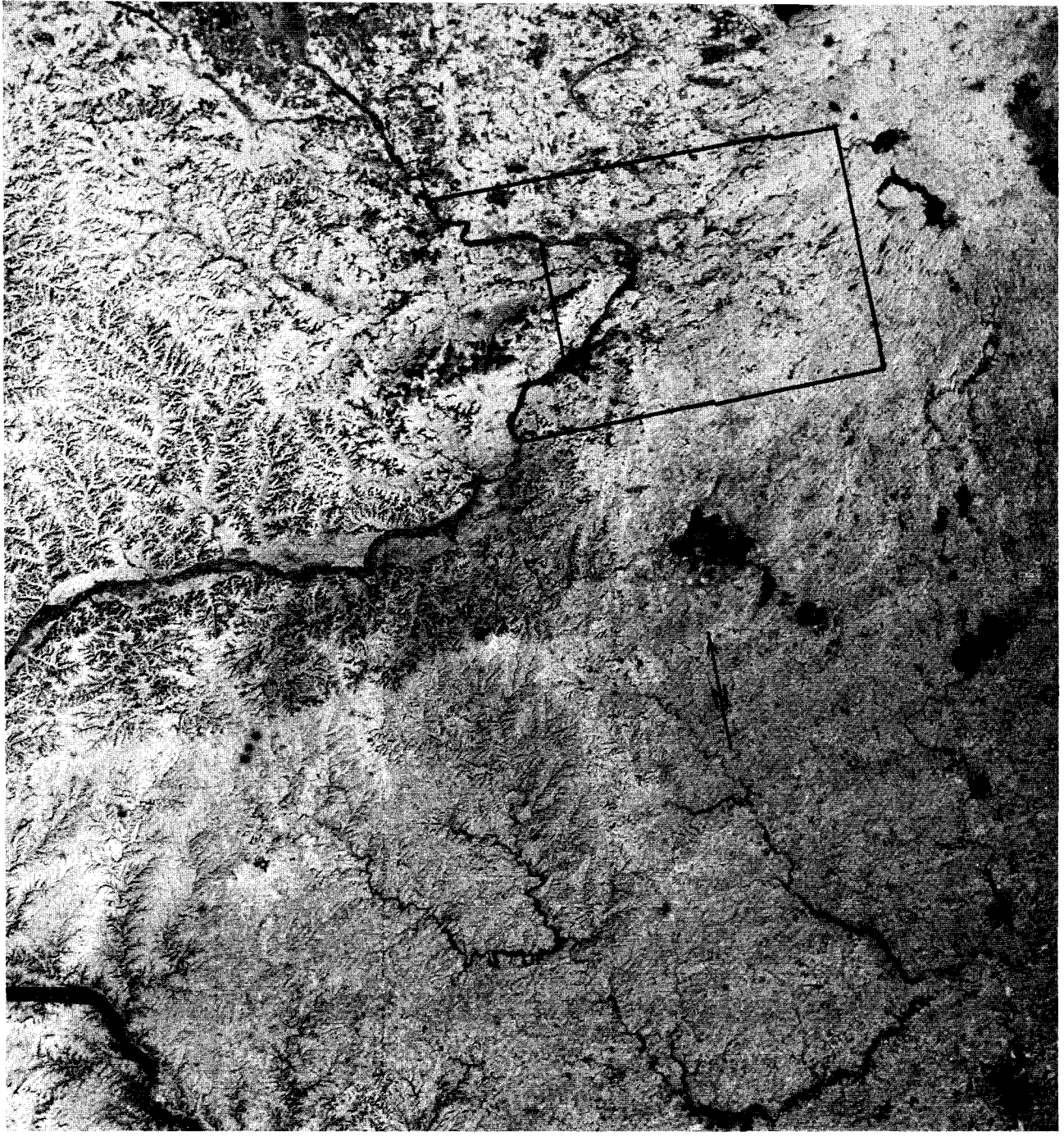


Photo courtesy of the Environmental Monitoring and Data Acquisition Group, Institute for Environmental Studies, University of Wisconsin.

NASA Earth Resources Technology Satellite photograph of Columbia County (outlined) and surrounding region taken 1 January 1973 from an altitude of about 600 miles. The scale is approximately 17 miles per inch. Note the Wisconsin River which flows through the Castle Rock flowage at the upper left, curves eastward around the Baraboo Hills, and then southwestward into the driftless area. The drift covered region is the right half of the photograph; and the well-dissected driftless area and its dendritic drainage lies to the left. A partial snow cover heightens the contrast between wooded and open land, but thins southeastward. The Madison chain of lakes and Lake Koshkonong are visible south of Columbia County; Fox and Beaver Dam Lakes and Horicon Marsh to the east; and Green Lake to the north.

INTRODUCTION

Contemplation of an area in Wisconsin completely unmodified by man may stimulate visions of grass-dominated expanses interrupted with low, spreading oaks — the prairies and savannas which once covered nearly 10 million acres of southwestern Wisconsin — or the magnificent pineries and conifer-hardwood forests of northern Wisconsin which the lumber barons bought and cut by the township. We will never see this awe-inspiring landscape again except through pioneer reminiscences and other historical accounts or by visiting the widely scattered and isolated natural area remnants preserved through the efforts of a few far-sighted individuals. Without these remnants, our link with the botanical past would be nearly severed.

There is one historical source of information — the records of the original land survey crews — that is frequently used by naturalists to look at the botanical past of a particular region. Collected during the 1830's and 1840's in southern Wisconsin, they contain a great deal of ecological information dating prior to all but the earliest of white settlement. For studying the original vegetation of a region, the original land survey records are unequaled in value. They may be used to:

- identify the major presettlement plant community types, their plant species composition and distribution.
- relate the occurrence and distribution of the major presettlement plant community types to the environmental and edaphic factors which influenced their creation and maintenance.
- serve as base data for naturalists who will systematically inventory the natural features of a region. A natural area inventory is the first step in the process of preserving areas which exhibit characteristics of the presettlement vegetation types.
- facilitate comparison of the presettlement plant community types with those of the present to emphasize the degree to which the landscape has been modified following settlement.

Columbia County was chosen as a study site for several reasons. First, the county contains a heterogeneous mixture of plant community types reflecting in part such topographical and geological features as the Baraboo Hills, the Wisconsin River, a prominent escarpment, and a flat drainage divide which forms the boundary between waters ultimately flowing toward the Gulf of Mexico or to the St. Lawrence. Secondly, the majority of data on which this study is based was gathered by the original land surveyors between 1832 and 1834, a time which predated nearly all white settlement and subsequent alteration of the native plant communities. In comparison, the original land surveys for several of the northern counties were not completed until the mid-1860's. Thirdly, the Wisconsin Scientific Areas Preservation Council considers Columbia County a high priority county for a natural area inventory; knowledge of the presettlement plant community types and their distribution would complement such an inventory. Lastly, Columbia County is one of the few remaining counties in southern Wisconsin that has not already been mapped from the original land survey records.

ORIGINAL LAND SURVEY RECORDS* AND VEGETATION MAPS

A number of botanists have utilized the original land survey records to construct presettlement vegetation maps of counties and regions in Wisconsin. County maps have been prepared for Dodge (Neuenschwander 1958), Dane (Ellarson 1949), Eau Claire (Barnes 1974), Jefferson (Zicker 1955, and redrawn in Milfred and Hole 1970), Iowa (Stroessner and Habeck 1966), Racine (Goder 1957), Rock (Moore 1971), Richland (Nee 1969), Sauk (Lange 1973, unpubl.) and Waukesha (Johnson and Schwarzmeier 1973, unpubl.). These additional maps have been prepared but have not been published: Barron County by M.A. Fosberg, Green County by H.C. Green and J.T. Curtis, Kenosha County by H.A. Klahorst, and Vernon and Vilas Counties by J.T. Curtis and N.C. Fassett (Curtis 1959). A map of Milwaukee County prepared by H.A. Klahorst was published by Whitford and Salamun (1954).

Other investigators have consulted the original land survey records for analysis of oak openings in Dane County (Cottam 1949), the vegetation of the Brule River basin (Fassett 1944), the driftless area (Trewartha 1940), and beech forests (Ward 1954). Comparisons of the early vegetation with the present were made by Stearns (1949) for a township in Forest County and Ward (1956) for a township in Rock County. The David Dale Owen maps of southwestern Wisconsin drawn in 1839 show mineral deposits as well as marsh, prairie and forest vegetation types for Grant, Lafayette, and Iowa Counties and parts of Dane, Columbia and Green Counties (Friis 1969).

The presettlement vegetation types of the lower St. Croix region, including St. Croix County and portions of Dunn and Pierce Counties, were mapped by Wooster (1882). Six vegetation types were delineated. Chamberlin (1877) delineated 11 vegetation types for a similar map of eastern Wisconsin including all or parts of 22 counties from Door, Green Lake and Walworth eastward to Lake Michigan. A map showing the extent of the prairies on the main ridges in Grant, Iowa and Lafayette Counties was prepared by Strong (1877), while the larger prairies in the Western Upland geographical province and in southeastern Wisconsin were outlined by Martin (1965). Whether these maps are based on

*Complete records of the original land survey, including township maps, are maintained by the Department of Natural Resources, Division of Trust Lands and Investments, 505 N. Segoe Road, Madison, Wis. 53705. In addition, the original land survey records for some individual counties are maintained at the various county seats.

field experience, the original land survey records, or both is uncertain. The Madison Four Lakes Country (Historic Madison, Inc. 1974) — 12 townships in central Dane County — was redrawn from the original land survey maps of 1832-34.

One of the first vegetation maps of the entire state was prepared by Hoyt (1861). Most of Columbia County was typed with oak opening symbols, but "heavy hardwoods" occurred along the Wisconsin River south of the Baraboo Range. Additional state maps include those of Chamberlin (1882), Finley (1951), Trygg (various dates) and the Wisconsin Geological and Natural History Survey (1965). The latter is a refined map that resulted from the detailed ecological studies of John T. Curtis and his students in Wisconsin. Fuller's (1933) work on the taxonomy and ecology of Wisconsin orchids contains a generalized state map showing 5 vegetation types, and was compiled from the earlier Geological and Natural History Survey maps. Kuchler's (1964) map titled "Potential Natural Vegetation of the Conterminous United States" shows 9 vegetation types for the state.

The data for the original land survey of Columbia County were collected primarily in the early 1830's, although one township was surveyed in 1845 and four were resurveyed in 1851 due to incomplete original surveys. At each section and quarter section corner along the survey lines, i.e., at ½-mile intervals, corner posts were set. In Columbia County, oak posts were most frequently set, but when oak was not available, the surveyors cut posts of maple, ironwood, tamarack, hickory, ash and cherry. From each post, surveyors measured the distance* and angle to the two closest trees in different quadrants, blazed the trees to facilitate relocation, and recorded the tree species and diameter. In addition, line trees — those intersected by survey lines — were recorded by species and diameter. Springs, ponds, streams, prairies, marshes, bottoms and other features encountered along the survey lines were recorded, and after each mile and township, the Deputy Surveyor completed a brief summary of the land surveyed.

Evidence of the fraud in the original land survey records has been found (Bourdo 1956, and Nee, pers. comm.), but there is no evidence indicating fraud in the data for Columbia County. It is assumed that these data are within the accepted limits of accuracy and remain as a valuable source for early Wisconsin ecological data. Bourdo (1956) discussed survey techniques in detail and analyzed accuracy and bias in the original land survey records.

COLUMBIA COUNTY - LOCATION, GEOLOGY AND TOPOGRAPHY

Columbia County lies in south central Wisconsin (Fig. 1) south of the tension zone which separates the Northern Hardwoods floristic province to the northeast from the Prairie-Forest province to the southwest (Curtis and McIntosh 1951). In area it encompasses approximately 780 square miles including some 498,000 land acres (Poff and Threinen 1965). An additional 9,000 acres were inundated following the creation of Lake Wisconsin on the Wisconsin River; thus presettlement Columbia County encompassed about 507,000 acres.

The surface features have been influenced primarily by glaciation and subsequent erosion. The county is covered with a mantle of glacial deposits which were laid down by a series of glacial advances, the last of which was the Green Bay Lobe of the Cary Ice Sheet. The thickness of the glacial deposits is generally less than 100 feet except in areas of marginal moraine deposits in the far northwest (T13N R7E) and southwest (T10N R7E) corners of the county (Chamberlin 1877), and outwash areas located along the Wisconsin River and at the north central border of the county (Fig. 2). There the glacial deposits vary between 100 and 300 feet in depth (Borman 1971).

Beneath the glacial till in the east and southeast portions of Columbia County lies the Prairie du Chien dolomite, while most of the remainder of the county, except for the Baraboo Hills, is underlain by the softer Upper Cambrian sandstone. Although the surface features of the areas underlain by sandstone and dolomite do not differ greatly, this was the basis on which Martin (1965) divided the county into two geological provinces, the Central Sand Plain and the Eastern Ridges and Lowlands. The boundary of the two provinces is the Prairie du Chien dolomite escarpment trending from southwest to northeast at elevations primarily between 1,000 and 1,150 feet. A number of outliers, most of which are capped with the resistant Prairie du Chien dolomite, are separated from the escarpment by differential erosion and lie within 4 miles of the escarpment. Gibraltar Rock, T10N R8E, the highest of these outliers, is capped with St. Peter sandstone (Finley 1975).

The Central Plain Province includes most of the northwest diagonal half of the county northwest of the Prairie du Chien dolomite escarpment. When it was stripped of its overlying dolomite, it offered little resistance to the glaciers (Poff and Threinen 1965). Except for the Baraboo Hills and the outliers, the elevations of this region vary between 200 and 350 feet lower than the escarpment ridge, and the topography is gently rolling with few hills rising more than 100 feet in height (Wis. Dep. Agric. 1954). A drained glacial lake basin with its characteristically broad and flat expanse occupies most of the five townships in the northwest corner of the county (Col. Co. Plan. Dep. 1970).

That the bedrock geology has been an important determinant of the local relief in the county is exemplified by the Baraboo Hills, which are a dominant feature of the landscape and rise to an elevation of over 1,450 ft at the west edge of the county. Composed of quartzite and quartzite conglomerate of Precambrian age (Dott 1970), the Baraboo Hills extend west 25 miles from the Wisconsin River.

Part of the western boundary of Columbia County is formed by the Wisconsin River, which enters the county in its northwest corner at the city of Wisconsin Dells and exits from its southwest corner at the city of Prairie du Sac. During glaciation the river was blocked and diverted from its preglacial channel through

*Surveyors measured distances in units of chains (66 ft) and links (.66 ft or 7.92 inches); 80 chains = 1 mile. Survey posts were set at the 40 and 80 chain points on the 4 sides of each section.

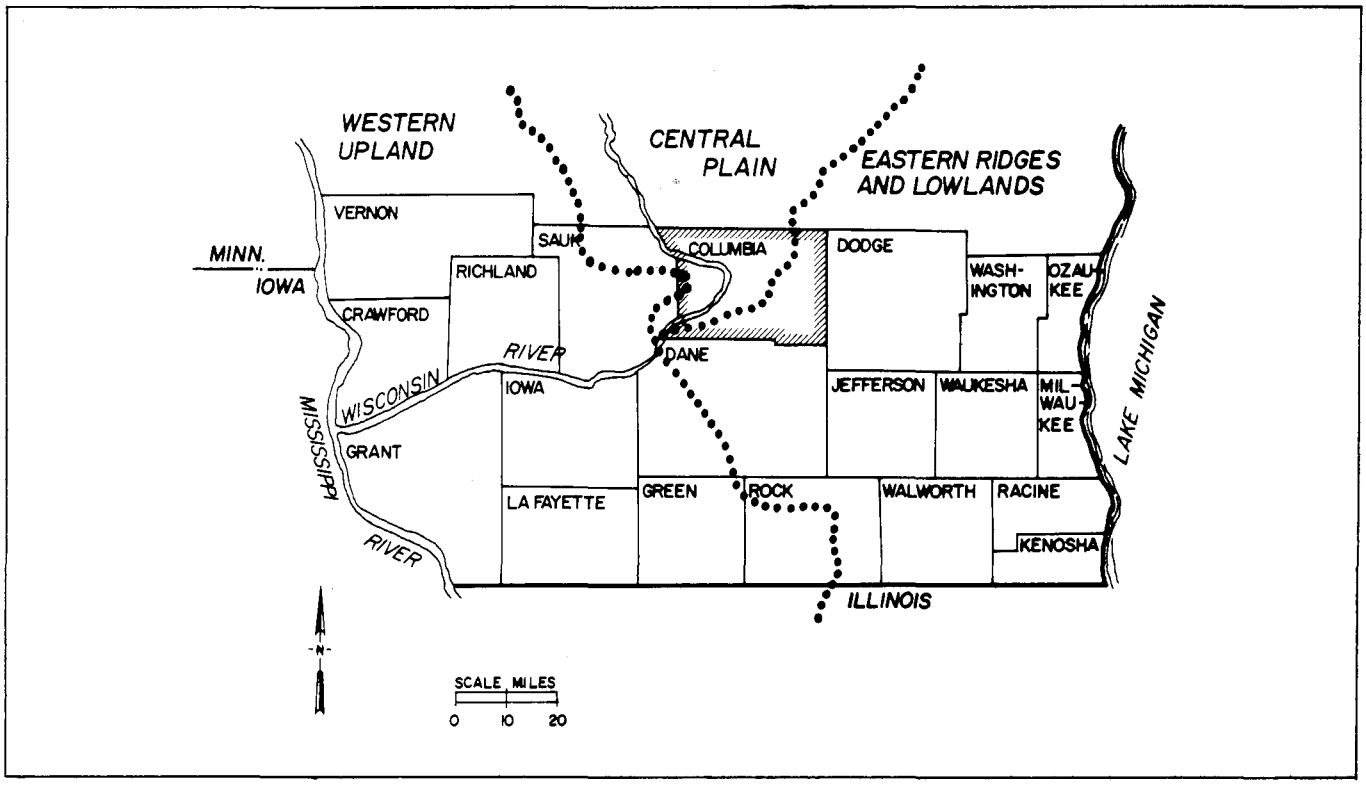


FIGURE 1. *The location of Columbia County in south central Wisconsin in relation to the Western Upland, Central Plain, and Eastern Ridges and Lowlands Geographical Provinces. Geographical Provinces follow Martin (1965).*

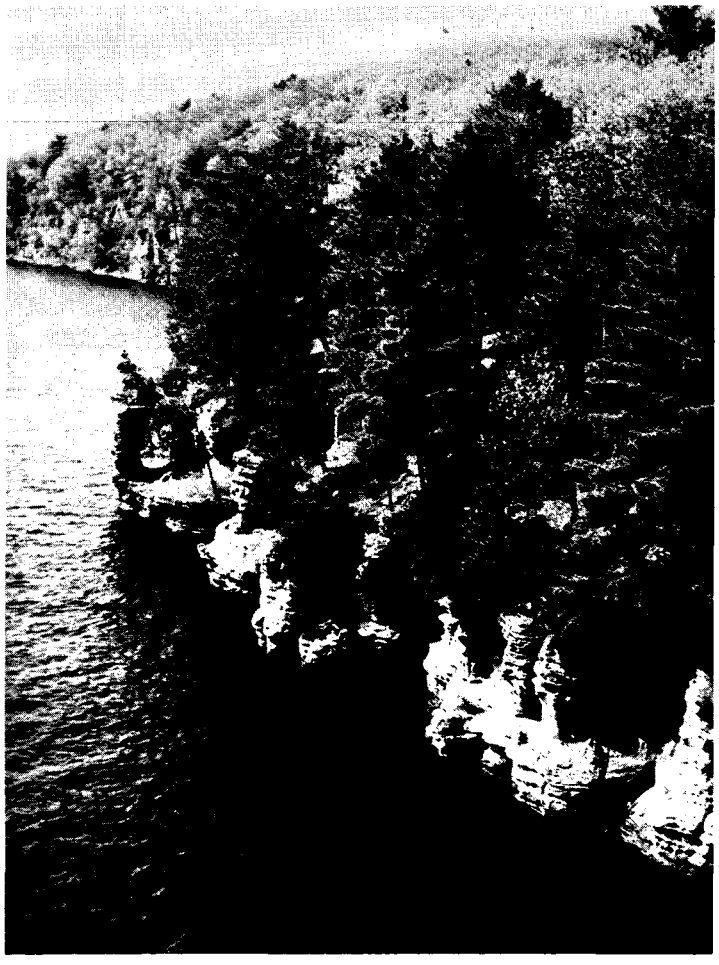


Photo by William Tans.

Cambrian sandstone cliffs in northwestern Columbia County at the dalles of the Wisconsin River.

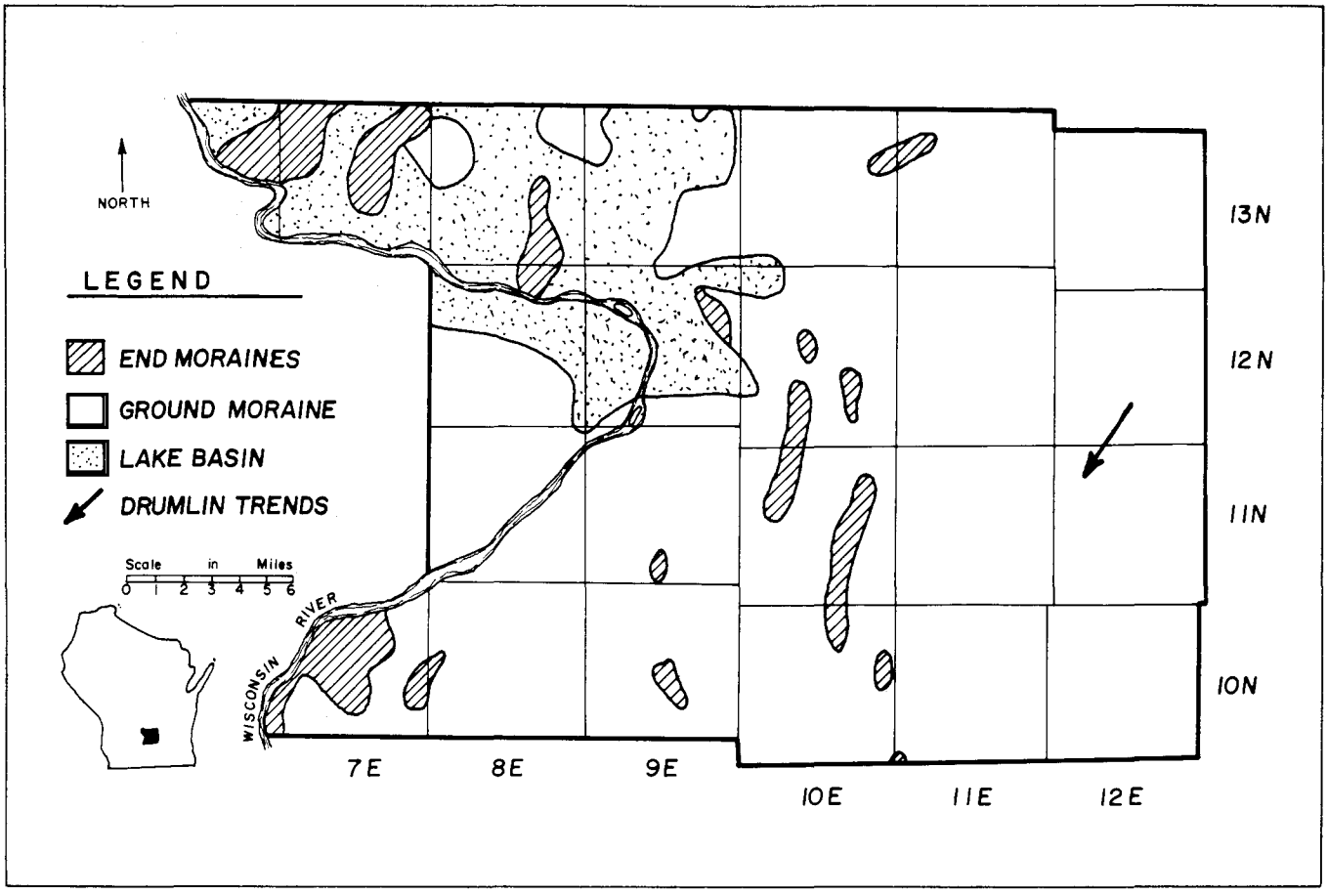
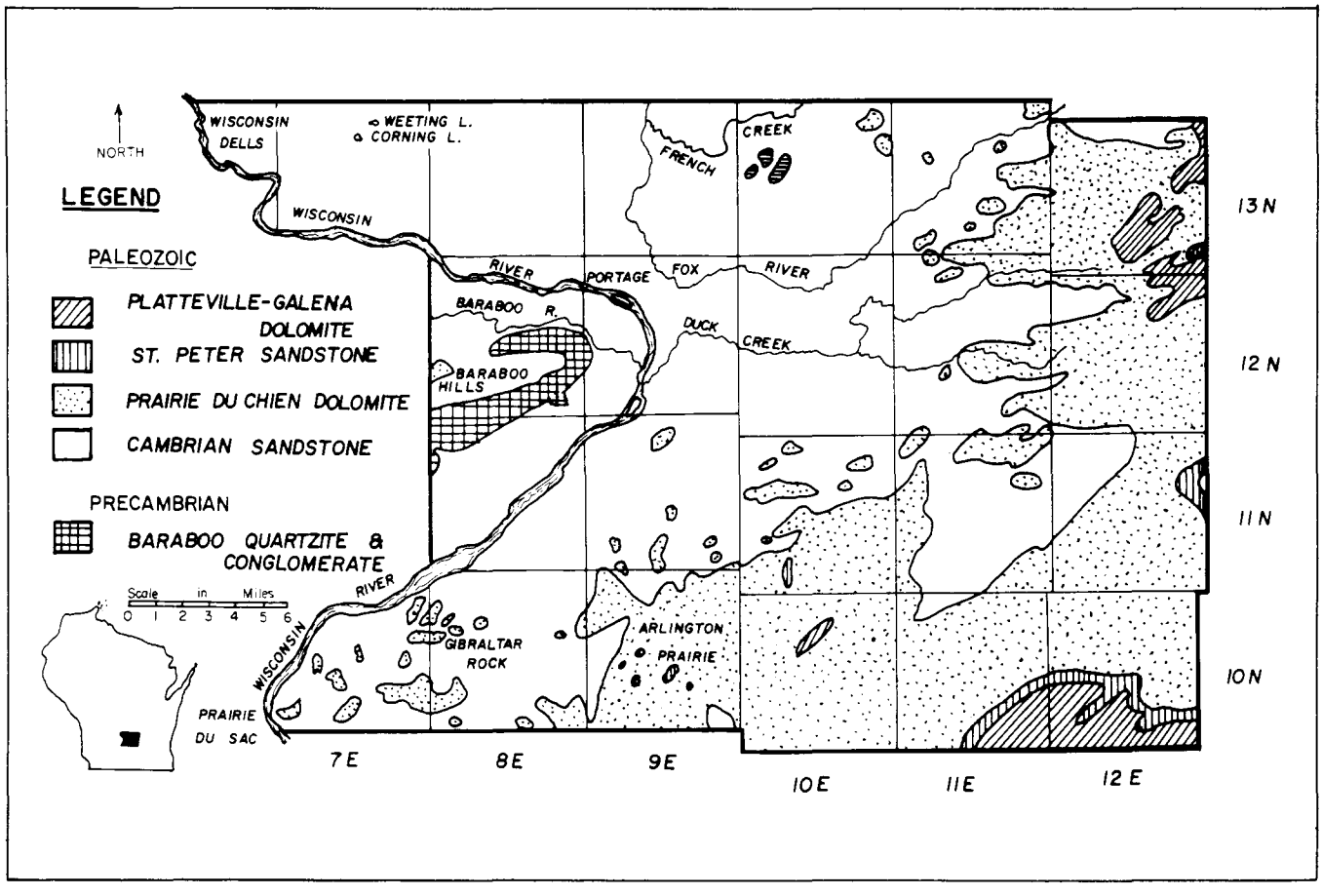


FIGURE 2. *The glacial deposits of Columbia County. (From Columbia County Planning Department 1970.)*

FIGURE 3. *The bedrock geology of Columbia County with some of the place names and features mentioned in the text. (From Columbia County Planning Department 1970.)*



the Baraboo Hills to its present location around the east flank of the Baraboo Hills (Alden 1918). Figure 3 shows the bedrock geology of Columbia County, the major watercourses and place names of some features mentioned in the text.

METHODS

From the original land survey field books on file at the Division of Trust Lands and Investments the surveyors' notes from all of the interior (within each township) and exterior (around each township) lines of each township in Columbia County were examined. The species and size of each bearing tree, the species and size of each line tree, and the distance from tree to survey post were transposed to blank township outline forms. The edges of prairies, marshes, watercourses, timbered areas and other features identified by the surveyors as well as pertinent notes from each mile and township summary were recorded. Data were located on the corresponding section and quarter section corners on the township outline form to facilitate mapping. As data from the original survey records were transposed, each section and quarter section point was coded according to the nature of the plant community.

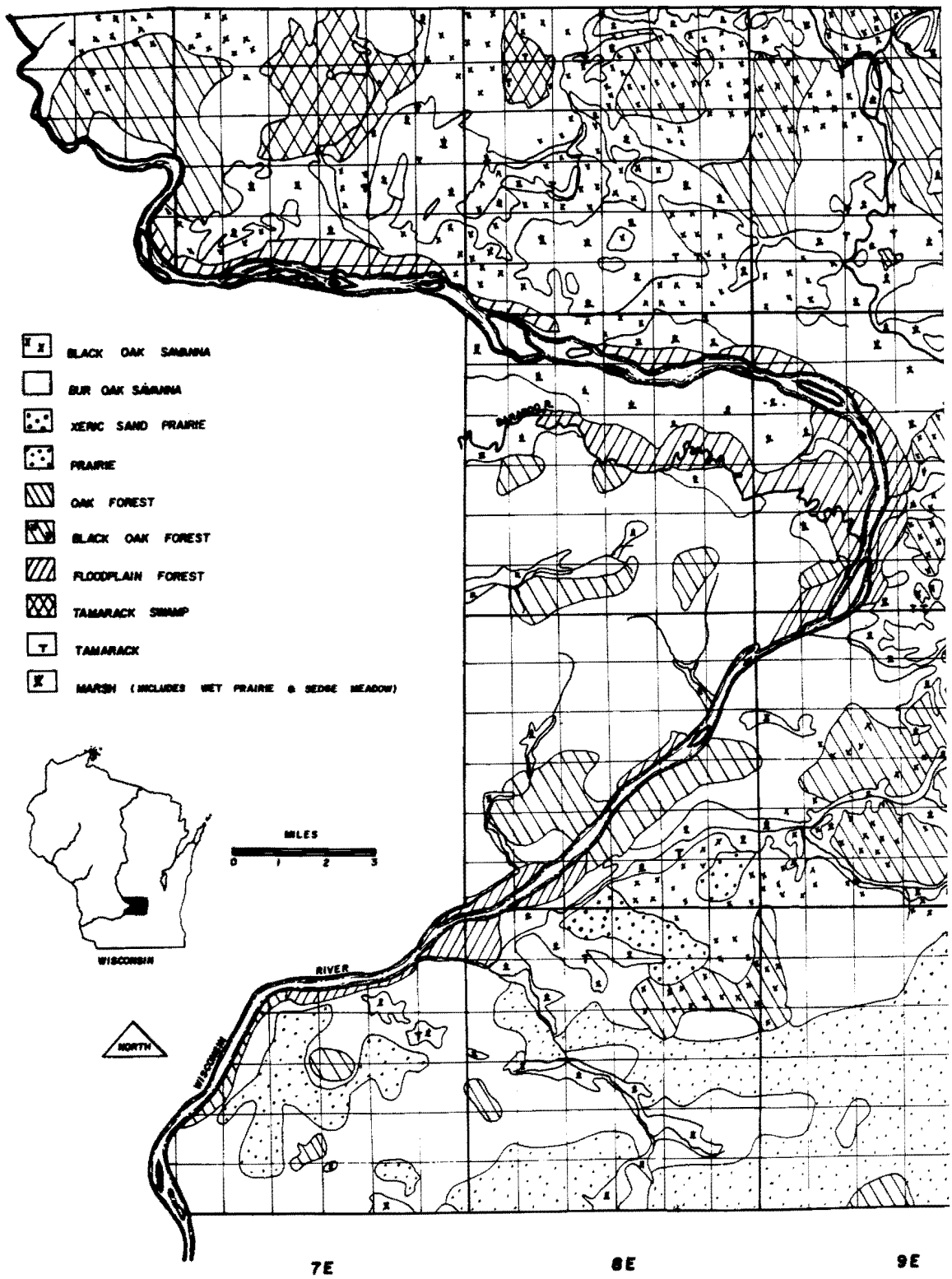
The determinants of the plant community types for the purpose of coding each section and quarter section point were: the dominant tree species, if any, at the point, characteristics of the landscape from the surveyors' comments, and density of tree canopy as indicated by the distance from surveyor post to tree. In a study designed to see whether reliable quantitative data on plant communities could be obtained from the survey records, Cottam and Curtis (1956) found that the mean of the two distances in links from survey post to tree corresponds well to the mean distance between trees in a natural situation. Thus, density can be calculated by squaring the mean distance, then dividing the resultant area occupied by each tree into a unit area (e.g., 43,560 ft^2 to calculate trees per acre) to obtain trees per unit area.

The major groupings of plant community types in the presettlement landscape were: savanna, prairie, upland oak forest, floodplain forest, tamarack swamp and marsh. Following the delineation of these groups, a more critical analysis of savanna and upland oak forests was made on the basis of soil types. A new set of data was collected from the coded township maps at points where upland oak forest and savanna occurred. Data were organized according to major soil group, i.e., droughty sands, sandy loam, and silt loams for comparative purposes. All of the section and quarter section points in the county where the droughty soil types occurred were sampled, giving a total of 487 trees; a sample of 332 trees was obtained from points lying over Miami fine sandy loam, which is the most extensive soil type in the county occupying one-fifth of the total area (Whitson et al. 1916); and 291 trees from points over Miami silt loam (deep phase) in the southwest and southeast corners of the county provided the third sample.

The completed township maps coded to identify the major vegetation types, together with the surveyors' maps, U.S. Geological Survey topographic maps and the county soils map were utilized in the preparation of the composite county map of the presettlement vegetation (Fig. 4).

The extent of each plant community type was calculated by dividing the number of section and quarter section points where each community type was found into the total number of points. The resultant percentage of plant community type and derived acreages must be regarded as approximations due to the location of sample points at half mile intervals and because the generalized nature of data collection was for survey purposes and not for cover typing.

Nomenclature is consistent with *Gray's Manual of Botany*, eighth edition (Fernald 1950).



PRESETTLEMENT VEGETATION OF COLUMBIA COUNTY, WISCONSIN

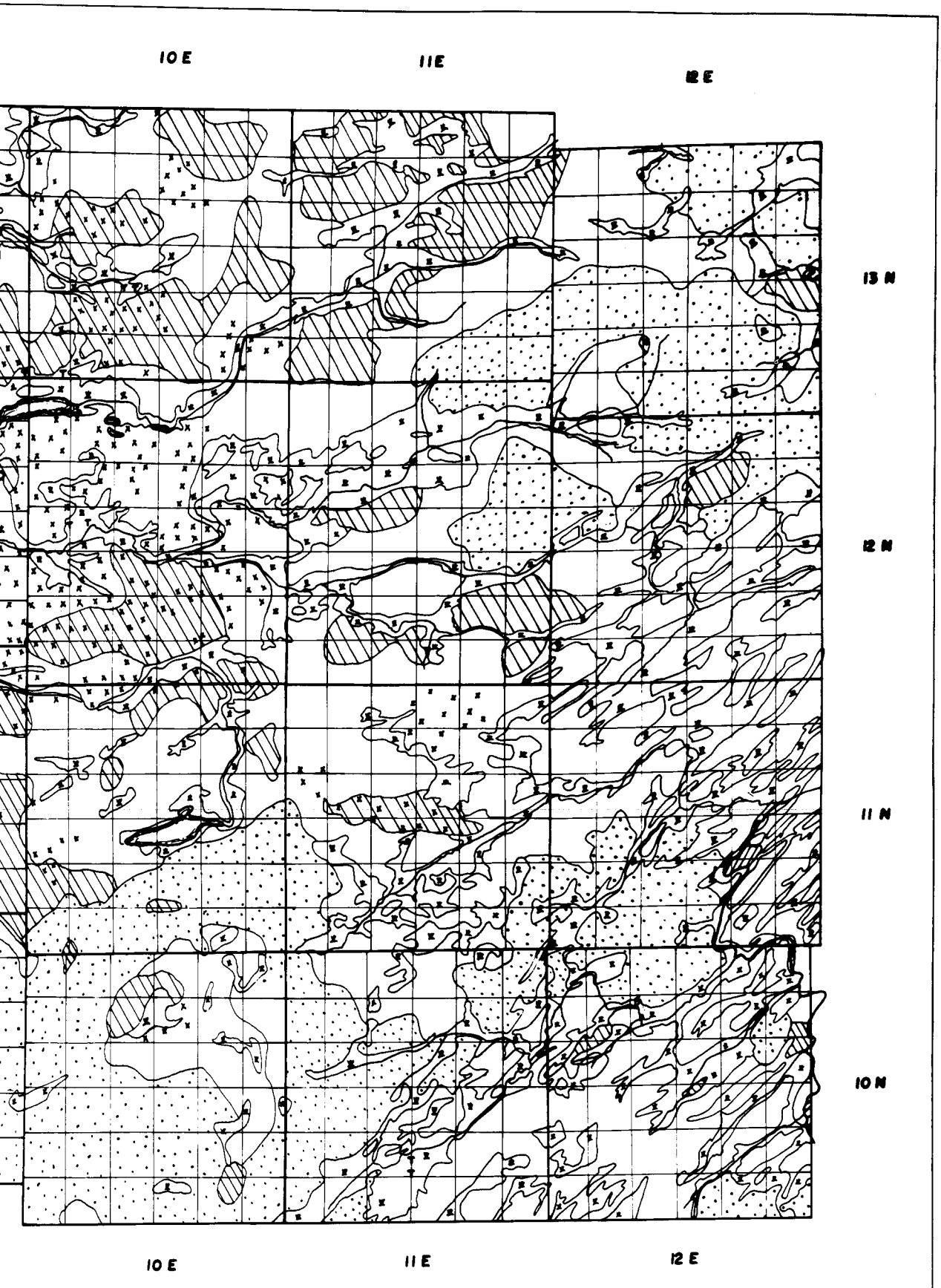


FIGURE 4. *The presettlement vegetation of Columbia County, Wisconsin, in the 1830's.*

RESULTS AND DISCUSSION

Nine plant community types were identified as comprising the presettlement vegetation of Columbia County in the 1830's. The community types with percent of county coverage and approximate acreage are shown in Table 1. The size class distribution of the 4,785 line and bearing trees recorded for the county during the original survey shows that the median size tree was in the 12-inch size class (Fig. 5). Nearly 86 percent of those trees were estimated to the nearest even-inch size class, and certain size classes, especially 24, 30 and 36 inches, were favored when large tree size was estimated.

Table 2 lists the 19 tree species intersected by the interior and exterior survey lines for the county. The common names are those given by the surveyors in identifying the trees. Nearly 92 percent of the line trees were identified as oaks, indicating (1) a landscape dominated by the five species of upland oaks, and (2) a probable bias toward the selection of oaks as bearing trees because of their longevity. If all trees had been selected as bearing trees with a frequency equivalent to their relative number in the presettlement landscape, then such species as ash, basswood, hickory and black cherry, in particular, should have been selected more frequently. These are upland forest trees, and 1 of 5 acres of presettlement Columbia was typed as upland oak forest, yet these 4 species comprised only 2.7 percent of the trees intersected by the survey lines.

The influence of soils on the tree species composition of savannas and upland oak forests was found to be significant. Both savannas and upland oak forests on droughty soils differed from comparable savannas and forests on sandy loam or silt loam soils (Table 3). **Black oak savannas** and **black oak forests**, named to reflect the dominant tree(s) as identified by the surveyors, occurred on droughty, sandy soils; **bur oak savannas** and **oak forests** both occurred on sandy loam and silt loam soils. A third plant community type, **xeric sand prairie**, was delineated on the basis of its soil type and topography, both different from those of the major expanse of prairie in the county.

SAVANNA

Savannas were upland sites delineated by section and quarter section points where the mean distance between survey post and tree was 209-50 links, which corresponds to a range in density of 1-17.4 trees per acre. Curtis (1959) used a density of at least 1 tree per acre but not more than 50-percent canopy coverage in defining savannas. Recently Anderson and Anderson (1975) calculated that a 50-percent canopy cover in savannas was the equivalent of 19 trees per acre.

TABLE 1. *The presettlement plant community types in Columbia County.*

Community Type	Percent of County	Approx. Area Acres	Approx. Area Hectares
Savanna	34	172,400	69,800
Bur oak savanna	(24.1)	(122,200)	(49,500)
Black oak savanna	(9.9)	(50,200)	(20,300)
Prairie	23.1	116,900	47,300
Xeric sand prairie	.4	2,200	900
Upland oak forest	20	101,400	41,000
Oak forest	(13.1)	(66,400)	(26,900)
Black oak forest	(6.9)	(35,000)	(14,100)
Marsh	18.3	92,800	37,600
Floodplain forest	2.6	13,200	5,300
Tamarack swamp	1.6	8,100	3,300
Total	100	507,000	205,200

The oak savanna or oak opening community was the most abundant plant community type in presettlement Columbia County, occupying approximately 34 percent of the county or some 172,400 acres. The mean distance from survey post to tree was 82 links, the equivalent density of 6.5 trees per acre (Fig. 6). Median tree size in the savannas was 12 inches in diameter.

Cottam (1949) described an oak opening as "...a plant community consisting of an overstory of broad-crowned, widely scattered trees with a ground cover consisting largely of prairie grasses." The surveyors characterized savannas with such terms as "thinly timbered" and "scattering" to describe timber density. A summary by Henry Howell in 1851 in the original land survey records described the west half of T13N R9E as "...much of this township is oak openings — the timber of quite thrifty growth of none or little use." Thickets of aspen, hazel, grape vines, briars and scrub oak attest to areas recovering from recent fires. Redroot (*Ceanothus*), rosinweed (*Silphium*) and grasses were frequently mentioned as associate plant species.

Some of the early accounts of the oak savannas in Columbia County distinguished between the black oak openings found on droughty soils and the bur oak openings on heavier soils. Haskell (1871) described them as follows:

> "The remainder of the county, comprising the greater part, is covered with oak openings. The surface of the bur oak openings is rolling and undulating, and differs from the prairies in no respect except that the soil of the latter seems a little more loose and friable. In other oak openings the soil is poorer; the white oak being generally clayey, and the red and black oak inclined to sand."

Previously, Hoyt (1861) made the same distinction and elaborated on the esthetic appeal of the oak openings:

"They are of two kinds — the Bur Oak and Black Oak [savannas]. The Black Oak Openings belong to the sandy regions, and are not marked by any considerable agricultural capacity. The Bur Oak Openings, however, are among the most productive portions of the State.... They are, moreover, the most beautiful portions of the varied and picturesque surface of the country. Grouped here and there, like so many old orchards, on the summit of a gentle swell of land, or on the border of a marsh, prairie or lake, there is nothing in the whole catalogue of American sylva that equals these Bur Oaks for the charming, homestead-like expression they give to the landscape."

Black oak savannas and bur oak savannas were differentiated in Columbia County on the basis of soil type and dominant tree species. Black oak savannas occurred almost exclusively in the Central Plain Province of Columbia County — the northwest diagonal half — on droughty soils of sand and fine sand. Twenty-nine percent of the oak savanna was of this type, which covered 50,200 acres.

Five soil types which delineated the occurrence of black oak savannas were Miami fine sand, Coloma fine sand, Plainfield fine sand, Plainfield sand, and Fox fine sand. Black oak savannas consisted of 56.9 percent black oak, 21.4 percent white oak and 19.8 percent bur oak (Table 3). Curtis (1959) defined a similar plant community as oak barrens... "savannas which have black and Hill's oak as their most prominent tree and in which jack pine is absent." The surveyors did not differentiate Hill's oak (*Quercus ellipsoidalis* E.J. Hill) from black oak (*Q. velutina* Lam.), which have close ecological tolerances and occur in the county; thus they would have identified both as black oak.

Black oak as determined by the surveyors was present in higher than expected frequencies on sandy loam and silt loam soils across the county as well as on the eastern tip of the Baraboo Hills. The soils there are well- and moderately well-drained loamy soils developed over glacial till and quartzite. The identification of these trees as black oak is questionable, and it is likely that most of them are red oak (*Q. rubra* L.) instead. Red oak is one of the dominant forest trees today in the Baraboo Hills, and it usually occurs in more mesic situations than either black oak or Hill's oak.

Bur oak savannas, dominated by bur oak with 63-65 percent of the

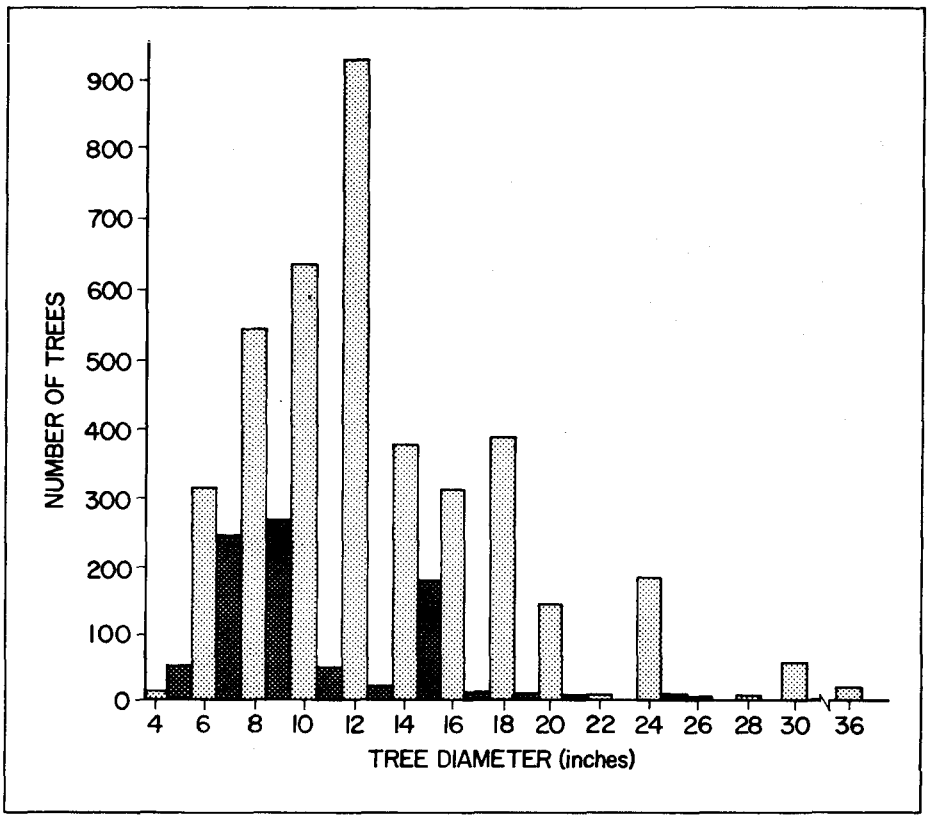


FIGURE 5. *Size class distribution of 4,875 line and bearing trees from the original land survey of Columbia County. Size classes were estimated by the surveyors.*

TABLE 2. *Trees intersected by the interior and exterior survey lines during the original land survey of Columbia County. Common names are those given by the surveyors.*

Common Name	Scientific Name	Number of Trees	Percent of Total
Black Oak	*Quercus velutina* Lam., *Q. ellipsoidalis* E. J. Hill, or *Q. rubra* L.	342	36.7
Bur Oak	*Quercus macrocarpa* Michx.	283	30.3
White Oak	*Quercus alba* L.	230	24.7
Tamarack	*Larix laricina* (DuRoi) K. Koch	23	2.5
Hickory	*Carya ovata* (Mill.) K. Koch	12	1.3
Aspen	*Populus* spp.	10	1.1
White Ash	*Fraxinus americana* L.	6	.7
Basswood	*Tilia americana* L.	5	.5
Elm	*Ulmus* spp.	5	.5
Yellow Oak	*Quercus* spp.	4	.4
Maple	*Acer* spp.	2	.2
Pine	*Pinus* spp.	2	.2
Cherry	*Prunus serotina* Ehrh.	2	.2
Swamp White Oak	*Quercus bicolor* Willd.	2	.2
Birch	*Betula* spp.	1	.1
Butternut	*Juglans cinerea* L.	1	.1
Black Ash	*Fraxinus nigra* Marsh.	1	.1
Willow	*Salix* spp.	1	.1
Hackberry	*Celtis occidentalis* L.	1	.1
Total		933	100

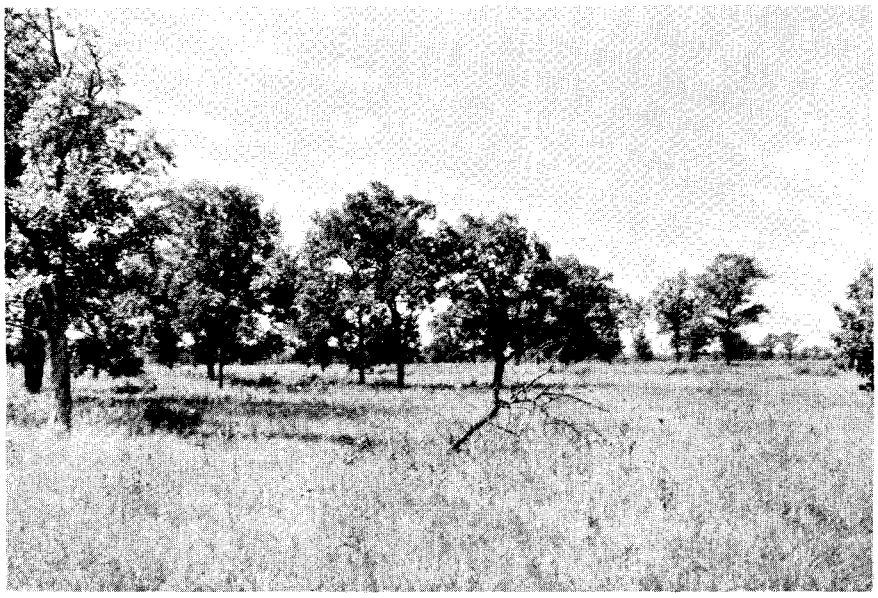


Photo by Clifford E. Germain

A contemporary savanna in southern Wisconsin, showing scattered broad-crowned trees and a ground cover primarily of prairie grasses. In presettlement Columbia County, savanna was the predominant cover type occupying approximately 172,400 acres.

TABLE 3. *Tree species composition of savanna and upland oak forest communities on three soil groups.*

SAVANNA	Number of Trees	Percent of Total	UPLAND OAK FOREST	Number of Trees	Percent of Total
DROUGHTY SOILS					
Black Oak Savanna			**Black Oak Forest**		
Black oak	178	56.9		99	56.9
Bur oak	62	19.8		38	21.8
White oak	67	21.4		34	19.5
Other	6	1.9		3	1.7
	313	100.0		174	100.0
MIAMI FINE SANDY LOAM					
Bur Oak Savanna			**Oak Forest**		
Black oak	34	17.1		27	20.3
Bur oak	131	65.8		68	51.1
White oak	34	17.1		36	27.1
Other	0	0		2	1.5
	199	100.0		133	100.0
MIAMI SILT LOAM (including deep phase)					
Bur Oak Savanna			**Oak Forest**		
Black oak	41	17.1		12	23.1
Bur oak	151	63.2		31	59.6
White oak	47	19.7		7	13.5
Other	0	0		2	3.8
	239	100.0		52	100.0
Median tree size - - 12 inches diameter			Median tree size - - 10 inches diameter		

trees in the community, were widely spread across Columbia County. Nearly one-quarter (122,200 acres) of the presettlement landscape was bur oak savanna developed over sandy loam and silt loam soils. Black and white oaks each maintained 17-19 percent of the trees in the canopy, far below the percentage occurrence of bur oak.

It is paradoxical that the most widespread plant community type of the 1830's in Columbia County is the rarest of types in the present landscape. The conversion of savannas for agricultural purposes does not fully explain their demise, but with the cessation of wild fires, which maintained the savannas, they have vanished from the landscape. Savannas rapidly reverted to closed oak forests in the absence of fires.

PRAIRIE

Prairies were defined by upland section and quarter section points (1) without trees, (2) where one distance was greater than 300 links, or (3) where the mean distance was greater than 209 links. Criterion 2 includes those points within the prairie which by chance were located close to a tree; criterion 3 includes those points where the tree density was less than one tree per acre. Approximately 23.1% of the county, or 116,900 acres, was prairie.

The major expanse of prairie in presettlement Columbia County was found along the escarpment ridge of the Prairie du Chien dolomite in the Eastern Ridges and Lowlands Province. Its lofty, streamless expanse forms the drainage divide between the Rock and Wisconsin River watersheds. The soils developed beneath the prairie sod were Carrington silt loam and, in part, Miami silt loam (deep phase), rich soils up to 4 and even 6 ft deep over glacial deposits (Whitson et al. 1916). This extensive prairie belt across the county was such a prominent part of the landscape that the early settlers named the prairies. In the northeast part of the county were the Welsh and Portage Prairies; along the south central edge of the county and continuing into Dane County was the Empire Prairie; and in the southeast portion of the county, the Fountain Prairie (Haskell 1871).

In describing their beauty and

richness Haskell (1871) wrote:

> "All these prairies are fringed, deeply indented and sometimes dotted with beautiful groves of timber and oak openings, and are, without exception, beautifully rolling, of a rich, deep, friable, black, and exceedingly fertile soil."

A second type of prairie, xeric sand prairie, occupied about 2,200 acres in the southwest portion of the county just east of the Wisconsin River, T10-11N R8E. It was a treeless, upland area formed over Miami fine sand and Plainfield fine sand, two droughty soils. The xeric sand prairie was similar to Curtis' (1959) sand barrens type. Irving (1877), a geologist, made the distinction between the flat, sand prairie found near the Wisconsin River and the larger expanse of upland prairie on the escarpment:

> "Very large areas in Adams County, for instance, which are now covered with a thick growth of small oaks, are said to have been prairies at the time of the first settlements. The prairies are by no means always flat; indeed the flat prairies are the exception, and have chiefly been noticed along the bottom land of the Wisconsin River. The ordinary prairie, however, as in northern Dane and eastern Columbia County, is very rolling...."

Identification of the type of prairie, whether low, mesic or dry, was not uniformly practiced by the surveyors, thus the prairie mapped for the county consists of upland prairie of the dry to mesic segments plus xeric sand prairie. That low prairie did occur in the presettlement landscape is shown by the persistence of two remnant low prairies, one along French Creek northeast of Portage (T13N R9E), the other south of the Wisconsin River (T12N R8E) on a moist river terrace. Whereas low prairies blended visually into the sedge meadows and were difficult to distinguish, upland prairies were easily separated from the adjacent savannas and forests, thus they were duly mapped by the surveyors. Low prairies and sedge meadows are included with the marsh type on the county vegetation map.

Upon entering the prairie, the surveyors were without corner posts and bearing trees which they used to mark section and quarter section corners. In order to mark the survey points, they constructed a mound of earth as explained in James Mullett's entry when he surveyed the Empire (Arlington) Prairie in 1834: "Set post common to sections 29, 30, 31 and 32. In prairie, made mound of earth and sod 2½ feet high and 4 feet square at base...."

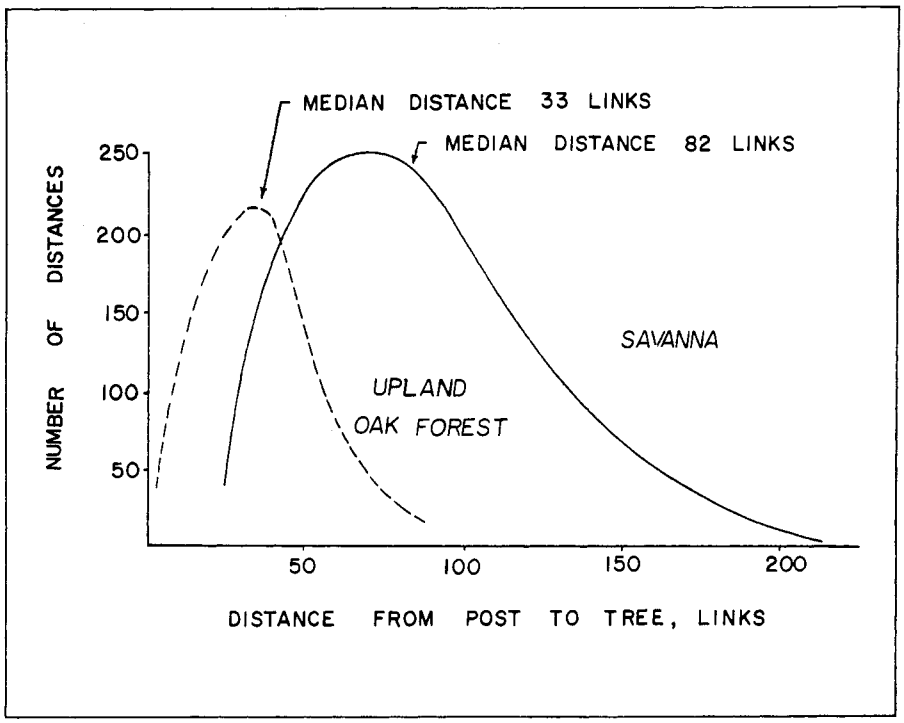


FIGURE 6. *Distance between survey post and tree for points in upland oak forest and savannas.*

One of the early descriptive accounts of prairie in Columbia County was by Ruggles (1836), a geologist who commented on the nature of prairies, their appearance and the role of fire in maintaining them:

> "Among the elevations of this county, we often meet with extensive prairies. The origin of prairies is doubtless attributable to the extensive fires which scour the whole country when vegetable matter becomes dry.
>
> "In some instances, prairies are found stretching for miles around, without a tree or shrub, so level as scarcely to present a single undulation, in others, those called 'rolling prairies', appears in undulation upon undulation, as far as the eye can reach, presenting a view of particular sublimity, especially to the beholder for the first time. It seems when in verdure, a real troubled ocean, wave after wave, rolls before you, ever varying, ever swelling."

Before the prairie sod was broken, the open prairies were an inhospitable and often dangerous place for early travelers and settlers. There were no streams for water or wood for shelter or fuel, and wild fires were possible during any dry season. The following account is of the Empire Prairie in the early 1850's:

> "Early in the spring of this year I witnessed some of the largest prairie fires I had ever seen. The greater portion of the prairie, south of where I lived...was burned over and as there was no stock kept on this prairie at this time and the land being very rich, the grass grew very rank and heavy, and when dry in the spring, it required but the touch of a lighted match, or in some instances the burning ashes from a smoker's pipe to ignite it.
>
> "It was a tiresome, dreary journey, when performed on foot, to travel over this prairie in those days. Not even a drop of water was to be found except at a small pond, called the goose pond, near the center or about half the distance across, and as this water was surface or seep water, it was unfit to use only by cattle or horses. A fire on this prairie, however, at that time was one of the most magnificent sights I ever witnessed." (Jones 1914.)

To some, the prairie was a place of beauty, with its treeless expanse and luxuriant growth. Merrill (1834) noted this and observed the interspersion of oak openings within the prairie in his pioneer reminiscences: "We struck the prairie which to me was a beautiful sight. Here we could see a grass plot for four or five miles, and not a tree or bush on it. Then again as we passed on, we could see orchards, as it were, the grass up to our horses' mouths so that they could nip at it as we rode upon the jump."

To Mrs. Kinzie (1901) the prairie was seemingly a lifeless, barren expanse likened to a desert, both an awesome and foreboding place. In 1831 she traveled northwesterly across Leeds Township, T10N R10E, from Sun Prairie (Dane County) and commented:

"...we entered upon what was known as the 'Twenty Mile Prairie' — and I may be permitted to observe that the miles are wonderfully long on the prairies. Our passage over this, was, except the absence of sand, like crossing the desert. Mile after mile of unbroken expanse — not a tree — not a living object except ourselves.

"Thus we went on, one little knoll rising beyond another, from the summit of each of which in succession, we hoped to descry the distant woods, which were to us the promised land."

UPLAND OAK FOREST

Upland Oak Forests were delineated at upland sites dominated by oaks where the mean distance between the survey post and tree was 50 links or less. This corresponds to a density of 17.4 or more trees per acre. Upland oak forests occupied 20 percent of presettlement Columbia County, the equivalent of 101,400 acres. The average distance from survey post to tree in these forests was 33 links, the equivalent density of 40 trees per acre.

The largest areas of upland oak forest were found in northern and central regions of the county within the Central Plain Province, although many small woodlands, some too small to map, were found in the southeast corner of the county where they occupied ridge summits and east-facing slopes. Upland oak forests occurred adjacent to natural fire barriers: east of the Wisconsin River, in areas characterized by an irregular topography created by relatively high outliers capped by Prairie du Chien dolomite, and where extensive wetlands occurred along the Fox River, French Creek, and the branches of Duck Creek. It is because of these natural barriers to fire that the oak forests owe their existence.

Two types of upland oak forests were delineated in the presettlement vegetation on the basis of tree composition and soil type. They were named **black oak forests** and, simply, **oak forests**. Black oak forests occurred on the droughty, sandy soils of Miami fine sand, Coloma fine sand, Plainfield fine sand, Plainfield sand, and Fox fine sand, and had a tree composition of 56.9 percent black oak as identified by the surveyors (Table 3). Nearly identical in tree species composition to black oak savannas, black oak forests occupied approximately 35,000 acres in Columbia County.

The second type, oak forest, included an estimated 66,400 acres on sandy loam and silt loam soils. Bur oak accounted for more than 50 percent of the tree species composition in forests found on both soil types. On fine sandy loam soils, 27.1 percent of the trees were white oak, but on silt loam soils only 13.5 percent were white oak. An important component of the oak forests was what the surveyors identified as black oak; 1 in 5 trees was "black oak". What appeared to be black oak to the surveyors was probably red oak, a common tree of the oak forests in the current landscape, but which was not identified by the surveyors.

Three species of oaks accounted for 97.8 percent of the trees in oak forests — an overwhelming dominance (Table 3). It is probable that the surveyors selected oaks more often as bearing trees, and it is likely, too, that the oak forests were simply oak savannas which had become closed communities by growth of root sprouts in the absence of regular fires; they represented an early successional stage of forests. If this were true, the median tree size of the oak forests, composed of numerous young trees crowding the older, savanna-grown trees, would be less than that of the oak savanna. As expected, the median size of the oak forest trees was 10 inches in diameter; for oak savanna trees, 12 inches in diameter.

Median tree size of 10 and 12 inches in diameter is small; almost any woodlot in the present day landscape, except those recently logged, has a larger median tree size. Assuming that the surveyors did not bias their selection of trees in favor of small ones, it is probable that severe fires periodically swept through oak forests. With occasional fires, forest growth would take place, but seldom under these conditions would a forest reach mature growth as we are accustomed to seeing today in Columbia County as well as in much of southern Wisconsin, where forest fires are rare.

MARSH

Marshes were delineated at treeless points along the survey lines described as marsh or low prairie by the surveyors or where the points were underlain by peat or muck soils as indicated by the soils map. Marsh as mapped on the county vegetation map is an inclusive community type that ecologists would separate into emergent aquatics, found in the deeper marshes and sloughs, sedge meadow and low prairie. One surveyor used the terms marsh and low prairie, but no surveyor consistently separated the types. Species such as wild rice (*Zizania*), bulrushes (*Scirpus*), rushes (*Juncus*), and "flaggs" (*Iris*) were identified as occurring in marshes.

Deeper marshes occurred in and along the major watercourses. The lush growth of wild rice in the Fox River, along which many of the early explorers journeyed, is repeatedly described. Schoolcraft (1821) comments on the Fox River after portaging from the "Ousconsing" River: "The river in this distance is about 20 yards wide, but often expands into little lakes, or ponds, and is extremely devious in its course. It is filled with wild rice, which so chokes up the channel that it is difficult to find a passage through it. The shores slope up gently from the water's edge, and are covered with scattering oaks, and prairie grass...."

Despite the fact that surveyors recorded 16 species of trees in marshes as bearing trees, marshes were interpreted as essentially open communities because of the long distances frequently recorded from post to tree. The usefulness of tree and distance data for marshes is reduced because surveyors probably preferred to measure to any tree at the marsh edge or even in adjacent upland communities, rather than build a mound of earth at the section or quarter section point. At a substantial number of points, however, mounds were built because trees were not present. Many marshes, according to the surveyors' comments, were suitable for "meadow and grazing purposes".

Extensive marshes occupied the low lying regions along the Fox and Wisconsin Rivers and in the drained glacial lake basin in northwestern Columbia County. Smaller linear marshes were located along the branches of Duck Creek and in the southeast portion of the county along the many streams alternating with ridges. In total, marshes covered 92,800 acres or 18.3 percent of the county, in areas of peat, muck, and several other poorly drained soils.

Marshes were subject to constant

change due to periodic flooding, cu ting or sedimentation as channe moved about and debris accumula ed. Differential erosion and sed mentation resulted in "islands" (slightly higher ground, deep marshe natural levees, and oxbow lakes. Be cause of their heterogeneous nature where a slight elevation differenc meant a substantial change relativ to the water table, marshes afforde ample conditions suitable for the establishment of woody species, both shrubs and trees. Doubtless, trees on wooded islands and scattered trees in the marshes were blazed as bearing trees by the surveyors.

Another factor which influenced the tree composition and structure of marshes, particularly the drier marshes and marsh edges, was fire. Periodic fires in the adjacent savannas could have swept unimpeded into the marshlands in late summer and early fall when the dense grass and sedge growth was driest, but the heterogeneous nature of marshes prevented a complete burn, resulting in a mosaic of vegetation growth. Portions of the larger marshes may have appeared like wetland savannas similar to those existing today in the Wisconsin River bottom within the Avoca Prairie Scientific Area, Iowa County, and along the Chippewa River, Chippewa County. No wetland savannas were mapped for Columbia County.

Photo by Robert H. Read.

A Wisconsin River slough dominated by floating-leaved and emergent aquatics and grading into a sedge meadow in the background.

Photo by William Tans.

An undisturbed sedge meadow in southern Wisconsin dominated by sedges and cattails.

FLOODPLAIN FOREST

Floodplain forest was delineated at points along the survey lines in lowlands dominated by wet forest trees where the mean distance between the survey post and tree was 50 links or less, which corresponds to a density of 17.4 or more trees per acre. The floodplain forest type occupied a relatively small total acreage of about 13,200 acres on alluvial deposits in Columbia County. It occurred along the east side of the Wisconsin River in a narrow, irregular band, at the confluence of the Wisconsin and Baraboo Rivers, and along most of the Baraboo River in T12N R8E. The surveyors called the floodplain forests "bottoms" or "swamp timber" and indicated their position when entering and leaving the bottoms. Dominant trees included silver maple (*Acer saccharinum* L.), elm (*Ulmus americana* L.), and ash. Surveyors frequently commented on the undergrowth of vines, briars and prickly ash (*Xanthoxylum americanum* Mill.). Two very small pockets of floodplain forest called "black ash swamp" by the surveyors were located along the Crawfish River in southeastern Columbia County.

TAMARACK SWAMP

Tamarack swamp was delineated at points in wetlands where tamarack was the dominant tree. Approximately 8,100 acres of tamarack swamp in 12 areas occurred in Columbia County, the largest of which occupied a low area in the glacial lake basin north of the Wisconsin River in T13N R7E. There approximately 2,800 acres of tamarack swamp surrounded Corning and Weeting Lakes and was one of two locations where black spruce (*Picea mariana* [Mill.] BSP.) was found in Columbia County. Areas of swamp conifer developed in low lying pockets over peat where the drainage was stagnant and where

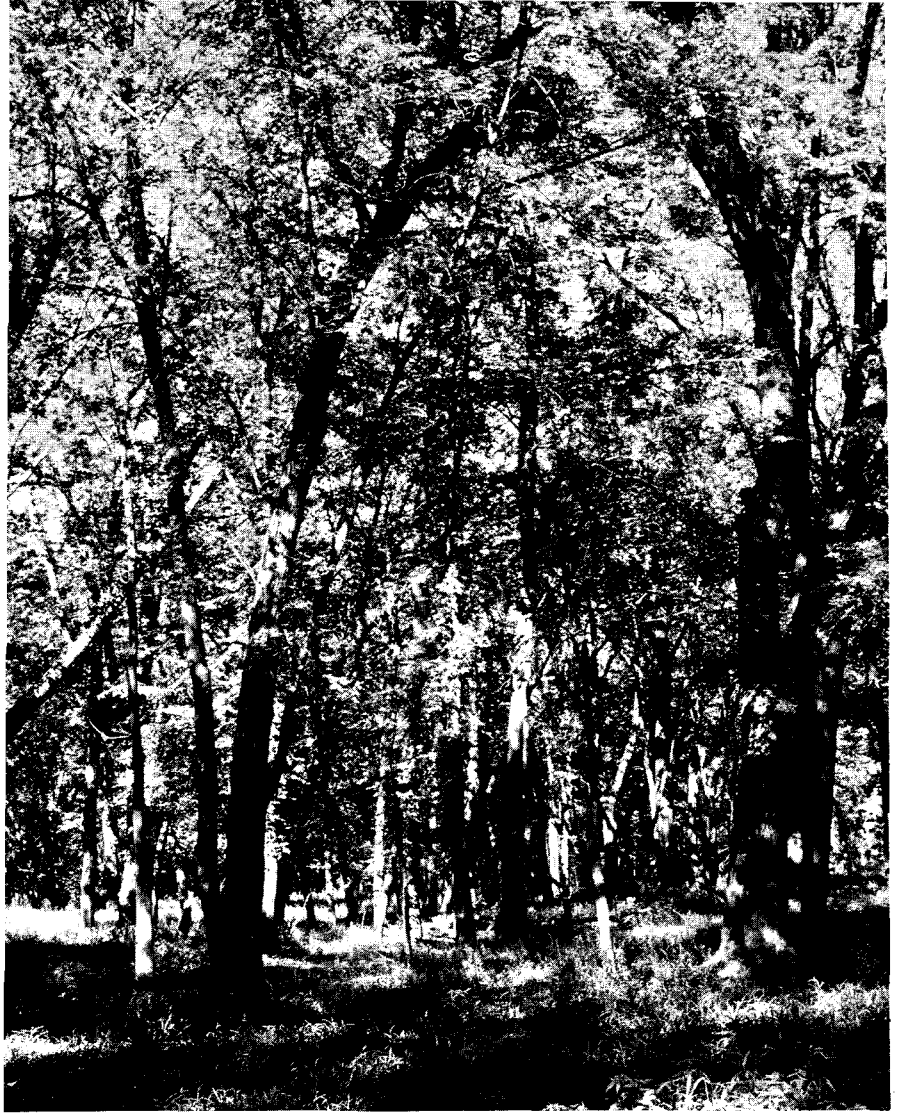


Photo by William Tans.

A typical Wisconsin River floodplain forest, dominated by silver maple (Acer saccharinum), *in midsummer.*

Photo by William Tans.

Xeric pine forest of white pine, red pine (Pinus resinosa), *and jack pine* (P. banksiana) *on sandstone cliffs at Wisconsin Dells.*

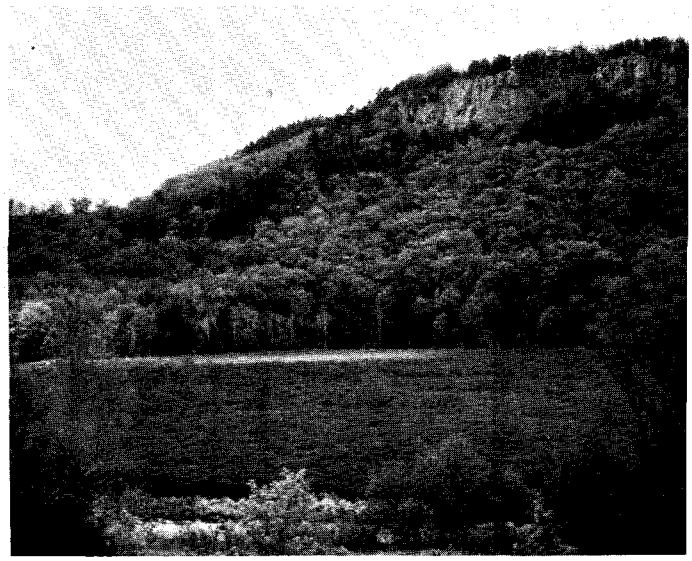


Photo by William Tans.

Gibraltar Rock, an outlier of the Prairie du Chien dolomite, with white pine (Pinus strobus) *above oak forest.*

the likelihood of fire was low. The larger tamarack swamps are located on the county vegetation map with a crosshatch pattern. A capital T locates the points along the survey lines where isolated tamarack trees were encountered by the surveyors.

LIMITATIONS OF THE ORIGINAL LAND SURVEY RECORDS

The original land survey records do have their limitations. The survey was a pioneering endeavor conducted under less than ideal conditions: instructions to the surveyors frequently varied, some surveys were conducted in winter months, different crews surveyed the interior and exterior lines of a township, the survey crews were not always literate, and the gathering of ecological data was not a stated goal of the survey. Still, many botanists have utilized the survey records and they have proved valuable.

The limitations of the survey records are chiefly responsible for the generalized nature of the Columbia County vegetation map. There are additional native plant communities that could not be mapped from the original land survey records. For example, Young's Woods, an oak-maple woods in southern Columbia County, T10N R9-10E, contains a subcanopy of sugar maple (*Acer saccharum* Marsh.) beneath the oaks. Maples can also be found in other cool pockets or north slopes. In total, however, only 5 sugar maples were utilized as bearing trees in the survey of the entire county.

The only mention of pines in the survey records was where white pines (*Pinus strobus* L.) near the Wisconsin River were used as bearing trees. Actually, a narrow pine forest zone of several miles in length occurs on the

Photo by William Tans.

A cedar glade (cf Curtis 1959) on a dry, south-facing slope at Gibraltar Rock, with dry prairie grasses and forbs between red cedars (Juniperus virginiana).

sandstone cliffs and ledges at the dalles of the Wisconsin River, T13N R6E. In addition to white pine, the two other species of pine native in the state — jack pine (*Pinus banksiana* Lam.) and red pine (*P. resinosa* Ait.) — grow on the dry sandstone cliffs.

At Gibraltar Rock in the southwest portion of the county, a white pine relic occupies the south-facing cliffs, and a cedar glade (cf. Curtis 1959) occurs on the steep, dry slopes. Pine relics are nearly completely confined to sandstone outcrops in the driftless area of southwestern Wisconsin (McIntosh 1950). It is curious that although the surveyors traversed Gibraltar Rock neither the different species of trees nor the spectacular cliffs were noted. The surveyors did map the small boggy marsh at its base! White pine on the exposed sandstone gorge at Pine Hollow, T10N R9E Section 4, and the white and red pines along the mile-long, northwest-facing St. Lawrence Bluff, T11N R8-9E, were also overlooked by the surveyors. Other plant communities, such as shaded and open cliffs, tall shrub thickets, sedge meadows, low prairies, and emergent aquatic types, although known from the county, could not be delineated from the land survey records.

Along with the taxonomic problems that the surveyors encountered with the black oaks, there was confusion with yellow oak, too. Six yellow oaks were used as bearing trees in or close to marshes. Zicker (1955) and Ellarson (1949) refer to it as black oak; Stroessner and Habeck (1966) called it chinquapin oak (*Quercus muehlenbergii* Engelm.). Surveyors differed in naming the oak, for when surveying the exterior lines of T11N R11E, John Brink noted yellow oak in the summaries and used yellow oaks as bearing trees. John Mullett surveyed the interior lines of the same township but failed to mention yellow oak. Today chinquapin oak is known to occur in its native habitat on limestone bluffs and hillsides (Costello 1931) and moist river terraces in southwestern Wisconsin, and its identification in Columbia County may have been a mistake.

To the surveyors, marshes had little potential value as croplands except if they could be drained, and consequently the smaller marshlands were incompletely mapped. The marshes as mapped, especially the smaller ones in southeastern Columbia County, were outlined from the county soils map.

SUMMARY AND CONCLUSIONS

From the original land survey notes of Columbia County, Wisconsin, qualitative data were obtained and used to prepare a presettlement vegetation map of the county. Six plant community groups were distinguished: savannas, prairies, upland oak forests, floodplain forests, tamarack swamps and marshes. Through analysis of soils information, savannas were subdivided into bur oak savannas and black oak savannas; upland oak forests were subdivided into black oak forests and oak forests; xeric sand prairie was an additional type distinguished. The location and distribution of the 9 plant community types were correlated with topography, soil type, drainage patterns, bedrock geology, glacial history and wild fires. Quantitative data were collected for savannas and upland oak forests, and the percent of county coverage and acreage of each plant community were calculated. The level of resolution of the original land survey records regarding delineation of plant communities and the limitations of the records were briefly discussed in relation to the features of Columbia County.

Today it is only 140 years after the original land surveyors criss-crossed Columbia County in their pioneering survey, and the landscape is vastly different, a product of our domination, manipulation and apathy. We have pioneer reminiscences and indirect records from which we can make calculated guesses regarding the exact nature of the presettlement landscape, but only in our mind's eye will we ever see the savannas and prairies extending as far as the eye can see.

Through careful planning aimed at avoiding a complete loss of our vegetational heritage, we must enter an era in which the biological and intrinsic values of natural systems are more fully appreciated and understood.

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CONVERSIONS

1 acre = .4046 hectares
1 hectare = 2.4710 acres

1 mile = 80 chains
1 chain = 100 links = 66 feet
1 link = 7.92 inches

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