

PDF - DESCRIPTION OF VEGETATION OF THE OAK OPENINGS OF NORTHWESTERN OHIO AT THE TIME OF EURO-AMERICAN SETTLEMENT - researchcub.info

Original land survey notes were used to produce a map of the Oak Openings of northwestern Ohio showing the vegetation at the time of Euro-American settlement (1817-1832). For that period, the area of the Oak Openings was 43% Oak Savanna, 27% Wet Prairie, 23% Oak Woodland, 7% Oak Barrens, and <1% Floodplain Forest. The composition of the tree layer was determined from analysis of records of bearing and line trees recorded by the land surveyors. The tree layer of each of the four major vegetation types was dominated by *Quercus alba*, with *Q. velutina* as a subdominant. *Quercus palustris* was also a subdominant in Oak Barrens and Wet Prairie. Tree density averaged 90 trees/ha in Oak Woodland, 14 in Oak Savanna, 2 in Oak Barrens, and <1 in Wet Prairie. The composition of the shrub and herb layers was estimated based primarily on the literature of the region and our own field research. Today most stands of the four major vegetation types have been eliminated by urbanization and agriculture, or have changed to forests as tree densities increased with the absence of fire and increased soil drainage. Extant Oak Savannas and Oak Woodlands are different in composition from those present at Euro-American settlement. OHIO J SCI 104 (4):76–85, 2004 Manuscript received 28 October 2002 and in revised form 12 May 2003 (#02-25). Present Address: Center For Applied Ecology, Northern Kentucky University, 510 Johns Hill Road, Highland Heights, KY 41076 Science Center, Grand Canyon National Park, PO Box 129, Grand Canyon, AZ 86023

INTRODUCTION The Oak Openings includes an area of 476 km of sandy soils in Lucas, Fulton, and Henry counties of northwestern Ohio. Scattered areas similar to the Oak Openings can also be found on sandy soils in several counties of southeastern Michigan (Comer and Albert 1998). Prior to Euro-American settlement, Ohio's Oak Openings was surrounded by Black Swamp Forest (Gordon 1966, 1969; Anderson 1992). The Oak Openings is located on sand laid down along the edges of former glacial lakes Wayne, Warren, and Lundy by longshore currents from Michigan. When first formed, the sand beaches were bare and fairly level, but as water levels dropped the wind formed low dunes (Forsyth 1959, 1968; Hehr 1970). The most extensive dune building occurred with Lake Warren, which had the highest elevation (207 m) of the three glacial lakes. Oak Savannas developed on dune ridges and Wet Prairies formed in interdunal areas (Sears 1926; Moseley 1928; Transeau 1935, Gordon 1966, 1969; Hehr 1970). Drainage was impeded by a clay lake bed 3.0 to 15 m below the sandy surface, so water often covered the Wet Prairies during the winter and spring (Mayfield 1969). By late summer, these wet areas dried and were burned by lightning and human-set fires. Drainage, agriculture, urbanization, and cessation of fires resulted in significant changes in the vegetation of the region following Euro-American settlement (Mayfield 1969). Nevertheless, the Oak Openings is still of great botanical interest. The combinations of dry and wet habitats, loose sand and black muck soils, and forested and open vegetation have produced an unusual flora. In fact, there are presently 145 state potentially threatened, threatened, and endangered plant species in the Oak Openings, more than any other area in Ohio (McCance and Burns 1984; ODNR 2002a,b; Walters 2003). Kitty Todd Preserve (253 ha) has 88 of these plant species, along with 23 state listed animals

(Haase 2003). Many of these plants are common in the northern Great Lakes and Canada (Easterly 1979). Others are western and Atlantic Coastal Plain disjuncts. Sears (1926) was the first to map vegetation in the Oak Openings, showing the approximate location of a few Wet Prairies and a few open oak areas. Transeau (1935) also mapped prairies in the Oak Openings. Moseley (1928) mapped the boundaries of the Oak Openings but delineated no vegetation types. Gordon (1969) mapped the pre-Euro-American settlement boundaries of the Oak Openings but did not map the different vegetation types. Hehr (1970) mapped pre-Euro-American settlement boundaries and included locations of Wet Prairies. He also determined the tree composition of the oak-dominated areas but did not separate Oak Forest, Oak Savanna, and Oak Barrens. The objective of this project was to improve on these earlier studies by producing a vegetation map and accompanying text with information on the area, distribution, and composition of the vegetation types in the Oak Openings at the time of Euro-American settlement.

MATERIALS AND METHODS

Description of Surveyors' Notes

Records of the US General Land Office Survey were used to produce a map of the vegetation of the Oak Openings as it existed in 1817-1832 (copies of the surveyors' original field notes are in the Office of the State Auditor in Columbus, OH). The original land parcels in Ohio were defined using the US Rectangular Survey System of township and range in which each township was subdivided into 1.0 mile (1.6 km) square sections.

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Although description of the vegetation was not the surveyors' main objective, they were required to gather specific data related to vegetation. These data included identification of two bearing trees at each section corner; two bearing trees halfway between these corners (that is, at quarter-section points); two bearing trees at points where survey lines entered and left rivers, lakes, or Native American reservations; and trees located directly on survey lines. The surveyors recorded the common name and diameter for each of these trees, as well as distance from the survey point for each bearing tree. In addition, surveyors usually described crossing boundaries of wet prairies, floodplain bottomlands, and various types of swamps or beech-maple forests in the areas surrounding the Oak Openings. Borders of oak savannas were mentioned only occasionally. The surveyors also described the general quality of timber and soil as well as density of undergrowth. The potential for bias in land survey notes has been noted by Bourdo (1956) and Hushen and others (1966). However, we found no evidence of bias in selection of species for bearing or line trees, except that successional trees such as *Populus tremuloides* (quaking aspen) and *Sassafras albidum* (sassafras) were likely underrepresented because the surveyors were instructed to select trees no smaller than 5.0 in (12.7 cm) dbh (Bourdo 1956). Also, close correlation between the surveyors' records of vegetation boundaries and present day topographical features indicates that the surveyors were accurate.

Classification of Vegetation Types

We focus on five vegetation types: Oak Woodland, Oak Savanna, Oak Barrens, Wet Prairie, and Floodplain Forest. Oak Savanna on sand dunes and Wet Prairie in interdunal swales have long been recognized as vegetation types in the Oak Openings, but we included a) Oak Woodland to recognize areas protected from fire that had greater tree density than Oak Savanna, b) Oak Barrens for

areas intermediate in tree density between Oak Savanna and Wet Prairie, and c) Floodplain Forest. Uncommon vegetation types such as sand prairie were not included. Definition and Delineation of Vegetation Types We used several methods to delineate vegetation boundaries. Foremost was calculation of tree density based on distances to bearing trees (Anderson and Anderson 1975). Section and quarter-section points were defined as having Oak Woodland vegetation where the mean distance from points to bearing trees was 50 links (10.5 m), Oak Savanna where 50-192 links (10.5-38.8m), Oak Barrens where 193-333 links (38.866.9 m), and Wet Prairie where >333links (>66.9 m). These distances correspond to density values of >43trees/ha for Oak Woodland, 4-43 for Oak Savanna, 1-3 for Oak Barrens, and <1 for Wet Prairie. Our density values for defining Oak Woodland, Oak Savanna, and Wet Prairie are similar to those used by Curtis (1959), Anderson and Anderson (1975), and Whitney and Steiger (1985). Our Oak Barrens vegetation type corresponds to low density savanna and high density prairie in these other studies. Where different density values occurred in a small area of several km, we calculated the percentages of Oak Woodland, Oak Savanna, Oak Barrens, and Wet Prairie and mapped the area as the most abundant vegetation type (usually only two vegetation types were present in these small areas). Because so few bearing trees were found in the Floodplain Forest, no attempt was made to determine the density of the trees in this vegetation type. Another important method to delineate vegetation boundaries involved references in surveyors' notes. For example, "post and mound in open plains or prairie" indicated Wet Prairie. Also, surveyors frequently described crossing boundaries of Wet Prairie and Floodplain Forest. Comments by the surveyors at the end of each mile were also helpful, for example, "first 1/2 mile oak woods — second 1/2 mile poor oak plains." In many cases they also listed the dominant species in the canopy and undergrowth, for example, "timber black oak and white oak — undergrowth hazle [that is, hazel], sassafras, whortleberry, fern, wintergreen." We also used topography as an indicator of vegetation, as Wet Prairies occurred on flat terrain and Oak Savannas on dune ridges. In addition, boundaries of Floodplain Forest often matched abrupt elevation changes of >1.0 m (and were noted in surveyors' descriptions). Vegetation boundaries were drawn on 7.5-minute series USGS topographical maps. Data were then entered into an ArcView Geographic Information System (GIS) to produce the map.

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