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LOSS OF TREES IN NEMAHA COUNTY, NEBRASKA, SINCE 1856 DUE TO AGRICULTURAL EXPANSION

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The distribution and species composition of trees as they occurred in Nemaha County, Nebraska, in 1856 were analyzed using the General Land Office survey records. Calculation of importance values for trees within the county indicated the predominance of elms, cottonwood, black walnut, and oaks. In 1856, 9,543 ha of trees were present. By 1955 there were 8,520 ha of trees. Tree area decreased to 5,563 ha by 1977. Evidence is given to support the coincident loss of trees with a large increase in the amount of land planted in crops beginning in approximately 1960.

† † †

INTRODUCTION

Forest surveys of Nebraska were conducted in 1955 and 1977 (Shasby, 1977). These surveys sought to characterize species, total area, and size classes of economically important trees. Information gained from these surveys is very alarming. The counties of Nemaha, Otoe, and Richardson in the southeastern survey district have lost between 34.7% and 53.9% of their trees during that 22-yr period. These are critical losses considering that these counties are only 2.8% to 5.5% forested.

The purpose of this study was to investigate historical changes in tree vegetation that occurred in Nemaha County. The trees as they occurred in the county when settlers started to colonize this part of Nebraska were studied. For this, the General Land Office surveys were helpful. Information of this type has been used to categorize presettlement forests in several states (Stearns, 1949; Spurr, 1951; Shanks, 1953; Bourdo, 1956; Wuenscher and Valiunas, 1967; Leitner and Jackson, 1981). Most of these studies did not concentrate on using available information to define losses in vegetation that occurred since the original surveys. Information in the General Land Office surveys can be used to determine the location, area, size classes, and species of trees that occurred in the past.

MATERIALS AND METHODS

Analysis

General Land Office survey records were obtained from the State Surveyor's Office in Lincoln, Nebraska. This information was in the form of township maps and microfilm of the surveyors' original written descriptions. These descriptions were viewed with a stereomicroscope at X10 and verbatim notes were taken of information pertaining to trees. The film copy was of variable quality and not clear enough to be read with a microfilm viewer for which it was designed. Some problems had to be dealt with in reading the surveyors' reports. A different penmanship was used which initially made the writing difficult to interpret. Also, common names of trees used by surveyors were not always those used currently. For example, "Lynn" was used to refer to linden and "coffee bean" referred to the Kentucky coffee tree. Written notes were compared to information on the township maps. With this comparison it was possible to determine that the surveyors had outlined the areas covered by trees on the map. This information made calculation of tree-area coverage much simpler. This advantage has not always been available to other investigators. With information on number of species and size of trees it was possible to define an importance value of trees in Nemaha County (Cottom and Curtis, 1956). Importance values for trees were calculated for the entire county. Additionally, three localities were analyzed separately. These included the Muddy Creek; Little Nemaha River; and Township 4 North, Range 16 East. This township was chosen because of its large area of trees. To estimate area covered by trees a coordinate grid was used.

Survey Methods

The original survey of Nemaha County was conducted

in 1855 and 1856. At each of the township and section corners, surveyors were to list a maximum of four trees, one tree in each quadrant defined by the sampling point. They determined the bearing and distance of the tree from the sampling point, its diameter, and species. Occasionally surveyors gave species and diameter designations to trees that occurred along section lines. The surveyors noted 217 trees in this manner in Nemaha County. Some timber area was not analyzed with the above parameters. Instead, surveyors summarized the trees within a stand of timber (e.g., bur oak, black oak, and elm). Some of the trees were defined by specific common names such as black walnut, while others were only put into groups such as "elms."

RESULTS AND DISCUSSION

The areas covered by trees in Nemaha County in 1856 are shown in Figure 1. This represents information summarized from written descriptions and 24 township maps. The trees in the county were primarily found along waterways including the Little Nemaha River, Muddy Creek, and Missouri River. The largest upland area covered by trees occurred in the southeasternmost part of the county (T. 4 N., R. 16 E.). Early reports of tree ecology in Nebraska by Pound and Clements (1900) indicate similar distributions of trees. An indication of how many and what type of trees were marked by surveyors is seen in a reproduction of a township map (Fig. 2). Tree locations have been superimposed on the township map as listed in the written description by surveyors.

Importance values were derived for trees within the entire county. The species in Table I are arranged according to these values. In addition, three of the major areas covered by

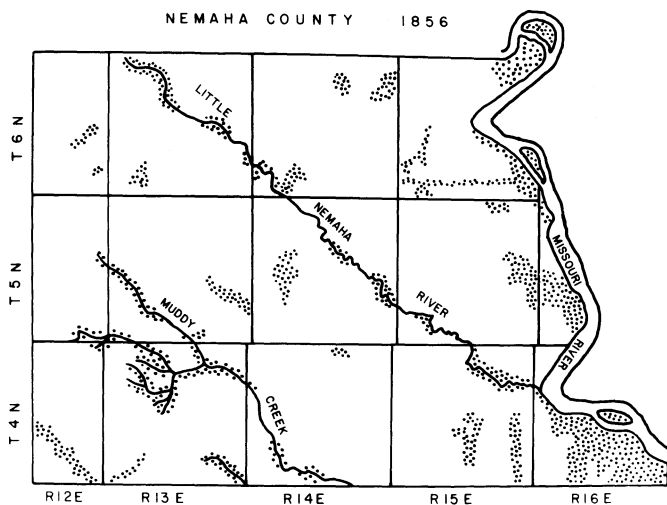


FIGURE 1. Map of Nemaha County, Nebraska. Dots indicate the location and areas covered by timber in 1856.

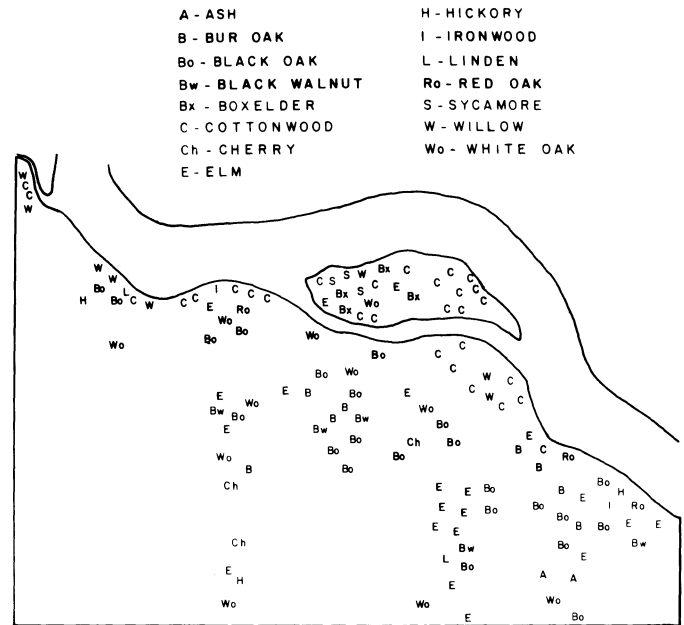


FIGURE 2. Township map of T. 4 N., R. 16 E. within Nemaha County of 1856. Locations of trees are superimposed on the township map.

trees were analyzed separately. According to original records, 21 species or groups were observed. The group listings include elms, hickories, maples, and willows. The elm group probably included the American elm (*Ulmus americana*) and slippery elm (*Ulmus rubra*). The elms had an average diameter of 56.6 cm. Although the American elm has been devastated by Dutch elm disease, Shasby (1977) reported that they still made up 7.3% of the growing stock of the southeastern district. The slippery elm is still found in large numbers although it is locally preferred by residents as the best species for firewood. If the elm species had been distinguished it is possible that the importance value of each would have been less than that of cottonwood (*Populus deltoides*), black walnut (*Juglans nigra*), or oaks. The ash group probably included green ash (*Fraxinus pennsylvanica*) and white ash (*F. americana*). The willows most likely included peach-leaved (*Salix amygdaloides*), black (*S. nigra*), and sandbar (*S. interior*). The hickories would have included bitternut (*Carya cordiformis*), shagbark (*C. ovata*), and butternut (*Juglans cinerea*). The maples would have included silver maple (*Acer saccharinum*). If the groups had been categorized by species, the species list could have increased to at least 26. This compares to the survey by Shasby (1977) which listed 32 species of trees in the southeastern district. The probability of which species would have represented these groups was surmised from the work of Pound and Clements (1900), Pool, Weaver, and Jean (1918), Weaver, Hanson, and Aikman (1925), and Aikman (1927).

TABLE I. Importance value of trees in Nemaha County, Nebraska in 1856.

Trees	Entire County	Little Nemaha River	Muddy Creek	T. 4 N., R. 16 E.
Elm	29.4	53.4	62.8	26.0
Cottonwood	28.5	18.3		37.9
Black oak	21.1			33.7
Black walnut	14.2	42.8	28.2	10.4
Bur oak	13.3	15.4	27.2	16.1
Sycamore	12.9			9.2
White oak	12.8			20.2
Maple	10.8	29.2		
Red oak	9.6	8.1		9.5
Boxelder	9.4	18.1		6.5
Ash	6.6	4.5	36.0	4.8
Linden	6.3			7.0
Willow	6.2	7.1		8.4
Hickory	5.8		30.1	3.8
Mulberry	3.8	3.1		
Ironwood	2.4			2.9
Black cherry	2.4		15.7	3.6
Hackberry	1.9			
Redbud	1.3			
Kentucky coffee tree	1.3			

Analysis of three areas within the county reveals distinct communities (Table I). The cottonwood and willow were not found on Muddy Creek although they were present on the Little Nemaha and T. 4 N., R. 16 E. These species are usually the first established along streams and rivers (Wilson, 1970). Weaver, Hanson, and Aikman (1925) indicated that sandbar willow is usually the first tree to establish and that numerous peach-leaved and black willows are found primarily at the margins of timber stands. Cottonwoods usually follow willows. The second stage of succession is characterized by bur oak, hickory, and walnut occurring on the banks of a stream. The third stage is characterized by American elm, slippery elm, and green ash. Other ancillary species include Kentucky coffee tree, Ohio buckeye, hackberry, silver maple, and sycamore. Muddy Creek seemed to be dominated by species representing the second and third stages of flood plain development. The Little Nemaha evidently consisted of areas which incorporated all three stages. Weaver, Hanson, and Aikman (1925) studied the lower reaches of the Little Nemaha and found a similar composition of trees.

The trees in T. 4 N., R. 16 E., away from the river seemed to represent a typical, mature upland-forest with the oaks,

black walnut, and elms dominating. Most likely this forest was made up of several associations such as the red oak-linden, bur oak-elm-walnut, and black oak-shagbark hickory (Pool, Weaver, and Jean, 1918). The black oak-hickory association was probably much more prevalent in 1856. The black oak had been cut to the point that few of these areas of association remained by 1928 (Weaver, 1960).

By comparing the species list of the present study for 1856 and previous studies on southeastern Nebraska trees, some comparisons can be made. Two species were not noted in 1856. The osage orange, a comparatively new introduction used primarily for windbreaks, was not mentioned in 1856. The chinkapin oak (*Quercus muhlenbergii*) was also not mentioned in 1856. The absence of this species may have been an oversight by surveyors or it may not have been present. This species is fairly easy to recognize because of its bark characteristics. Its apparent absence in 1856 is interesting because it reaches its most northerly expansion along the Missouri River within Nemaha County (Pool, Weaver, and Jean, 1918). This tree presently occurs in Nemaha County in fairly large numbers in association with the red oak. Early surveys listed the chinkapin oak in Indiana as "yellow oak" (Lindsey, 1961) or as "pigeon oak" (Shanks, 1953) in Ohio. Leitner and Jackson (1981) thought that early surveys of southern Illinois may have listed this species as "white oak." A large number of "white oak" is listed as occurring in Nemaha County in 1856. It seems possible that the "white oak" may in fact be *Q. muhlenbergii*.

The area covered by trees in 1856 was determined from original maps. In 1856, 9,543 ha of trees were present. In some cases surveyors marked the area covered by trees on the township maps. Therefore, our calculations could be checked. When comparing calculations we were within 5% of that marked on the map. More recent studies show 8,520 ha of trees in 1955 and 5,563 ha in 1977 (Shasby, 1977). This represents an 11% decrease in the 99-yr period between 1856 and 1955 (Fig. 3). During the next 22 yrs, 34.7% of the area covered by trees was lost from Nemaha County. The Little Nemaha was lined with 714 ha while the Muddy Creek was bordered by 888 ha. The T. 4 N., R. 16 E. contained 3,629 ha. The remaining area was primarily along the bluffs overlooking the Missouri River and small tributaries. Pound and Clements (1900) noted that the Little Nemaha was lined by extensive forests. Later, Weaver, Hanson, and Aikman (1925) noted that several portions of the Little Nemaha were plowed to within a few meters of the river in several locations.

One purpose of this study was to determine the contributing factors for the large loss of trees in Nemaha County. The demographics of Nemaha County were examined for relationships with population changes, farm practices, crop production, farm size, and forested land. The population of

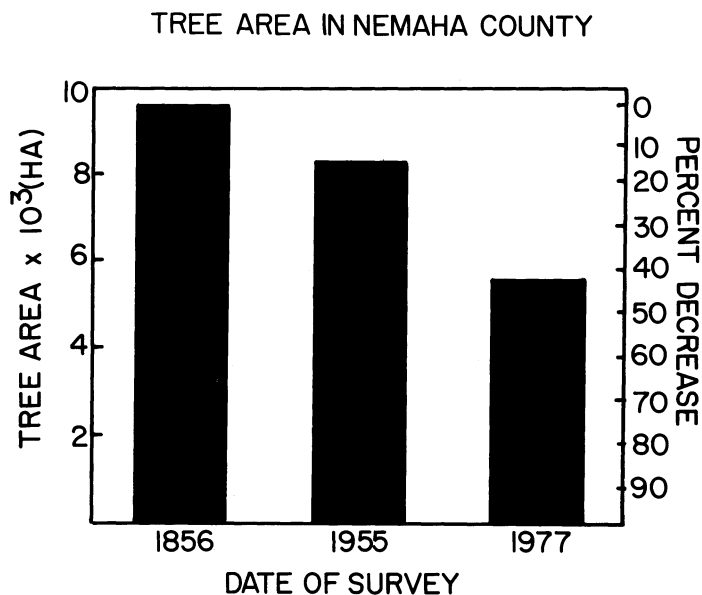


FIGURE 3. Tree area in Nemaha County as surveyed in 1856, 1955, and 1977. The 1955 and 1977 data are from Shasby (1977).

the county decreased from 12,356 in 1930 to 8,132 in 1976. The number of farms decreased from 1,070 in 1960 to 700 in 1976. The size of farms increased continually from 1850 when a farm averaged 90 ha to 1974 when each averaged 273 ha.

The relationship between crop production and forested area is seen in Figure 4. There was a rapid increase in the amount of land in production from 1879 to 1899. In 1879, 43,709 ha were in production. This expanded to 67,250 ha in 1899. This rapid expansion seems not to have had a significant effect on forested land. From that period, the area of crop-land oscillated around 62,000 ha until about 1960. From 1960 crop-land increased continually to approximately 77,200 ha in 1979. Crop estimates were taken from the U.S. Census on Agriculture.

These data indicate that the expansion of agriculture in the last 35 yrs may have contributed to the displacement of a large portion of forested habitat in Nemaha County. Several current indicators show that cultivation is still increasing. Extensive windbreak destruction has been witnessed in the past two years. Many fields are now being plowed right to the side of county roads. The topography of the extreme eastern portions of the county bordering the Missouri River and representing most of the forested land in the county has probably kept cultivation from further expanding. However, the advent of widespread use of heavy machinery for leveling and terracing land, coupled with increased land value and decreased crop

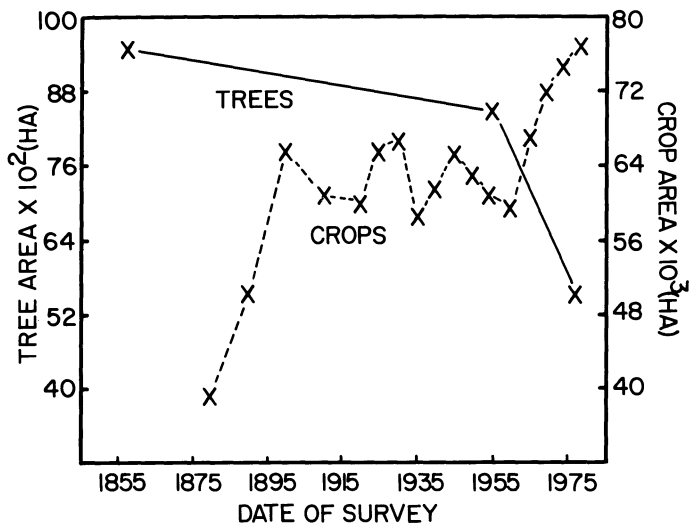


FIGURE 4. Comparison of tree and crop areas in Nemaha County from 1856 to 1979.

value, may result in further destruction of forest in the county. Another factor leading to future forest destruction may be the increased use of bluffs overlooking the Missouri River for homesites.

ACKNOWLEDGMENTS

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