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Title of Study: Western Distribution of Platanus occidentalis L. in Oklahoma  
Pages in Study: 42      Candidate for Degree of Master of Natural Science  
Major Field: Natural Science.

Scope and Method of Study: Determine the Western Distribution of Platanus occidentalis L. in Oklahoma. This was accomplished by making trips into Love, Carter, Murray, Garvin, McClain, Cleveland, Pontotoc, Seminole, Pottawatomine, Lincoln, Logan, Payne, Pawnee, Kay, and Grant Counties. Collections were made to verify the location. A distribution map of plant collected and they are on deposit in the Bebb Herbarium of the University of Oklahoma. A study was made of the unpublished Paper of the Ecology of the Bottomland of Oklahoma by Rice (1962).

Findings and Conclusions: P. occidentalis L. are found along most of the creeks and rivers in the eastern half of the counties above. More abundant growth is along larger and wider creeks and rivers in the counties mentioned. P. occidentalis L. are found growing with other species of trees. Few young trees were found in the narrow creeks. More trees were growing on limestone soils. P. occidentalis L. are found to be more abundant to the east of the distribution found in this paper.

Adviser's Approval: L. Herbert Bowers

WESTERN DISTRIBUTION OF PLATANUS  
OCCIDENTALIS L. IN OKLAHOMA

By

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THE WESTERN DISTRIBUTION OF THE PLATANUS  
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## PREFACE

This paper is an attempt to describe the western distribution of the species Platanus occidentalis L. in its natural ecological habitat. This survey started in the summer in 1963 while I was attending the University of Oklahoma on a National Science Foundation Research Participation Institute stipend. The research I was doing at that time was the collection of the flora of Grady County. This survey was made in addition to the research plan. The study continued through the spring of 1965, when, on my own time, the survey was finished. Most of the collection and survey was done during the summers of 1963 and 1964. At this time I was on research grants financed by the National Science Foundation, under the direction of Dr. G. J. Goodman, Curator of the Bebb Herbarium, University of Oklahoma.

I would like to thank Dr. H. I. Featherly, Professor Emeritus of Botany and Plant Pathology, Oklahoma State University for giving me the research idea during one of his lectures. Also acknowledgement goes to Dr. Elroy Rice, Professor of Botany, University of Oklahoma, for his assistance by allowing me to read his unpublished paper on the ecology of the bottomland creeks in Oklahoma; to Dr. Jerry Crockett, Assistant Professor of Botany and Dr. U. T. Waterfall, Professor of Botany, Oklahoma State

University for the basic training in Plant Ecology and Plant Taxonomy which enable me to finish this paper. I would like to acknowledge also the help of Dr. Doyle Anderegg, Chairman of the Department of Botany and Microbiology, University of Oklahoma, for the financial help by his selection of me to participate in the Research Program. I am very indebted to Dr. G. J. Goodman, Professor of Botany and Curator of the Bebb Herbarium, University of Oklahoma, for his untiring assistance with the P. occidentalis L. in Oklahoma and to Dr. L. H. Bruneau, Associate Professor of Zoology, Oklahoma State University, as my graduate advisor for the Master of Natural Science Degree.

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## CHAPTER I

### INTRODUCTION

After making observations and collections of the P. occidentalis L. in many parts of central Oklahoma, trips were made to determine the western distribution. These locations will be mentioned to the nearest hundred yards of the actual collections or observations.

The specimens were prepared, pressed, and recorded by the author. They are on deposit in the Bebb Herbarium of the University of Oklahoma.

This study started in the summer of 1963 and was completed during the spring of 1965. There were over 1,500 miles of travel to the counties that were studied for observations. New locations of P. occidentalis L. were noted in some counties. Most of the soil types and vegetation of counties were observations at the time of collections but detail accounts were reported by literature cited.

#### Method

The method used to prepare this paper was first to check the species of P. occidentalis L. collected by earlier workers. Their collections were studied in the Bebb

Herbarium, University of Oklahoma. From these, a preliminary distribution map was made of the counties in which P. occidentalis L. were found. Only a few specimen were in the herbarium. The author read the unpublished paper of the exology of the bottomland creeks in Oklahoma. (Rice, 1962). From this paper, the locations of all the counties in the central sections of Oklahoma were recorded. Later these locations were checked for the western distribution.

Trips were made into each county that was on the distribution maps, made from the studies of the herbarium sheets and the paper of Rice. These trips were made to Love, Carter, Murray, Garvin, McClain, Pontotoc, Pottawatomine, Cleveland, Seminole, Lincoln, Logan, Payne, Pawnee, Kay, Noble, and Grant counties. Collections were made and the natural habitat was noted with the western distribution location recorded. These collections were placed in the Bebb Herbarium.

### Ecology

The natural habitat of the P. occidentalis L. was described by Bruner. (1931), as a oak-hickory savannah formation. They are found near creeks, rivers, or lakes where there is an abundance of moisture. They are associated with limestone and flint soils of the eastern half of the state. Under natural conditions they will grow to a height of 30 to 70 feet and diameter of 2.0 to 2.5 feet. The largest are 21 feet 2 inches in circumference, 81 feet height, and 69 feet spread in Oklahoma (near Sperry, Tulsa,



County) and 32 feet 10 inches in circumference, 80 feet height, and 102 feet spread in the United States (Bloomfield, Ohio). (The Daily Oklahoma, 1963). The habitat for the P. occidentalis L. in its western most range is near creeks, rivers, and lakes where there is an abundance of moisture. The soil is sandy or small gravel in most of the area, limestone in Murray and part of Carter Counties. The size of the trees will vary from 20 feet to 60 feet in height and 2 feet to 2.5 feet in diameter. While the author was collecting, the growth patterns were observed. Soil type changed from sandy to limestone, with most areas being small gravel. Temperature was about the same, with the most moderate in the southern half of the state, but this was not a major factor. The humidity was about the same in all regions where the P. occidentalis L. was found. The amount of light that all the tree received varied with the intensity of cover by other trees in the area. The rainfall ranged from 32 inches to 38 inches per year. Subsoil moisture was good or there was water flowing in the creeks or rivers at the time of the collections. The general ecological habitat was rolling grassy hills with forested creeks or rivers in the lowlands. The P. occidentalis L. are found in the forested creeks or rivers in the lowlands of its western distribution.

The P. occidentalis L. appeared to be a poor competitor. Best growth is in areas where there are few species of other trees.

## CHAPTER II

### THE DISTRIBUTION OF P. OCCIDENTALIS L.

The western distribution of *P. occidentalis* L. in the state of Oklahoma will be described according to the major water sheds, counties, and ecology.

#### Love County

Love County is in the south central section of the state along the Red River. It is in the physiographic division of North American, known as the Gulf Coastal Plains. (Bullard, 1925). Love County is in the transitional belt between the prairies of the west and the forests of the east, but supports vegetation common to both sections. The county consists of a rolling to strongly rolling forested plain which slopes gently from northwest to southeast. The plains are interrupted by areas of rolling prairies. This area is surrounded by prairie soils developed from heavy shales. In many places the shales are interbedded with sandstone ridges that extend northwest to southeast direction. Along the major creeks in the county another physiographic unit of bottomland and terraces is common, which range from 2 to 3 miles in width.

Two distinct types of native vegetation are found in the county. The prairie is divided into heavy soil prairie and cultivated areas. The principal trees are post oak and blackjack oak. Other trees are chinquapin, red, black, and bur oaks, blackhaw, pecan, persimmon, soapberry, redbud, sycamore, cottonwood, and willow. The principal grasses, which form the heavy sod in the prairies area are buffalo grass, blue grama, bluestem, wire grass, and silver bluestem. Crab, Johnson, and Bermuda grasses are common in cultivated areas. The common weeds in the cultivated areas are cocklebur, sunflower, thistle, bindweed, horse-nettle, buffalobur, pigweed, sandbur, and ragweed.

The major watersheds are the Red River and Walnut Bayou. P. occidentalis L. follows along the Red River west to Barneyville to the mouth of Walnut Bayou. They follow Walnut Bayou north intermittently to near the hamlet of Oswalt. North of Oswalt, the P. occidentalis L. become more abundant as they leave Love County entering Carter County to the north. The Red River is a sandy, wide and shallow river with shale, and sandstone bluffs occasionally towering to a height of 75 feet above the river. Walnut Bayou is a sandy stream that rambles through the south central section of Carter and Love Counties for about 50 miles. This stream is narrow with banks of four to five feet in height in some areas. There is some occasional coarse gravel about 30 centimeters in diameter and less in the stream bed. During the collection period the stream had

very little water in it, but by digging a few feet into the dry streambed, water is abundant. The general ecology of the stream is of a prairie folded plain type with few trees growing along it. The terraces of this creek are 3 to 4 miles wide in some places. P. occidentalis L. is found growing very well due to the large amounts of moisture and sunlight. Young trees are also growing along the stream. P. occidentalis L. is growing west a few hundred yards, in some places, along the small tributaries of Walnut Bayou.

#### Carter County

Carter County is in the south-central part of Oklahoma north of Love County. It is in the transitional belt between the prairie land of the west and the forested land of the east, but supports vegetation common to both sections.

Rolling to strongly rolling forested plains which slope gently from northwest to southeast, constitute this county. This plain is interrupted by areas of rolling prairies. There are also two very prominent folds in the earth's crust and several smaller folds. (Fitzpatrick, 1933). The most important of these folds comprises the Arbuckle Mountains which are made up of principally limestone that has been exposed by the folding and the geologic erosion of overlying formation. These low smooth mountains extend from east to west in the northern part of the county. The

other important fold, forming the Criner Hills in the southern part, extends in a northwest-southeast direction. The Criner Hills are much like the Arbuckle Mountains but much lower and less extensive. Both areas are surrounded by prairie soils developed from heavy shales which have been exposed to weathering by folding in the earth crust. In the Criner Hills these shales are embedded with sandstone ridges that extend northwest-southeast. Along the Washita River, another physiographic unit of bottomland terraces is common. They range from two to three miles in width.

There are two distinct types of native vegetation. The principal trees are post oak and blackjack oak. Other trees are chinquapin, red, black, and bur oak, blackhaw, hickory, pecan, persimmon, soapberry, redbud, sycamore, cottonwood, and willow. The principal grasses on the heavy soil in the prairie area are buffalo grass, blue grama, bluestem, wire grass, and silver bluestem. Crab, Johnson, and Bermuda grasses are in cultivated areas. The common weeds in the cultivated areas are cocklebur, sunflower, thistle, bindweed, horsenettle, buffalo-bur, pigweed, sandbur, and ragweed. A more complete list of the flora of the county and the Arbuckle Mountains area is published by Dale. (1956).

The climate of Carter County is warm summers and short, mild winters, punctuated by several short cold waves which are sometimes accompanied by rain or snow. Average rainfall at Ardmore is 28.66 inches (United States Department of Agriculture Yearbook, 1941).

The major water sheds in Carter County are the Red River, Washita River, Caddo Creek, and Walnut Bayou. The distribution extends into Carter County from Love County along Walnut Bayou west of Cheek, a small hamlet in the south section of the county just north of Oswalt, and extends to the northeast of the town of Wilson three miles. The P. occidentalis L. follows along Walnut Bayou to a small branch northwest of Wilson and extends one and one-half miles north of Oil City. The branch is sandy with mixed prairie woodland association. The northern part of the branch is a limestone soil with some large rocks along the branch. The P. occidentalis L. is more abundant in the limestone soil than the shales. The P. occidentalis is found in some of the small branches north and west of Oil City for several hundred yards. To the east of Oil City they become more abundant. From Oil City one and one-half miles east, P. occidentalis L. is found growing from the headwaters of Bear Creek, that flows to the north and drains into Caddo Creek to three miles west of Milo in north Carter County. The P. occidentalis L. is growing along Spring Creek that flows from Humble Lakes through Milo to Caddo Creek. They are found growing near all creeks along the county line of Murray and Carter Counties, from Milo to eight miles north of Milo. They are growing along Massey Creek to near Alpers, and into Garvin County two miles west of Hennepin. Massey Creek flows into Wildhorse Creek which empties into the Washita River near

Davis. However, P. occidentalis L. is not found growing along Wildhorse Creek. The mountain creeks in Carter County are shale and limestone soils. The creeks are spring fed and have water flowing in them the year round. These creeks have steep, narrow banks. P. occidentalis L. is more abundant in this limestone soil with the more abundant water supply. Along some of these creeks, P. occidentalis L. is the dominant tree.

#### Murray County

Murray County is in south-central Oklahoma, north of Carter County. This county lies in the transitional belt between the forested land and grass land. The southern half of the county consists largely of low stony mountains known as the Arbuckle Mountains. (Rose, 1935). The northern half of the county consists of strongly dissected prairie with some forested areas. The major water sheds in the western part of the county are the Washita River and Wildhorse Creek in Garvin County; Caddo Creek in Carter County; and Spring Creek. The Arbuckle Mountains dominate the county with limestone outcrops. Along the Washita River, the overflow terraces are poorly drained. Sandy to sandy loam soil is found one to two miles on each side of the river. The ridges are covered with grass. The valleys and slopes are predominantly forested. The county has two vegetative regions. The prairie types of vegetation are bluestem, side-oats grama, blue grama, buffalo grass,

Bermuda grass, western wheatgrass, wild-rye, and Panicum sp. These are found on the heavy soils.

The forested area supports the growth of chiefly post oak and blackjack oak. Associated with these trees, mostly in the valleys and on the slopes, are Chinquapin, red, black, and bur oaks, American elm, winged elm, hackberry, persimmon, hickory, redbud, red mulberry, Osage-orange, juniper, ash, sycamore, pecan, black willow, cottonwood, dogwood, alder, horse-chestnut, black walnut, chittamwood, redhaw, blackhaw, and sand plum. Other trees found in the area are recorded in Dale's (1956) publication.

The native flowering plants growing in this region are too numerous to record. (Dale, 1956).

The climate of Murray County is humid and characterized by warm summers with comparatively short mild winters. The mean annual temperature is 62.7° F. The average annual precipitation is 38.65 inches. About 70 per cent of the precipitation occurs during the growing season. (United States Department of Agriculture Yearbook, 1941).

The distribution of P. occidentalis L. extends throughout the county. From north of Humble Lake over the mountains to the north slope in T2S, R1W, Sec. 18,7,6, and T1S, R1W, Sec. 31,30,19,18, they are growing along Eight Mile Creek to near the hamlet of Hennepin, then to Wildhorse Creek. P. occidentalis L. is found along Squirrel, Colbert, Red Branch, and Hover Creeks in the northern part of the county. These creeks flow into the Washita River near Davis. P. occidentalis L. is one of the dominant trees in the county.



They are found along the ravines in the west and on the slopes in the east.

### Garvin County

Garvin County is in the transitional belt between the forested land and grass land. The area is described as a Oak-Hickory savannah (*Quercus* association) and True Prairie. (Bruner, 1931). The eastern part of the county is forested, while the western part is mostly prairie. The county is predominately smooth rolling hills formed from shales. It is described as the Permian Redbed. Some sandstone outcrops in the extreme western part of the county are remnants of the Arbuckle Mountains. The terraces along the Washita River are sandy to sandy loam soils for one to two miles on either side of the river. The county lies within the great physiographic province of the central United States known as the Central Lowland, and in the Cross Timber section of Oklahoma. (Fitzpatrick, 1936).

The drainage in the county is through the Washita River and its tributaries. The tributaries are Wildhorse, Rush, Willow, Sandy, Kiel Sandy, and Cherokee Sandy Creeks.

The vegetation in the county is forest and prairie. The forested land is associated with open areas of grasses. The dominate trees on the uplands are post oak and blackjack oak. The trees in the lowlands are hickory, persimmon, blackhaw, American elm, winged elm, redbud, red mulberry, Osage-orange, juniper, ash, sycamore, pecan, black willow,

cottonwood, dogwood, alder, horse-chestnut, black walnut, chittamwood, redhaw, blackhaw, hackberry, chinquapin, red, black, and bur oaks, and sand plum.

The grasses that dominate the area are hairy grama, side-oats grama, blue grama, bluestems, indian grass, wild ryegrass, western wheatgrass, cheatgrass, three awn, and Panicum sp. These are found on the prairies and the rolling hills of the county.

The climate is mild winters with a few intermittent cold snaps known as "norther". The summers are warm with a mean annual temperature of 62.5° F. The rainfall is the greatest during the growing season. Its average annual precipitation is 34.86 inches. (United States Department of Agriculture Yearbook, 1941).

The distribution of P. occidentalis L. in Garvin County, which is north of Carter and Murray Counties, is on Massey Creek which flows into Wildhorse Creek west of Hennepin two miles. P. occidentalis L. is growing along the creeks near the county line of Garvin and Murray Counties. These creeks flow into Wildhorse Creek from the Arbuckle Mountains. Wildhorse Creek does not have P. occidentalis L. growing along it, but the mountain creeks have P. occidentalis L. growing intermittently near them. From Davis, along the Washita River, to Wynnewood, P. occidentalis is found abundantly on both sides of the river. The Washita River has water flowing in it all year and is of a flood plain type. The river will overflow in wet seasons. It has sandy soil with banks about five to ten feet above the river bed. From Wynnewood, north along the Washita

River, to one mile north of Pauls Valley, P. occidentalis is growing intermittently. The P. occidentalis L. is found growing in the first flood terrace of the Washita River. It is also found growing along Cherokee Sandy Creek northeast of its mouth four miles southeast of Pauls Valley. They follow along Cherokee Sandy Creek and its tributaries, Kiel Sandy and Willow Sandy Creek. They leave the county and continue into Pontotoc County along Cherokee Sandy Creek nine miles southeast of Stratford.

#### Pontotoc County

Pontotoc County is east of Garvin County. It lies within the great physiographic province of the Central United States known as the Central Lowland and Cross Timber section of Oklahoma. (Fitzpatrick, 1936). The county consists of rolling prairies, forested land, and some hilly land.

The drainage of the county is through the tributaries of the Blue River, Canadian River, Muddy Boggy Creek, Clear Boggy Creek, Sandy Creek, and Spring Creeks. The hilltops are stony and the valleys broad, V-shaped, and shallow. The eastern part of the county is underlain by dolomitic limestone, and the western part by sandstone. In the eastward and southeastward drainage sandstone is the dominant rock; but shale, granitic conglomerate, limestone and old river deposits of sandy clay are present.

The native vegetation embraces three distinct types of plant associations. The prairie type of vegetation is on calcareous soils, as a rule. The vegetation on coarser textured soils on the uplands is dominated by post oak and blackjack oak. Associated with these trees are hickory, black, red, bur, and chinquapin oaks, persimmon, blackhaw, redhaw, ash, hackberry, winged elm, American elm, redubd, dogwood, cottonwood, alder, bitternut, black walnut, juniper, Osage-orange, pecan, chittamwood and willow. The third vegetate association in the county is the native vegetation along the stream bottoms which consists of a heavy growth of trees, mainly black oak, elm, pecan, chinquapin oak, sycamore, bitternut, black walnut, flowering dogwood, and buttonbush. Large parts of the land has been cut and cleared. A complete list of the native vegetation is in the publication by McCoy, (1959).

The climate of the area is warm summers and cool winters. The mean annual temperature is 61.8° F. with a mean annual rainfall of 39.97 inches (United States Department of Agriculture Yearbook, 1941).

The distribution of the P. occidentalis L. in Pontotoc County is wide spread in all parts of the county. The western most distribution is along the tributaries of Sandy Creek in T3N, R4E, Sec. 31, 30, 19, and 18 south-west of Vanose and continues along Sandy Creek to the South Canadian River. The northwestern distribution of P. occidentalis L. is in T4N, R4E, Sec. 18 and 19 along Spring

Creek northwest of Vanoss. It follows Spring Creek to Sandy Creek two miles west of Ada. On all the tributaries to the south of the South Canadian River, P. occidentalis L. will be found. It is also in the northwest corner of the county in T6N, R4E, Sec. 30, 31, and along the river bed of the South Canadian River. The P. occidentalis L. is found in most of the bottomland creeks in the northwest part of the county.

#### McClain County

McClain County is in the Osage Plains section of the Central Lowland physiographic province. (Fenneman, 1930). The county is an undulating to smooth rolling prairie. The drainage of the county is through the Canadian River, which forms the north boundary of the county, its tributaries, and the Washita River, to the south in Garvin County, its tributaries. The P. occidentalis L. is not found along the drainage of the Washita River in this county. It is only found along the Canadian River drainage.

The county is underlain by Permian red beds of the Paleozoic era. (Buckhannan, 1942). The county has three major geology formations. The first one is the Garber Formation, which occupies the forests areas of the rolling hills of the eastern part of the county. This formation consists of red sandstone with some beds of red clay shale. The vegetation associated with the Garber Formation is

dominantly post oak, and blackjack oak with association of hickory, persimmon, red oak, where moisture and soil permits growth. Second formation is the Hennessey Shale Formation, that is red calcareous clay shale with some dolomite and sandstone formations. This formation is found in the prairies of the western part of the county. The native vegetation of the prairie and the Hennessey Formation are little bluestem, big bluestem, side-oat grama, buffalo grass, and Panicum sp. Some of the less important grasses are hairy grama, blue grama, silver bluestem and three-awn. There are some areas of Indian grass and switch grass of some importance. The third formation is the Duncan sandstone. It is found in the highest extreme northwestern parts of the county. The vegetation in this area overlaps that of the Hennessey Shale Formation. Along the rivers and creeks in the county, large alluvial deposits from the Pleistocene Formation occur. Vegetation along the alluvial deposits from the Pleistocene Formation are in association with the trees of the Garber Formation. These trees of the alluvial soil are American elm, bur oak, hackberry, black walnut, pecan, cottonwood, willow, sycamore, buttonbush, wild grape, smilax and buckbrush. Some of the vegetation found in the disturbed, overgrazed pastures, and abandoned fields are three-awn, dropseed, little barley, brome grass, Sixweeks fescue, red lovegrass, fall witchgrass, hairy triodia, hairy crabgrass, and Johnson grass. The annual

The annual weeds of importance in this area are pigweed, sunflower, cocklebur, horsenettle, buffalobur, sandbur, tick trifolium, and croton.

The climate is continental and humid with hot dry summers and usually short mild winters with some short severe cold spells. Those "northers" are accompanied by strong north winds that may last for two to three days. The annual mean precipitation is 35.10 inches recorded at Purcell. The average maximum winter temperature is 38.8° F. The average maximum summer temperature is 83.4° F. (United States Department of Agriculture Yearbook, 1941).

The western distribution of P. occidentalis L. extends to two miles east and one-half mile north of Wayne and becomes more abundant to the east of Wayne. The distribution is east of Wayne to the McClain and Pontotoc Counties line near the South Canadian River. P. occidentalis L. extends along the South Canadian River to the north of Wayne.

#### Cleveland County

Cleveland County is in the Osage Plains section of the Central Lowland physiographic province. (Fenneman, 1930). It contains undulating to smooth, rolling prairie that slopes to the south-southeast. Cleveland County is in central Oklahoma. The western and northwestern parts of the county are prairie, and the eastern and southeastern parts of the county are forested land. Adjacent to the

rivers and creeks are benches or terraces that occur in strips of one to four miles wide.

The drainage of the county is through the Canadian River and Little River and their tributaries Hog, Spring, and Pond Creeks. The western part of the county is drained by short unnamed tributaries.

The county is underlain by Permian red beds of the Paleozoic era. (Buckhannan, 1942). Duncan sandstone is found in the highest extreme of the northwestern part of the county and consists of red calcareous sandstone. Hennessey Shale, a red calcareous clay shale with some dolomite and sandstone formations, is found in the prairie. The last major soil distinction is the Garber Formation, which occupies the forested areas of eastern Cleveland County. This formation consists of red sandstone with some beds of red clay shale that are from two to ten feet thick.

The alluvial deposit from Pleistocene Formations occurs along the larger streams in the county.

The native vegetation of the prairie of Cleveland County is predominantly bluestems, side-oat grama, and buffalo grass. Less important grasses are hairy grama, blue grama, silver bluestem and three-awn.

The native vegetation of the forested area of the eastern part of the county is predominantly post oak and blackjack oak, with the association of hickory, persimmon, red oak, where moisture and soil permits growth. The



vegetation found along alluvial deposits includes the above trees as well as American elm, bur oak, hackberry, black walnut, pecan, cottonwood, willow, sycamore, button-bush, wild grape, smilax and buckbrush.

Some of the grasses found in the disturbed, overgrazed pastures, and abandoned fields are three-awn, dropseed, little barley, bromegrass, sixweeks fescue, red lovegrass, fall witchgrass, hairy triodia, hairy crabgrass, and Johnson grass. The annual weeds of importance in this area are pigweed, sunflower, cocklebur, horse nettle, buffalo-bur, sand-bur, tick trifol, and croton.

The climate is continental and humid with hot dry summers and usually short mild winters with some short severe cold spells. These "northers" are accompanied by strong north winds that may last for two or three days. (Thorntwaite, 1948).

The annual mean precipitation is 33.02 inches, but ranged from 19.19 to 56.64 inches. There are 209 frost-free days in the county. The average winter temperature is 38.8° F. and that of summer is 82.0° F. (United States Department of Agriculture Yearbook, 1941).

The western distribution of P. occidentalis L. is found one mile south and one and three-fourths miles east of Corbett in the T6N, R1E, Sec. 28. The distribution is along the Canadian River west from the Pontotoc County line to south of Corbett. There is P. occidentalis L. growing north of Box along Pond Creek north nine miles

across highway 39.

### Pottawatomie County

Pottawatomie County is located east of Cleveland County and north of Pontotoc County with the Canadian River forming the southern boundary. The county lies in the great physiographic province of the central United States known as the Central Lowland and in the Cross Timber section of Oklahoma. (Fitzpatrick, 1936). The county is in the Oak-Hickory vegetative formation. (Bruner, 1931).

This county is drained by the Canadian River in the South; the Little River across the south-central section of the county; and the North Canadian River in the north-central section of the county. Some of the more important tributaries associated with the distribution of P. occidentalis L. are Pond, Blacksmith, Bruno, Tyner, Brier, Rock, and Painter Creeks.

The county consists of undulating hills with some wide flood plains along the streams and rivers about one to three miles wide in places.

Pottawatomie County consists of several geological formations. (Weirich, 1956). The Pontotoc group is of sand, shales and conglomerate outcrops in the eastern part of the county. The overlying Acher formation outcrops in the western part of the county. The Hanceville-Conway Red-and-yellow Podzolic soils occur throughout the county. ("Soil and Man", 1938).

Alluvial soil along the streams and rivers supports the growth of American elm, bur oak, hackberry, black walnut, pecan, cottonwood, willow, sycamore and river birch in the eastern part of the county. Large areas are not cultivated in this county. Most of the county is shale and outcrops of conglomerate. The rolling hills are covered with blackjack oak, post oak, and hickory.

The climate is warm, humid, and continental with the wind coming from the south. Summers are long and hot; winters short and relatively mild. The annual mean temperature is 61.8° F. with an average annual precipitation of 34.81 inches. (United States Department of Agriculture, 1941).

The distribution of P. occidentalis L. in Pottawatomie County extends to the southwestern corner of the county along Pond Creek south one and one-half miles to Wanette. It extends along Pond Creek for seven miles northwest to the county line from Wanette. It is found growing along the Canadian River and tributary to the north about one mile. The P. occidentalis L. is growing along an unnamed creek to the southwest of Asher and extends north for two miles; also along a creek to the southeast of Asher going north for three miles. Along Bruno Creek two miles north and three miles east of Asher, P. occidentalis L. is growing well. It continues along Bruno Creek to the county line north for seven miles, where Bruno Creek joins Salt Creek four miles east of St. Louis. P. occidentalis L. is found

along Blacksmith Creek two and one-half miles east and three miles north of Asher; also along an unnamed creek one mile south of St. Louis. Salt Creek leaves the county going into Seminole County to the east where it joins Little River. The next place P. occidentalis L. is found is along Little River north of Maud by three miles. It follows along Little River three miles northwest to Harjo. From here it follows along two creeks. One of these creeks goes north of Harjo four miles. The other is Tyner Creek northwest of Harjo. It continues along this creek until it joins the North Canadian River two miles southeast of Shawnee. P. occidentalis L. is found along Brier Creek two and one-half miles west of Earlsboro; also it is growing along Rock Creek two miles north and two and one-half miles west of Earlsboro. The P. occidentalis L. is growing along the North Canadian River from east of Shawnee to the eastern part of the state. The next place P. occidentalis L. is found is along an unnamed creek in the northern part of the county along the Lincoln and Pottawatomie County lines. This location is four miles east and two miles north of Aydelotte.

#### Seminole County

Seminole County is located north of Pontotoc County. Seminole County is in the east central part of Oklahoma. This county is within the great physiographic province of the central United States known as the Central Lowland (Tanner, 1956) and in the Oak-Hickory Formation. (Bruner, 1931).

This county is drained by the Canadian River in the south, which forms the southern boundary; Little River in the south-central; and the North Canadian River in the north, which forms the northern boundary. These rivers have many tributaries. Some of the important ones are Turkey, Gar, Browns Fork, Sand, Wewoka, Salt, Nigger, and Bruno Creeks.

The western part of Seminole County consists of the Pontotoc group of sand, shales, and conglomerate outcrops. The Hanceville-Conway red-and-yellow Podzolic soils occur throughout the county. ("Soils and Man", 1938). The soils are not cultivated. The vegetative cover is largely blackjack oak, post oak, and hickory. About two-thirds of the area is blanketed with shallow, stony or gravelly soil; elsewhere the soils are fine sandy loam. Alluvial soils are along the rivers, creeks and streams. These soils are dominated by the growth of pecan, sycamore, elm, cottonwood, willow, and black walnut.

The climate of the county is warm, humid, and continental with the summers being long and hot. The winters are short and relatively mild. The annual mean temperature is 61.8° F. The average annual precipitation is 43.20 inches. (United States Department of Agriculture Yearbook, 1941).

The western distribution of P. occidentalis L. in Seminole County follows along Salt Creek from Pottawatomie County and extends through the county. P. occidentalis L. follows along Little River from Pottawatomie County.

The tributaries of both Salt Creek and Little River, three to five miles southwest of Maud, have P. occidentalis L. growing along them.

### Lincoln County

Lincoln County is in the central part of Oklahoma. It is in the southern part of the tall-grass prairie in the Central Lowland Province of the United States. (Oakes, 1948).

Lincoln County is a plain consisting of weakly consolidated reddish clays and sandstones of Permian time. Most of the upland is gently rolling. The northwestern part of the county is a rolling to hilly, thinly wooded area, known as Cross Timbers, that is underlain by sandstone.

The major watersheds are the Quapaw Creek, Deep Fork Creek, Canadian River, Bellow Creek, Dry Creek and Headquarters Creek. Most of the surface drainage enters the Cimarron River, which flows eastward through the northern part of the county. Drainage in the hilly southeastern part of the county is toward Deep Fork Creek, a tributary of the North Canadian River. Deep deposits of old alluvium and loess occur on former flood plains of the Cimarron River and Stillwater and Deep Fork Creeks.

The county has two major vegetative associations. The eastern half of the county is of the Oak-History association and the western half is True Prairie. (Bruner,

1931). The dominant grasses are the "big four": little bluestem, big bluestem, Indian grass, and switchgrass. The hills are steep, rocky and covered with post oak, black-jack oak, and hickory. The P. occidentalis L. becomes more abundant along creek in the east with cottonwood, willow, hackberry, black walnut, and elms present also. The western part of the county is more of a prairie with oaks covering about half of the land. Along the creeks, cottonwoods and elms are the dominant trees.

The major geological formations are the Hennessey formation exposed in the western part of Lincoln County, Garber formation outcrops at lower elevations, Hayward sandstone in the upper Garber formation, and Wellington formation is mixed clay and sandstone of the rolling hills. Soils along the flood plains of the creeks and rivers are fertile alluvial types. The flood plains overflow yearly. The alluvial soils are divided into first and second terraces. The second flood plains never overflow.

The creeks in the county are spring-fed and water runs all year in most of the creeks.

The annual precipitation record at Chandler is 33.31 inches with the average summer temperature of 82.6° F. and the average winter temperature of 38.6° F. The summers are hot with the months of July and August dry. The winters are mild with several periods, occurring for the length of two to three days, of severe cold waves called "northers".

The distribution of the P. occidentalis L. runs three miles south, and two miles east of Meeker in south-central Lincoln County along Sandy Creek, a tributary of Quapaw Creek. They are growing north along Sandy Creek to Quapaw Creek. From the mouth of Sandy Creek, they follow Quapaw Creek north and east of Payson, then north to Sparks where they are found along the Deep Fork Canadian River. They are found growing west along the Deep Fork Canadian River to three and one-half miles south and one-half mile west of Chandler. Then it follows Belcow Creek north to one-half mile west of Chandler, extending to two miles north of Chandler. Now the P. occidentalis L. is found near Davenport. Here it follows along Dry Creek starting at the southwest corner of the town of Davenport. From here it is growing along Dry Creek northwest three miles east and one and one-half miles north of Chandler. P. occidentalis L. is growing north, along a tributary of Dry Creek, two and one-half miles east of Agra. It is growing along Big Creek, northeast of Agra, one-half mile to the county line north, which is three miles north and one and one-half miles east of Agra. The western most distribution is west of Agra two and one-half miles to East Creek, then north to the county line. It is growing along Sand Creek north of Tryon five miles to the county line, but the western most place where P. occidentalis L. is found in the county is one-half mile east of Highway 40, nine miles north of Carney. Here the P. occidentalis L.



is found along a creek that flows into the Cimarron River north into Payne County.

### Logan County

Logan County is in the central part of Oklahoma. It is in the southern part of the tall-grass prairie in the Central Lowland Province of the United States. (Oakes, 1948).

Logan County is a plain consisting of weakly consolidated reddish clays and sandstones of Permian time. Most of the upland is gently rolling. The southeastern part of the county is a rolling to hilly, thinly wooded area, in the association of *Stipa-Koeleria* of the Oak-Hickory Savannah, known as Cross Timbers, and is underlain by sandstone. The western part of the county is level and open upland.

The drainage is through the Cimarron River, which flows through the county. The southern drainage is through the tributaries of the Deep Fork River, a tributary of the North Canadian River, in Oklahoma County to the south. The Cottonwood and Skeleton Creeks in the North drain the northern part of the county through the Cimarron River and tributaries.

The summers are hot and dry. The driest years were 1954 and 1964, and the wettest year was 1915. The winters are mild with several cold spells, "northers", that last for two to three days. The average temperature for the summers is 82.4° F. and for the winters a 38.8° F. Average

was recorded at Guthrie. The average precipitation is 32.34 inches. (United States Department of Agriculture Yearbook, 1941).

Logan County was originally tall grass prairie, True Prairie, mainly bluestem grasses together with switchgrass, Indian grass, side-oats grama, blue grama, and buffalo grass. The Oak-Hickory Formation consists of post and blackjack oaks, and hickory which occupy the sandy areas. Elm, oaks, hackberry, sycamore, black walnut, pecan, and other hardwoods are common on bottomlands. (Bruner, 1931).

On loams underlain by medium to clayey subsoils, the natural tendency is for some kind of grass to persist, even after heavy grazing. Sumac and persimmon invade old fields and overgrazed pastures on these heavier soils, but cause less trouble than the invasion of oak on sandier soils.

The major geological formations are the Hennessey, Garber, Hayward, and Wellington. The principal rocks are sedimentary clay and sandstone of the Permian "Red Beds" type.

The Hennessey formation, exposed in western Logan County is in an area of gentle slopes and steep areas along the sides of drainageways and roadways.

The upper part of the Garber formation is the Hayward sandstone. The Garber formation outcrops at the lower elevations of the Hennessey formation.

The Wellington formation is mixed clay and sandstone, and it occupies the rolling to hilly eastern part of the county.

P. occidentalis L. is found in the northeast corner of the county. It is found growing, along the tributaries of the Cimarron River, five miles south and one and one-half miles east of Coyle. From here it is growing south, along the same tributaries, for about four miles. It is growing up to the Cimarron River in this area. The western most part of the county that P. occidentalis L. is found, in Logan County, is one mile south and one mile east of Coyle. There are only a few trees growing at this location. It is difficult to find P. occidentalis L. among the large trees along the Cimarron River.

#### Payne County

Payne County lies within a transition belt of the prairie and the woodland. Its soil and vegetation indicate that it is more a prairie than woodland. (Snider, 1925). Most of the county is treeless, except for some areas of sandy soil near the streams, which are forested. This county belongs to the Oak-Hickory Savannah, True Prairie, and Stipa-Koeliria associations. (Bruner, 1931). The forested areas are covered with oaks, elm, hackberry, willow, and cottonwood. The hills are covered with post oak and blackjack oak with the prairie consisting mainly

of Indian grass, big and little bluestem, and switchgrass.

The soil for the county lies within the Great Plain Soil Province, as defined by the Bureau of Soils. (Snider, 1925). The upland soils are divided principally between rock of the Permian and the Pennsylvanian divisions of the Carboniferous era. The western part is derived from sandstones and shales of the Permian "red beds", limestones of Pennsylvanian Age.

The upland is generally undulating, although there are comparatively large areas of rolling land in the western and extreme eastern parts of the county. In the western and extreme eastern parts of the county, the streams have carved comparatively deep valleys, with exposures of sandstone and shale in places. The central part of the county has more gradual slopes to the streams. An area in the center of the county is more nearly level. Other smaller flat areas occur scattered over the county.

The high terraces or second bottomlands along the Cimarron River are frequently separated from the first bottom by a belt of gradually sloping or gently rolling land consisting of a former terrace now thoroughly eroded. The flood plain or first bottom along the Cimarron River varies in width from one-fourth mile to nearly two miles.

Almost the entire county is drained through the Cimarron River, which empties into the Arkansas River in southeasterh Pawnee County. The northern part of the county drains into Long Branch and Black-Bear Creeks,

tributaries of the Arkansas River. The principal tributaries of the Cimarron River are Stillwater, Council, Euchee, Lost and Wildhorse Creeks.

The climate for the county is mild and generally agreeable, but during the summer months, the days are sometimes extremely hot for periods of weeks or more. Some of the winters are quite severe. Average temperature mean is 59.1° F. with a precipitation mean of 33.83 inches. (United States Department of Agriculture Yearbook, 1941).

The distribution of P. occidentalis L. in Payne County follows along the Cimarron River west to the tributary, Wildhorse Creek which is five miles west of Perkins in the south part of the county. It is found growing north, along Wildhorse Creek, nine miles northwest of T18W, R1E, Sec. 8, 9, and 16. It is found intermittently along the creeks of the area. This would be the western most distribution for Payne County. Now the trail of the P. occidentalis L. takes the path up Lost Creek one and one-half miles east of Perkins. It follows Lost Creek two and one-half miles north, then it follows a tributary north one and one-half miles to the upland prairie. P. occidentalis L. is found growing along a tributary of Stillwater Creek that is four miles west of Mehan. From here it follows this tributary to Stillwater Creek, then along Stillwater Creek to Brush Creeks. The P. occidentalis is found intermittently along the East Branch of Brush

Creek four miles northeast of Stillwater. All along Little Stillwater Creek, from Mehan north to one-half mile south and one mile west of Glencoe, P. occidentalis L. is found. It is along a small creek east of Glencoe that flows into Lion Creek into Pawnee County. Lion Creek flows into Black Bear Creek near Lela in Pawnee County.

### Pawnee County

Pawnee County is an undulating to rolling prairie area north of Payne County. This county, in the early days, was part of the "Strip". (Templin, 1952).

Pawnee County is part of the Osage Plain section of the Central Lowland Province of the United States. The county has a belt of cross timber and tracts of hilly grasslands called Bluestem hills. Most of the surface appears to be level with rolling hills and high bluffs along the rivers. The area west of Pawnee is smoother, has less pronounced ridges, and has less local relief.

The erosion cycle that followed the formation of the Peneplain, probably began in Tertiary times, and is still active. The thick beds of alluvium in the stream's valleys are of recent origin and are fairly shallow, forming broad U-shaped valleys. The bottomland of the Arkansas and Cimarron Rivers is narrow in this county because it is confined by the resistant rock that extends south from the Flint Hills section of southern Kansas.

The drainage for the county is by two main rivers, the

Arkansas River through Black Bear Creek, its tributary, and a number of shorter streams; and the Cimarron River which is drained through small streams. The Arkansas and Cimarron Rivers both flood small areas each year and in wet years they flood large areas of good fertile bottomland.

The Dougherty and Eufaula soils of the upland support the growth of oaks. (Templin, 1952). About 20 percent of the county is forested. On the thin, stony Darnell and Stephenville soils of the upland, blackjack and post oaks are slow growing. The alluvial soils of the bottomlands have trees growing faster and taller than on the upland.

The grassland area is known ecologically as the True Prairie and Oak-Hickory Savannah. (Bruner, 1931). Normal cover of bluestems and medium tall grasses is found. The eastern third has wooded and grassy openings. The central section has oaks and grassland prairie assortments. The names and growing sites of grasses, plants, and trees common in the county are listed in the section on management of range and natural meadows. (Templin, 1952).

The distribution of P. occidentalis L. in Pawnee County is found along an unnamed creek on the Payne-Pawnee County line, one and one-half miles north, and one-half mile east of Glencoe in Payne County. The P. occidentalis L. is found growing along that creek for about one mile, then it is found along Lion Creek which flows into Black Bear

Creek near Lela west of Pawnee. Lion Creek is partly in Noble County, between Glencoe and Lela. From Lela, P. occidentalis L. follows along Black Bear Creek northeast to the mouth of Turkey Creek, then six miles northwest of Pawnee, It follows Turkey Creek north to T22N, R3E, Sec. 9. P. occidentalis is found on Rock Creek one mile northeast of Turkey Creek at T22N, R3E, Sec. 9. It follows Rock Creek to the Arkansas River. Along the Arkansas River, north to the next county, P. occidentalis is growing, as well as along all the tributaries about one-half mile from the Arkansas River.

#### Noble County

Noble County is north of Pawnee County in undulating to rolling prairie area. Grass has developed on the dominant soils. Surface layers are slightly to moderately acid loam and silt loam, and the subsoils are limey, compact, very slowly permeable clay. (Fitzpatrick , 1941).

The climate is continental, warm temperate, and subhumid. Average annual precipitation is 34.24 inches. The average temperature is 60.3° F. (United States Department of Agriculture Yearbook, 1941).

The soils are the driest in July and August. In late spring, summer, and early fall the heavy showers are capable of washing the top soil away. Vegetation and terracing are used to prevent the soil from eroding.



The native vegetation consists principally of mixed, tall, and short grasses. There are three distinct associations in this county. The first association, *Stipa-Koeleria*, occurs on the silt loam, loam, and clay loam soil of the uplands. Bluestems, grammas, and buffalograss dominate the uplands. Bluestems are found in the meadows and roadsides. The second association, True Prairie, occupies deep and loose sandy soils in the northeast part of the county. This area is surrounded by the Arkansas River on three sides. Post and blackjack oaks are dominant. The sandy prairie is associated with the little bluestems, sand bluestem, Indiangrass, *Panicum* sp., Johnsongrass, field sandbur, and hairy grama. The third association, Oak-Hickoary Savannah, occurs along the alluvial soils. The elm, chinquapin oak, post oak, blackjack oak, hackberry, chittamwood, willow, cottonwood, and sycamore are found intermittently with several surbs in this area. (Bruner, 1931).

The distribution of *P. occidentalis* L. has been noted one and one-half miles west, along Black Bear Creek, of Lela in the southern part of the county and in the "Big Bend Country", the land surrounded by the Arkansas River on three sides, in the northeast part of the county. (Fitzpatrick, 1941). The *P. occidentalis* L. is growing along the Arkansas River and along the tributaries flowing into the Arkansas River, in the "Big Bend Country". It

follows the Arkansas River to the mouth of the Salt Fork of the Arkansas River, then follows the Salt Fork Arkansas River into Kay County.

### Kay County

Kay County is in the north central part of Oklahoma with its north boundary being the Kansas=Oklahoma line. It lies in the Stipa-Koeleria association of the Oak-Hickory Savannah. (Bruner, 1931). The major waterways of the county are the Salt Fork Arkansas River, Chikaskia River, Arkansas River and their tributaries. These rivers will overflow in some places in the county each year. The water damage to property and lives is great. The land is generally smooth with large amounts of open soil for crop land in the western part of the county. Along the major rivers, there are large amounts of sand and sandy soils. The Arkansas River has banks of a limestone or flint type soil with bluffs of rock along the river. The trees along the Arkansas River are large in diameter and tall. The plant association to the east along the Arkansas River, with alluvial soils, is elm, cottonwood, hackberry, chittamwood, chinquapin oak, oak post oak, blackjack oak, and sycamore. The plant association, in the rest of the county, is mixed tall grasses with bluestems of the Flint Hills of Kansas. Grama and buffalograss are dominant. Most of the bluestems are found in meadows and roadways. Buffalograss is in the northwest part of the county. The last association is the county is along the

Salt Fork Arkansas River and the Chikaskia River. On the sandy soil of these rivers, there are fast growing trees of willow, cottonwood, and elm. Plants in this area are field sandbur, sand bluestem, and sunflower. Along the Chikaskia River, hackberry, elm, cottonwood, post oak, black-jack oak, and chinquapin oak grow, with little bluestem, grama, Panicum sp., and Johnsongrass growing on the slopes to the river.

The average summer temperature is 81.2° F. with an average winter temperature of 36.8° F. The average annual precipitation is 33.92 inches. The recording station is at White Eagle, Kay County. (United States Department of Agriculture Yearbook, 1941).

The distribution of the P. occidentalis L. is along the Salt Fork Arkansas River from the mouth of the river in Noble County to the Chikaskia River, east of Tonkawa. The P. occidentalis L. is found growing along the Chikaskia River to the northwest corner of the county and into Grant County. P. occidentalis L. is found about 200 yards to the west in some places along this general distribution. P. occidentalis L. is not found along the Salt Fork Arkansas River above the Chikaskia River. A few P. occidentalis L. are found growing along the Salt Fork Arkansas River a hundred yards west.

#### Grant County

Grant County is in the north-central part of Oklahoma.

Its boundary forms the Kansas-Oklahoma State line. The county lies in the plains region of Oklahoma, which slopes slightly toward the east. The land, in general, is smooth, consisting of small areas of undissected upland scattered throughout. The county is drained by the Sa t Fork Arkansas River and its tributaries.

This county is in the Osage Plains section of the Central Lowlands Province of the United States. Goks, 1931). It is in the Stipa-Koeleria association of the Oak-Hickory formation. (Bruner, 1931).

The mean annual rainfall is 29.52 inches, most of which occurs during the growing season. The mean annual temperature is 58.3° F. (United States Department of Agriculture Yearbook, 1941).

The soils are of the Reinach, Osage, and Yahola series. Large areas of the county are good cropland. (Goke, 1931).

The P. occidentalis L. is found along the Chikaskia River 200 yards west of the Kay-Grant County line with the Kansas-Oklahoma State line on the north. It is found in two sections of the northeast corner of the county T29N, R3N, Sec. 13 and 24.

## CHAPTER III

### INTERPRETATION OF RESULTS

The results of this paper determined the western-most part of each county where P. occidentalis L. is found. The P. occidentalis L. is growing along the creeks and rivers of these counties. It seems to do well in open areas which have no over-growth from other species of trees. Few young seedlings are found in the western-most parts of the distribution. The P. occidentalis L. is growing well along the larger creeks and rivers, where there are more open areas. Less frequently it is found in the narrow creeks. Also it is found growing in an area of 29 to 38.6 inches of precipitation. P. occidentalis L. is growing to the west of the 97°00' meridian. In the southern part of the state it grows further west of the 97° 00' meridian than in the northern part of the state. Through the middle section of the state the P. occidentalis L. is growing along the 97° 00' meridian. The P. occidentalis L. seems to be growing to the eastern edge of the Permian Red Bed Plains. It is growing well when there is an abundance of moisture wither in the creeks, rivers or the sub-soil. The trees grow to a good size in the western area.

P. occidentalis L. in Cultivated Areas

*P. occidentalis* L. is found growing in Grady County two and one-half miles west of Chickasha, one tree is near an old homesite. Also, one and one-half miles north, one and one-half miles west, and three-fourths mile north of Minco there is a shelter belt of *P. occidentalis* L. Some young seedlings are growing north of this shelter belt along the South Canadian River. There were five young trees, three to five feet tall. Some young trees were planted in Red Rock Canyon in Caddo County in western Oklahoma during the summer of 1964. There is a shelter belt growing seven miles west of Crescent, Oklahoma in Logan County. Three trees are growing near a barn one-fourth mile east of Malcomb in Pottawatomie County. There is one tree growing near an old estate swimming pond one-half mile north of Noble in Cleveland County. Many towns use *P. occidentalis* L. for their parks and home landscaping. North of highway 66 and Lincoln Blvd. in Oklahoma City, some *P. occidentalis* L. have escaped from some of the estates in the area and are growing along the creeks in the area. One tree is growing near the bridge over the North Canadian River north of McCloud in Oklahoma County. It was planted about 25 years ago by one of the residents of McCloud. This resident planted two more west of McCloud along Highway 3.

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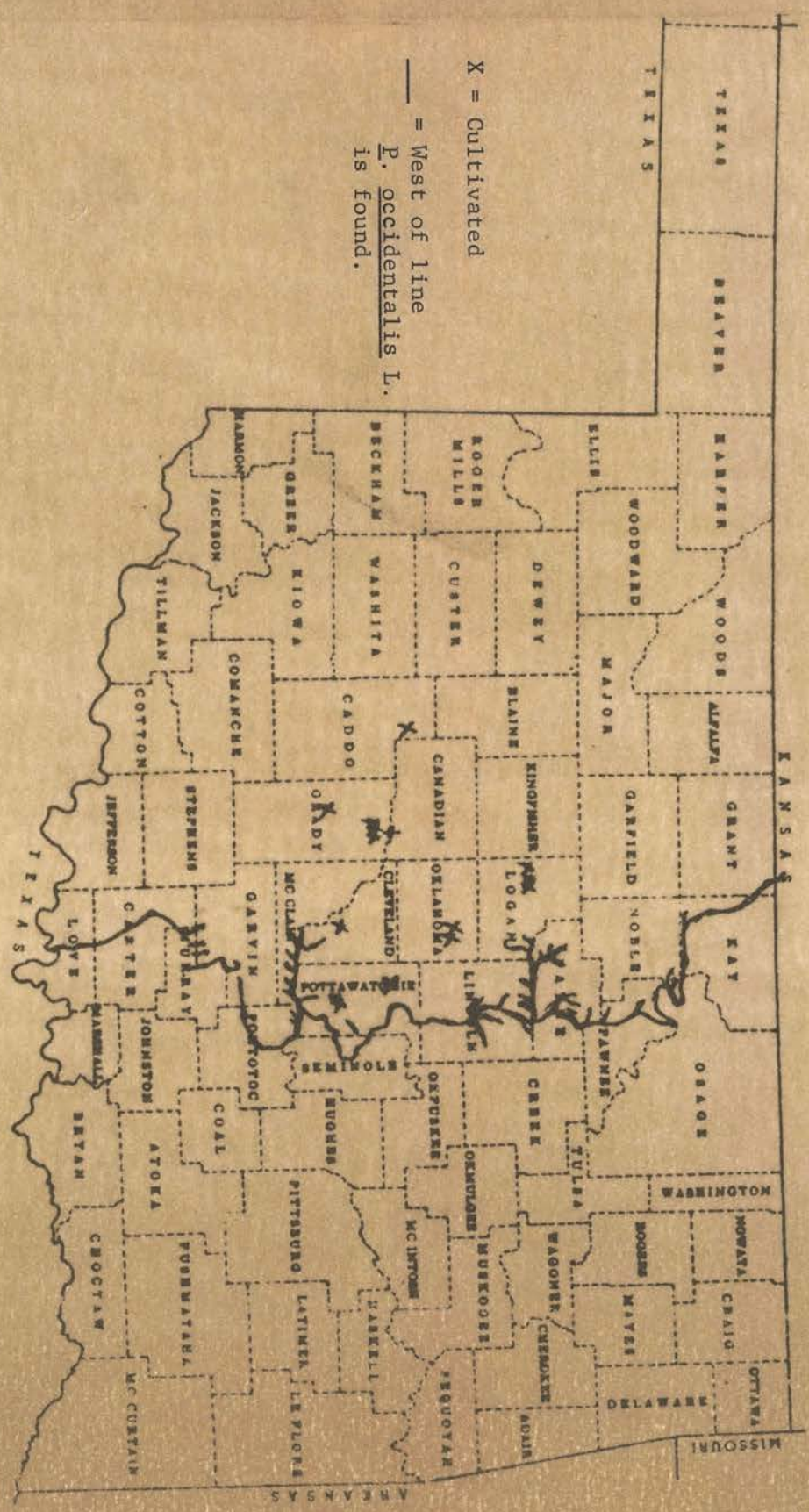
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X = Cultivated  
 — = West of line  
P. occidentalis L.  
 is found.



VITA

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the University of Oklahoma for two years under  
a National Science Foundation Research Grant, Some  
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