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A SURVEY OF THE WOODY PLANTS OF A SELECTED AREA IN OSAGE TOWNSHIP ALLEN COUNTY KANSAS

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A SURVEY OF THE WOODY PLANTS OF A SELECTED AREA
IN OSAGE TOWNSHIP ALLEN COUNTY KANSAS

A Thesis Submitted to the Graduate Division in
Partial Fulfillment of the Requirements for the
Degree of Master of Science

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By

French Booher

KANSAS STATE TEACHERS COLLEGE

Pittsburg, Kansas

August, 1935

WITHDRAWN

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CHAPTER I

INTRODUCTION

This paper contains the results of studies of the woody plants of a selected area in Osage township, Allen county, Kansas, during the spring, summer, and fall of 1934 and spring of 1935.

This area which is two miles long and approximately three hundred yards wide is located in the northeastern part of Allen county about three miles east of Mildred, Kansas.

In making this survey the writer has attempted to identify and classify the woody plants, namely the trees, shrubs, and vines. This area has been used by the writer for the past several years as a field laboratory, for high school classes in the study of trees, shrubs, vines, and flowering plants.

Everyone should know the woody plants, especially the ones that grow in the community in which he lives. It is hoped that the present study will be helpful to the patrons of the school and the high school boys and girls who are interested in the study of nature and its related subjects.

(The value of trees, shrubs, and vines to a community cannot be definitely estimated. They are a source of shelter and food for the wild life that inhabit wooded sections. (The birds find shelter, protection, and some of their food on the trees, shrubs, and vines of wooded areas. Many birds nest in the trees and shrubs that are located

near a supply of food of which they are particularly fond. The fruit of the elders, sumachs, thornapples, hackberries, and wild cherries afford such food in great quantities.) The squirrel depends entirely upon trees for its shelter, protection, and food. The walnut and hickory trees provide these necessities.

The following list of plants may not be complete due to the fact that the major portion of this survey was made during the extremely dry season of 1934. A further survey during a normal season might show the presence of other specimens that had been affected by the drought. It is hoped this paper will create an interest in nature for both young and adults and cause others to make a greater and even more complete survey of this section.

The writer has no knowledge of any survey ever having been made in Allen county or in any of the adjoining counties.

PROCEDURE

In making this survey of the woody plants a small section of the entire area was selected. Beginning at the western extremity of the selected area in Osage township, Allen county, Kansas, imaginary lines were drawn with some particularly outstanding tree or shrub marking the boundary of the small area to be surveyed. This small area selected was thoroughly examined and studied for every tree, shrub, and climbing plant.

This same method was used for each small section until the entire area had been carefully surveyed and studied.

Notes were made at the time of survey on the following characteristics: color, roughness and smoothness of bark; height of plant; method of branching; time of flowering and color of flowers; shape, size, and form of leaves; numbers of each species, in societies and associations; plants growing in sunlight or shaded areas; soil conditions such as, texture, porosity, moisture content, temperature, and any other characteristic that would be valuable.

The writer attempted to identify all specimens as they were found in the field using both the natural and artificial keys used in the classification of plants.

In cases of doubt or where the identification of a particular species depended upon the flower parts this plant was checked and rechecked the following spring during the flowering season.

CHAPTER II

PHYSICAL FEATURES

PHYSIOGRAPHY AND GEOLOGY OF ALLEN COUNTY

The rocks and shales of Allen county are of the Carboniferous system. This system was formed in the Carbonic age which lasted approximately two and one-half million years. It was grouped into three well defined periods. These periods were the Mississippian, Coal Measures, and Permian, with outcroppings of the following formations: the Erie limestone, Thayer shale, Iola limestone, Lane shale, and Garnett limestone. These formations consist of alternating beds of shale and limestone belonging to the Carboniferous system. The stratigraphic formations of this area, however, are later deposits forming the basal members of the Upper Coal Measures. These strata are conformable one with another and have a slight dip to the north and west, thus successively exposing the five formations, as recognized by the state geologists. Each of these outcrops reveals itself in the characteristics of the soil formed thereon and by the peculiarities of the surface.

The limestone of the Erie formation is associated with large, light colored, chert fragments, the upper stratum of this limestone and the included chert are exposed along the banks of Big Creek.

The Thayer shale which overlies the Erie formation

has furnished the surface materials for a narrow area extending in a northeast-southwest direction from the Little Osage river to the vicinity of Leanna.

The Iola limestone is the next higher member in the geologic column and is covered with the Lane shale which has a wide exposure through the central part of the area, contributing liberally to the formation of the Oswego Silt loam of this section.

The uppermost member of the geologic column, the Garnett limestone, outcrops near Carlyle, Kansas, which is at some distance west of this plant survey.

The geology of this area is, in a measure, a description of its physiography. The area has only one topographical feature. In the eastern half of this area, the south bank of the creek, which is almost solid limestone, rises almost perpendicular for about thirty to forty feet. The soil has fallen over the edges of the cliff and lodged in cracks and crevices where small trees and many other plants are found growing in great numbers.

In general, the major portion of this area may be described as a gently rolling upland, rising from forty to one hundred feet above the valleys of the larger streams. The extreme elevation, which is about eleven hundred feet above sea level, is near Moran, Kansas. Aside from this limestone bluff, the profile and contour lines have slight curves. The surface features and soil are favorable for plant production.

SOILS

The Oswego Silt Loam, commonly known as, "white ashy land", covers about one-eighth of the area of this survey. It is located on the south side of Little Osage river and varies from seven to eighteen inches in depth with an average of about twelve inches.

It is best described as a gray to dark-gray, more or less ashy silt loam containing small amounts of very fine sand, which is difficult to observe without the aid of a microscope.

Underlying the Oswego Silt Loam from twelve to thirty six inches is found a dark-drab to yellow silty-clay subsoil, which is compact, stiff, impervious, and popularly known as "hardpan".

The vegetation found growing in the Oswego Silt Loam soil is more of the shrub and thicket type. Here may be found small societies of wild plum, dogwood, hawthorn and Indian Current. The soil in this formation lacks sufficient organic material and depth to support the larger plant forms.

The Yazoo Loam soil makes up approximately seven-eighths of the soil of this survey. It is an alluvial deposit and varies somewhat in texture. It is composed chiefly of silt, fine sand, and clay in different proportions, with the silt largely predominating. This silt loam has an average depth of ten inches. Below this to a depth of thirty-six

inches is found a dark-gray to dark-yellowish-gray silt and fine sandy loam, permeable and easily penetrated by all deep rooted plants. This soil is very rich in organic material.

In places where the Yazoo loam extends into cultivated fields erosion has occurred to some extent. In the timbered sections the trees and shrubs protect this soil from washing readily. The Yazoo loam supports an abundant vegetation because of its depth and large amount of organic material. Here may be found the larger plants such as white oaks, walnuts, hickories, and hackberries.

CLIMATE

The climate of this region is moderate. The minimum temperature hardly ever exceeds five degrees below zero during the winter months and one hundred degrees above zero during the summer months. The mean average temperature for a period of twenty eight years was approximately fifty five degrees.

The rainfall for this area averages about thirty seven inches per year with the greatest amount of precipitation coming during the growing seasons. This rainfall with the moderate temperature range is very conducive to the greatest plant growth.

The growing season is somewhat longer than the average for Kansas. The last frosts usually occur about April first to April tenth and the first frosts October fifteenth to October twentieth. This gives to this section a growing

season of approximately one hundred ninety to one hundred ninety five days.

The average monthly rainfall, temperature, and direction of the wind for a period of twenty eight years, 1906 to 1934 inclusive, is shown on page nine, table one.

TABLE I

THE AVERAGE MONTHLY RAINFALL, TEMPERATURE, AND DIRECTION OF WIND FOR A PERIOD OF TWENTY-EIGHT YEARS, 1906-1934 INCLUSIVE

Month	Rainfall	Temperature	General Direction of Wind	Velocity of Wind Miles per hour
Jan.	1.370"	31.96°	South	7.60
Feb.	1.397"	36.00°	North	8.26
Mar.	2.531"	46.00°	N.-S.	9.02
Apr.	3.925"	57.00°	South	8.64
May	4.594"	60.96°	South	7.11
June	4.802"	73.03°	South	6.09
July	3.324"	78.46°	South	5.24
Aug.	3.439"	76.41°	South	5.20
Sept.	4.814"	68.85°	South	5.44
Oct.	3.176"	54.37°	South	5.86
Nov.	2.416"	47.23°	South	7.37
Dec.	1.279"	35.07°	South	7.80
Total	37.067"	665.34°	South	85.65
Mean Monthly Average	3.088"	55.453°	South	6.969

CHAPTER III

TAXONOMIC LIST OF PLANTS

ORDER JUGLANDALES; WALNUTS, HICKORIES

Family Juglandaceae

Carya ovata Shellbark Hickory

The Shellbark Hickory is a tall straight tree with a central shaft which sends out many short, small, lateral branches almost at right angles to the trunk. The bark is gray, loose, and appears to roll upward, giving the trunk of the tree a very shaggy appearance.

The wood is heavy, strong, tough, close-grained, and elastic. It is used in the manufacture of agricultural implements, carriages, handles, and hoops. The nuts are used for food.

It is found in the New England states, west to the Dakotas, and south to Arkansas. It reaches its largest size in the Ohio valley. This hickory prefers a deep, rich, moist soil.

Carya glabra Pignut or Brocm Hickory

The Pignut Hickory is a tall straight tree. The bark is gray, firm, close, and divided by small fissures. There are usually five to seven leaflets that make up the compound leaf. The nuts grow in small clusters, have a bitter taste,

and are much smaller than the nut of the shellbark.

The heart wood is either dark or light-brown; the sapwood is nearly white. It is heavy, hard, close-grained, tough, elastic, and is used in the manufacture of agricultural implements. The nuts make good feed for hogs.

It is common throughout the northern states, as far south as Florida, and southwest to Texas. It prefers dry ridges and hill sides, but grows well under many different conditions.

Juglans nigra Black Walnut

The Black Walnut is a picturesque tree with a long pinnately compound leaf. The bark of the tree is very dark and the branches, in contrast with the light-green foliage, look black. One objection to the tree is that the leaves are late in coming out in the spring and fall early in the autumn. The fruit grows in clusters and ripens in early fall.

The wood is dark purplish-brown, heavy, hard, close-grained, and strong. It is very durable and because of its beautiful grain it is used for fine furniture, interior finishing, and gunstocks.

The Black Walnut has a general distribution but is least common in the Atlantic states and most abundant in the middle Mississippi valley. It prefers rich bottom lands and fertile hillsides.

ORDER CARYOPHYLLALES; WILLOWS, COTTONWOODS

Family Salicaceae

Salix nigra Black Willow

Salix nigra or Black Willow is usually a small tree but often grows tall in eastern and central North America. It is usually found leaning over the water of streams, lakes, and may be recognized by its long, narrow, yellow-green, shining leaves, which taper gradually to a long point and give the effect of delicate foliage.

The bark is dark brown or nearly black, and sometimes a lighter brown. The wood is light reddish-brown, light, soft, close-grained, and weak.

Its range is from New Brunswick to Florida, westward to the foot hills of the Rocky Mountains, and south to Mexico. It prefers moist or wet soil.

Salix wardi Black Willow (Wards Willow)

Salix wardi is a large shrub or small tree. It is found growing in close relationship with *Salix nigra*. It grows along the streams and lakes and has a long taper-leaf with cordate stipules at the base of the petiole.

The bark is dark-brown or nearly black. The wood is light reddish-brown, light, soft, close-grained, and weak.

Its range is from New Brunswick south to Florida, westward to the foot hills of the Rocky Mountains, and south into Mexico. It prefers a moist or wet soil.

It differs from *Salix nigra* in that it has an entirely different shaped stipule and leaf. The fruit is somewhat larger, and more globose-conical.

Populus deltoides Cottonwood

The cottonwood is a large tree with greenish-gray bark on the trunk and light-gray in the smaller branches. The leaf was named after the Greek letter Delta. This tree is a rapid grower and has been planted in the west because of this fact. It blooms before the leaves come out. The leaves turn yellow early in the fall and usually drop before the first frost.

The wood is dark brown, light, soft, close-grained, and weak. It warps badly in drying. It is used in the manufacture of paper pulp, cheap packing cases, and fuel.

It is comparatively rare and of small size in the eastern states. The cottonwood is the largest and most abundant tree along the streams between the Appalachian and Rocky Mountains.

ORDER RANUNCULALES: PAPAWE

Family Anonaceae

Asimina triloba Common Papaw

The Papaw is a small tree that has adapted itself to growing in the shade of other trees. The leaves are large, alternate, simple, feather-veined, and obovate-lanceolate. The bark is dark-brown and blotched with gray spots. The inner bark is tough and fibrous.

The wood is pale, greenish-yellow, light, soft, coarse-grained, and spongy. The fruit has an unusual taste, is very nutritious, and is used for food by both man and other animals.

The northern range of the Papaw is western New York, east to eastern and central Pennsylvania, west to Michigan and Kansas, and south to Florida and Texas. It prefers rich bottom lands where it sometimes attains the height of thirty feet.

ORDER ROSALES; CHERRY, PLUM, REDBUD, LOCUST

Family Rosaceae

Prunus virginiana Choke Cherry

The bark of the Choke Cherry is dark-brown and slightly fissured. The leaves are alternate, oval, wedge-shaped, rounded at the base, and feather-veined. This tree blooms in May after the leaves appear. The blossoms are white. The fruit is a drupe. It is globular, dark red, and astringent to the taste.

The wood is light-brown, heavy, hard, and close-grained. It is easy to polish and is used in the making of furniture and ornaments.

The Choke Cherry is one of the most widely distributed of American trees. It grows all over the United States except from the continental divide westward. In the north it is a small shrub or tree, while in the south it is much larger. It grows best along creeks and rivers.

Prunus serotina Wild Black Cherry

The Wild Black Cherry is a tree with a sturdy stout trunk and spreading branches. The head of the tree is usually round, but sometimes narrow and oblong. The bark on the old trunks is black, rough, and broken into small irregular rounded plates. On the young trunks and large limbs it is smooth and shining. The branches are pale green and smooth. The leaves are alternate, simple, and oblong to lanceolate-oblong.

The wood is light brown or red, darkening with exposure. It is light, strong, and close-grained. Because the wood takes a fine polish it is of great value for cabinet work and interior finish for houses.

The Wild Black Cherry grows well in the eastern half of the United States. On the slopes of the southern Alleghanies it grows to the height of one hundred feet. It prefers a rich moist soil, but will grow on light sandy soil.

Prunus americana Wild Plum

The Wild Plum is a small tree less than twenty feet high. The trunk of the tree divides into a number of stout, upright branches. The bark is gray-brown. Its branches are bright green at first and later become dark brown tinged with red. The leaves are alternate and simple. The flowers come out in May before the leaves, they are white and fragrant, and the fruit is red.

The wood is a bright red-brown. It is heavy, hard, strong, and close-grained.

The Wild Plum is found growing in thickets in almost every state east of the Rocky Mountains, except in the extreme north and northeast. It prefers alluvial soil.

Family Platanaceae

Platanus occidentalis Sycamore

The Sycamore is a large tree seventy to one hundred and twenty feet in height, often divided near the ground into several secondary trunks, and very free from branches. Spreading limbs at the top make an irregular, open head. The bark is silver-gray. The leaves are alternate, planately nerved, broadly ovate or obicular. The flowers appear in May with the leaves and are borne in dense heads.

The wood is light-brown, tinged with red, heavy, weak, and difficult to split. It is used for furniture, interior finish for houses, and butchers' blocks.

It is common throughout the eastern half of the United States, except in the extreme north and northeast. It prefers the soil along the banks of streams and on rich bottom land.

Family Leguminosae

Gleditsia triacanthos Honey Locust

The Honey locust is a medium sized tree with a round top. The bark of the trunk is dark gray-brown tinged with

red. Long three pointed spines may or may not cover the trunk of the tree. The leaflets are lanceolate-oblong. The flowers appear after the leaves in May. The fruit is borne in a long flat pod that matures in August, turning from pale green to brown-black.

The wood is a pale yellow-brown, heavy, hard, strong, and close-grained. Its durability makes it useful for fence posts.

The Honey Locust is found from Pennsylvania to northern Georgia, westward as far as eastern Oklahoma, and north to central Iowa. It prefers rich soil, but will grow on poorer soils.

Gymnocladus dioica Kentucky Coffee Tree

The Kentucky Coffee Tree is a tall straight tree, with gray, rough bark. The trunk of the tree ordinarily divides thirty or forty feet from the ground, with few branches. The leaves are bi-pinnately compound. A greenish-white flower appears in June. The fruit is borne in broad, heavy pods.

The wood is light brown, heavy, strong, coarse-grained, and durable.

It is widely distributed, but only a few specimens are found in any particular area. It grows from New York southwest to Oklahoma, prefers bottom land, and a rich, moist soil.

Cercis Canadensis Red Bud

The Red Bud is a small tree with a sturdy upright trunk

which divides into stout branches that usually spread to form a broad, flat head. It will grow in shade and often forms a dense undergrowth in a forest. It is easy to distinguish in the spring by its red flowers that appear before the leaves come out. The leaf is cordate. The fruit is borne in small pods that hang on the tree the entire winter.

The wood is dark red-brown, heavy, hard, coarse-grained, and weak.

The Red Bud is found on rich bottom lands throughout the Mississippi valley. It is very abundant in Arkansas, Oklahoma, and eastern Texas. It grows rapidly and is used as an ornamental tree.

Family Urticaceae

Maclura pomifera Osage Orange, (Hedge)

The Osage Orange is a tree that grows from forty to sixty feet high. The bark is deeply furrowed and scaly. The young branches are bright green. The stems are covered with thorns. The leaves are simple, alternate, and glossy. The fruit is large, green, and wrinkled. The roots are thick and covered with bright orange colored bark.

The wood is a bright orange-yellow, heavy, hard, strong, flexible, and capable of taking a fine polish. It is used for fuel, fence posts, and bows and arrows.

The Osage Orange grows well in the rich bottom lands of Arkansas, Texas, and Oklahoma. It is adapted to all soils, therefore it is found throughout the middle section of the United States.

ORDER GERANIALES; PRICKLY ASH, FLAX

Family Rutaceae

Zanthoxylum americanum Northern Prickly Ash

The Northern Prickly Ash is a small tree not over fifteen feet tall. The leaves and flowers are borne in umbellate clusters. The leaves are thick, dark green, and glossy. The tree is covered with prickles. The flowers are small and greenish-white.

The bark is green-brown. The wood is light and hard to split.

The Prickly Ash is found from west Quebec to Minnesota, south to Virginia, Kentucky, Missouri, and eastern Kansas. It prefers a rocky, well drained soil.

ORDER SAPINDALES; OAK, MAPLE

Family Fagaceae

Quercus velutina Yellow-Barked or Black Oak

The Black Oak is a large tree. The bark is dark brown or black on the old trees, deeply furrowed, and scaly. The stems and branches, on the young trees, are smooth. The inner bark is deep orange-yellow. The leaves are alternate, long, wide, ovate or obovate, and usually seven lobed. The tree blooms in May when the leaves are half grown. The leaves remain on the trees throughout the winter.

The wood is light brown tinged with red, heavy, hard, strong, coarse-grained, and checks in drying. The bark is used for tanning leather.

The black or yellow oak is found over the eastern half of the United States, except in northern Wisconsin, Michigan, and Maine. It prefers soils composed of glacial drift, but is found on the mountain sides.

Quercus Q. muhlenbergii Yellow Chestnut Oak

The Chestnut Oak is a tree of medium size. The bark is light silvery-gray, sometimes whitish, and scaly. The leaves are alternate, long, broad, and oblong or lanceolate. The tree has a small head, narrow, and is round topped.

The wood is dark brown, heavy, hard, strong, and close-grained. It is used for posts, barrel-making, and the manufacture of wheels and railroad ties.

The Chestnut Oak is found from New York westward through southern Ontario to southeastern Nebraska, eastern Kansas, southward in the Atlantic region to the District of Columbia, and west of the Alleghanies southward to the Gulf of Mexico. It prefers a limestone soil.

Quercus macrocarpa Bur Oak

The Bur Oak is one of the largest oaks. The average height is about eighty feet. The bark is light grayish-brown, deeply furrowed, and scaly. Its branches have corky ridges. The leaves are alternate, long, and wide. The flowers come out in May when the leaves are one-third grown. The fruit is annual, solitary, and variable in size and shape.

The wood is brown, strong, heavy, and close-grained. It is valuable for ship construction, interior finish of houses, barrel making, railway ties, and posts.

The Bur Oak grows on many kinds of soil. It is found from Nova Scotia to Manitoba, south to Massachusetts, Pennsylvania, Kansas, and Texas.

Quercus coccinea Scarlet Oak

The Scarlet Oak is a tall tree with a slender trunk. The branches are rather small, the head is open and narrow. The bark is dark-brown with shallow, scaly fissures. The inner side of the bark is reddish-gray. The leaves are alternate, oblong or obovate, with seven or nine lobes which are dentate and terminate in bristle pointed teeth. The leaves turn scarlet in the fall. The acorns ripen in autumn of the second year.

The wood is light brown, heavy, hard, coarse-grained, and strong. The acorns resemble those of the Black Oak.

The Scarlet Oak is found from Maine, through central New York to southern Ontario, west through Michigan, Minnesota, Nebraska, Kansas, and south on the Alleghanies to North Carolina and Tennessee.

Quercus texana Red Oak

The bark of the Red Oak is dark gray-brown tinged with red. It has broad, thin, rounded ridges and is scaly. On the young trees and large stems the bark is smooth and light

gray. The leaves are alternate, seven to nine lobed, oblong to oblong-ovate, long, and broad. This tree grows to a height of approximately ninety feet.

The wood is pale red-brown, heavy, hard, coarse-grained and strong. It is used in the making of furniture and interior construction of houses.

This tree grows from Maine to Georgia and Tennessee, westward to Minnesota and Kansas. It is tolerant of many kinds of soil, but prefers glacial drift and well drained borders of streams.

Family Aceraceae

Acer negundo Box Elder

The Box Elder tree appears gray or light brown from a distance. When observed closely the smaller branches are green. The trunk often divides near the ground. The bark is deeply cleft into broad ridges and is scaly. The leaves are opposite, compound, and composed of three to five leaflets. The flowers appear before the leaves. The fruit resembles that of the maples.

The wood is cream-white, light, soft, close-grained, and weak. It is used for wooden ware and paper pulp.

The Box Elder is distributed across the continent, is abundant throughout the Mississippi valley, and along the banks of streams and borders of swamps. It prefers a deep rich soil and grows to a height of thirty to fifty feet on the best soils.

Acer saccharinum White or Silver Maple

The Silver Maple is a large tree that grows to the height of ninety to one hundred feet. The trunk divides into three or four stout, upright, secondary stems, forming a wide spreading head with drooping branches. The bark is light-gray and smooth until the tree is of considerable size. The old trees are reddish-brown, furrowed, and scaly. The leaves are opposite, simple, palmately five lobed with narrow acute sinuses and acute divisions. They are light green on top and silver underneath.

The wood is cream colored and slightly tinged with brown, hard, strong, close-grained, and brittle. It is used in cabinet work.

The Silver Maple is found growing throughout the Mississippi valley, where it is one of the largest and most common of the river trees. It is rare along the Atlantic coast.

Family Sapindaceae

Aesculus hippocastanum Horse Chestnut

The bark of the Horse Chestnut is dark brown, rough, and divided into shallow fissures. The branches are red-brown. The leaves are opposite and digitately compound with seven obovate leaflets. White clusters of flowers appear in May and June. The fruit ripens in October. There are from one to three seeds or nuts in a globular, rough, prickly capsule.

The wood is white, light, soft, close-grained and not very durable.

This tree is a native of Greece and was first introduced into western Europe and then into the United States. It is found growing with other trees in forest regions throughout the Mississippi Valley. It prefers a moist, rich soil.

ORDER MALVALES; ELM, MULBERRY, HACKBERRY

Family Urticaceae

Morus rubra Red Mulberry

The bark of the Red Mulberry is dark-brown tinged with red. It is divided into irregular plates, spreading into thick scales. This tree grows to a height of thirty to fifty feet. The stout spreading branches give it a dense broad, round-topped head. The leaves are alternate, cordate-ovate, serrate, rough above, downy beneath, and pointed. The sap is milky. The flowers appear in May and June with the leaves.

The wood of the Red Mulberry is pale-orange, light, soft, coarse-grained and weak.

The Red Mulberry grows in the lower Mississippi valley and east to the Atlantic coast. It prefers the rich soils in the lowlands and low hilly regions.

Celtis occidentalis Hackberry

The hackberry is a tall tree with a slender trunk, rising to a height of forty to sixty feet. It has a handsome round-topped head. The bark is light-gray and broken

on the surface into thick appressed scales. The leaves are alternate, ovate to ovate-lanceolate. The flowers appear in May, soon after the leaves. Three kinds of flowers are borne on a slender drooping pedicle, namely, staminate, pistillate, and perfect.

The wood is light yellow, heavy, soft, coarse-grained, and weak. It is used for cheap furniture.

The hackberry grows throughout the United States, except along the western coast, in Arizona, New Mexico, and Texas. It prefers rich moist soil, but will grow on gravelly and rocky hillsides.

Ulmus americana White Elm

The White Elm grows very tall. It usually divides at one-third the height of the tree, into two to five branches. The bark is dark-gray, rough, with loosely adherent ridges. The branches are light green, later turning red-brown. The leaves are alternate, obovate-oblong or oval, and doubly serrate. The flowers appear in March and April before the leaves.

The wood is red-brown, heavy, hard, strong, tough, and coarse-grained. This wood is used for hubs of wheels, saddletrees, and barrel making.

The White Elm grows from the foot hills of the Rocky Mountains to the Atlantic coast and from Canada to the Gulf of Mexico. It prefers a rich moist soil, but will grow on almost any kind of soil.

Family Tiliaceae

Tilia americana Linden or Basswood

The trunk of the linden is erect and pillar-like with spreading branches. They are often pendulous, forming a broad, rounded head. The bark is light brown, furrowed, and the surface is scaly. The inner bark is very tough and fibrous. The leaves are alternate, simple, feather-veined, and obliquely cordate. The flowers are perfect, regular, yellowish-white, and borne in clusters. They appear in June and July.

The wood is pale brown sometimes nearly white or faintly tinged with red. It is light and soft with a fine close grain. This wood is used in the manufacture of wooden ware, wagon-boxes, and furniture.

The linden is a native of the rich woods of northern United States and Canada. It reaches its greatest size in the valley of the Ohio.

ORDER EBENALES; PERSIMMON

Family Ebenaceae

Diospyros virginiana Common Persimmon

The persimmon is a small tree seldom over fifteen or twenty feet high. It has a trunk diameter of about ten to fourteen inches. The top of the tree is rounded. The bark is dark-brown and deeply divided into plates with a scaly

surface. The fissures of the bark are red. The leaves are simple, alternate, oval, and narrowed or rounded at the base. The flowers appear in May or June when the leaves are half grown. The fruit is juicy, pale orange and often red checked when ripe, and contains from one to eight seeds.

The wood is very dark, heavy, hard, strong, and very close-grained.

The persimmon was originally a tropical tree. It now appears along the coast from New York to Florida, west of the Alleghanies along the Ohio, Mississippi, and Missouri rivers. It prefers a rocky well drained soil, but is often found growing on rich bottom soils.

ORDER GENTIANALES; ASH, GENTIAN, JESSAMINE

Family Oleaceae

Fraxinus nigra Black Ash

The Black Ash is a tall, slender tree with a narrow head of upright branches. The bark is granite-gray, fissured, and scaly. The branches are stout, and dark green. Later they turn to an ashy-gray. The leaves are opposite, pinnately compound, with seven to eleven leaflets. The flowers appear in May before the leaves.

The wood is dark brown, heavy, soft, tough, and coarse-grained. It is used for barrel hoops, baskets, and cabinet work.

The Black Ash is distributed from Newfoundland to

Manitoba, southward to Delaware and Virginia, and westward.

Fraxinus americana White Ash

The White Ash is a tall graceful tree sometimes growing to a height of fifty to seventy feet. If it is allowed to grow alone, it produces a round top or a pyramidal head of great beauty. The bark is gray, deeply-furrowed into narrow flattened ridges, with a scaly surface. The leaves are opposite, and pinnately compound. The fruit is borne in crowded drooping panicles, six to eight inches long. These hang upon the leafless branches until mid-winter.

The wood is brown, heavy, tough, elastic, and close-grained. It is used in the manufacture of furniture and agricultural implements.

The White Ash is distributed from Nova Scotia and Minnesota to Florida and Texas. It reaches its greatest size in the valley of the Ohio. It prefers rich moist soil.

ORDER RUBIALES; HAWTHORN, ELDER, CORAL BERRY

Family Valerianaceae.

Crataegus mollis Hawthorn

The hawthorn is a small tree with a straight trunk. It has spreading and contorted branches which form a round, compact head. The branches are covered with spines. The bark is reddish-brown to ashy-gray, and the surface is broken into small scales. The leaves are alternate, simple, and broadly

ovate. The flowers appear in May when the leaves are half grown. They are white and borne in clusters. The apple-like fruit ripens in September and falls immediately.

The wood is light brown, heavy, hard, and close-grained.

The hawthorn grows along the margins of swamps, banks of streams, and on prairies of rich soil. They are found from Ontario to eastern South Dakota, eastern Kansas, and south to Kentucky.

ORDER CONIFERALES; CEDAR, PINES

Family Pinaceae

Juniperus virginiana Red Cedar

The Red Cedar is an evergreen tree that varies in size from a shrub to a tree of fifty or sixty feet in height. The tree is conical in shape. The bark is light reddish-brown and scaly. The leaves are opposite and of two kinds, awl-shaped and loose-scale shaped. They are appressed, imbricated, and crowded. The flowers appear in April and May, and are found on short axillary branches.

The wood of the Red Cedar is bright red, fragrant, light, soft, close-grained, and weak. The color of the wood fades when first exposed to the light. It is used for cabinet making, pencils, posts, and railway ties.

The Red Cedar grows throughout the United States. It prefers the rich alluvial bottom land of the southern and southwestern states.

ORDER ROSALES

Family Saxifragaceae

Ribes gracile Missouri Gooseberry

The gooseberry bush is a medium sized shrub. It is armed with thorns and prickles. The leaves are lobed, alternate, or clustered. The white, greenish flowers appear in April before the leaves. The fruit is a green, fleshy berry, turning red when ripe.

The gooseberry is found growing in wooded regions, protected from the heat of the sun, in the central part of the Mississippi valley.

Family Rosaceae

Rosa setigera Prairie Rose

The Prairie Rose is a thorny shrub growing in dense clusters. It sometimes shows a tendency to climb. The leaf is compound with three, rarely five, leaflets. The flower is red but later fades to a whitish color. It has five petals. The fruit is small, red, and is shaped like an apple.

The Prairie Rose grows naturally on the prairies of the central parts of the United States. It prefers a rich well drained loam soil. It is found growing on most every kind of soil. It grows well along the margins of timbered land.

ORDER SAPINDALES

Family Anacardiaceae

Rhus quercifolia Poison Oak

The Poison Oak is a low branching shrub, spreading by underground stems. They have long petioles, three-foliolate, dark green above, and lighter green below. The flowers appear in May and are small, greenish-white. The fruit is small, round, and smooth when mature.

The Poison Oak grows from southern New Jersey and Delaware to Georgia, Alabama, and Texas. It prefers dry woodland areas, and is found growing some distance from the creek on well drained soils.

Family Betulaceae

Corylus americana Hazel Nut

The Hazel Nut is a bushy shrub. It grows approximately five feet tall. The leaves are alternate, simple, straight-veined with notched edges. They are more or less covered with rusty spots when mature. The flowers are greenish catkins with both staminate and pistillate flowers on the same plant. The fruit is a round hard-shelled nut, enclosed more or less in green leaf bracts or shucks. The nuts are brown.

The Hazel Nut is found growing throughout the central portion of the Mississippi valley. It prefers the rich bottom soil along rivers and creeks. It grows best where there is an abundance of sunlight.

Family Staphyleaceae

Staphylea trifolia American Bladdernut

The bladdernut is usually a shrub growing from three to five feet in height. It has bright green, compound leaves with three leaflets. It blooms in the spring. The flowers are greenish-white. The fruit is a swollen bladder-like sac, with three distinct divisions and contains one to four rather large bony-like seeds.

The bladdernuts are found growing in shady, damp places close to the bank of the creek. It prefers a deep moist soil.

Family Anacardiaceae

Rhus typhina Staghorn Sumach

The Staghorn Sumach is a shrub that grows from five to twenty feet tall. The leaves are pinnately compound with eleven to thirty one smooth, notched leaflets. The bark of this shrub is brown and shiny. The fruit which is dark red or purplish grows in clusters of berry-like drupes which remain on the plant throughout most of the winter.

The Staghorn Sumach grows throughout the entire middle west, where soil conditions are favorable. It grows best on the south slope of a hill, where the soil is more or less rocky and well drained.

ORDER UMBELLALES

Family Cornaceae

Cornus Florida Flowering Dogwood

The Flowering Dogwood is a shrub or small tree from seven to fourteen feet tall. The dogwoods have a peculiarly veined entire-edged leaf. The side veins are distinctly parallel with each other, and incurving toward the acute tip of the leaf. It has white or pinkish flowers in May. The green fruit which grows in clusters changes to a scarlet in the fall when it ripens.

The Flowering Dogwood generally grows along the banks of streams. It is found in the central part of the United States. At times it is found growing some distance from the streams on rocky, rough soil.

Family Cornaceae

Cornus stolonifera Red Osier Dogwood

The Red Osier Dogwood is a shrub that seldom exceeds twelve feet in height. The branches are a purplish or blood-red color. The flowers are greenish-white and the fruit is black. The leaf is characteristic of the Cornaceae.

The Red Osier is found throughout the Mississippi valley. It grows along streams and near swampy places. It prefers a good rich soil, but has been found growing on rocky soils.

ORDER RUBIALES

Family Caprifoliaceae

Sambucus canadensis Common Elder

The elder is from five to eight feet high. It has a large, white pith filling over half the diameter of the stem. The leaves are compound with five to eleven smooth, notched leaflets. The flowers are fragrant. They appear in broad, flat clusters in June and July. The fruit is purple and ripens in August and September.

The elder grows along the banks of creeks and rivers yet is may be found on the edge of swampy places. It prefers a rich, moist soil, and grows best when exposed to the sunlight.

Family Rubiaceae

Cephalanthus occidentalis Button Bush

The Button Bush is a native American shrub. It is from three to twelve feet tall. The leaves are opposite, simple, glossy and often in whorls of three. The flowers are small, white, tubular, and form a globular cluster. The fruit is a round cluster of one to two dry seeded nutlets.

The Button Bush is found growing throughout the lower Mississippi valley. It prefers rich, moist soil and grows well in shaded places.

Family Caprifoliaceae

Symphoricarpos orbiculatus Coral Berry (Buck Brush)

The Coral Berry is a small shrub. The leaves are opposite, simple, short-stemmed, and feather-veined, with

entire edges. Inconspicuous pink flowers appear in July. The ripe fruit is dark red and hangs on the plant most of the winter.

The Coral Berry grows well in any soil. It spreads rapidly by sending out underground stems. It grows in shaded places as well as in the sun. Its range is from New Jersey to Georgia, Kansas, Texas, and westward to South Dakota.

ORDER LILALES

Family Liliaceae

Smilax rotundifolia Green Brier

The Green Brier is a woody vine, dark green, and covered with stout prickles which are straight or curved. The leaves are thick, glossy, and palmately veined. Numerous small green tendrils enable it to attach itself to the plant on which it is growing. The fruit is black and has one to three seeds.

The Green Brier ranges from Nova Scotia to Minnesota, south to Texas, and Florida. It is generally found growing in woods and thickets on some small shrub or brush pile. It prefers damp, rich soil and seems to do best in shaded places.

ORDER RANUNCULALES

Family Ranunculaceae

Clematis viorna Virgin's Bower

The Virgin's Bower is a woody vine which climbs by means

of clasping petioles. The leaves are opposite, entire, ovate-lanceolate, and long-pointed. The flowers are solitary and purple in color.

The Virgin's Bower is found growing from Pennsylvania, south, and west. It prefers a moist soil in shaded places.

ORDER SAPINDALES

Family Anacardiaceae

Rhus radicans Poison Ivy

The Poison Ivy is a woody climber. It attaches itself by numerous aerial rootlets. The leaves are petioled, three foliolate, glabrate or somewhat pubescent, especially beneath. The flowers are greenish-white, and appear after the leaves. The ivy is a poisonous plant.

The Poison Ivy is found growing from Nova Scotia to British Columbia, Florida, Arkansas, Texas, Mexico, Bermuda, and Bahamas. It grows along fence rows, thickets, wooded sections, and in both open and shaded places.

ORDER RHAMNALES

Family Rhamnaceae

Berchemia scandens Supple Jack

The Supple Jack is a woody vine, with slender, round branches. The leaves are ovate or ovate-oblong, dark green above, and paler beneath with eight to twelve pairs of veins

in each leaf. The flowers appear in small terminal panicles. The fruit is a drupe. The stems are very pliable and can be easily tied in knots. It is sometimes called Rattan Vine.

The Supple Jack grows from Virginia to Florida, Kentucky, Missouri, and Texas. It prefers a moist soil and is found in well shaded places.

ORDER RHAMNALES

Family Vitaceae

Vitis aestivalis Wild Grape

The wild grape is a large woody vine that grows in the heavily timbered regions. The vines are found growing on trees climbing by coiling tendrils. The leaves are rather thick, ovate-cordate to circular-cordate, strongly dentate, and three to five lobed. The tendrils are intermittent. The young leaves, when they first appear, are hairy and reddish in color, changing to the characteristic green after a week's growth. The bark of the vine is scaly and dark brown.

This variety of wild grape grows from New England, south to Florida, west to Wisconsin, and south to Kansas. It prefers a deep, moist soil in shaded areas.

Family Vitaceae

(*Psedera*) *quinquefolia* *Parthenocissus*
Virginia Creeper

The Virginia Creeper is a very strong, high climbing vine. The climbing tendrils are branching and have adhesive

tips, which resemble small rootlets. The young stems are purplish in color. The leaves are compound with five leaflets, dull-green above and much lighter below.

The Virginia Creeper is found growing over eastern North America, both wild and cultivated. It requires a fertile soil with abundant moisture.

ORDER POLEMONIALES

Family Solanaceae

Solanum dulcamara Bittersweet

The Bittersweet is a woody vine that grows on small trees and shrubs. The woody stem twines around the trunk and branches of the plant on which it grows. In this respect it is like the morning glory. The bark is smooth and grayish. The stem is very supple. The plant blooms in May, the flowers are whitish-green and not very conspicuous. The fruit which ripens about the middle of October has a bright orange color and is very attractive.

This plant is found growing on the rocky well drained soils of the central states. It does not get very large or grow to any great heights. It is never found in thick heavily shaded places.

ORDER RUBIALES

Family Caprifoliaceae

Lonicera caprifolium "American" or Italian Woodbine

The Italian Woodbine is a deciduous climber. It seldom ever ascends more than twenty feet. The leaves are obovate or oval to oblong, and rounded at the apex. The flowers are yellowish-white, often slightly purplish and pubescent outside. They are produced in the axils of the connate leaves. The blossom appears in early spring or summer.

The Italian Woodbine was first found in central Europe and western Asia. It was introduced to America where it has escaped cultivation. It prefers the shady forest regions, and grows best on fertile well-drained soils of the central and eastern part of the United States.

CHAPTER IV

GENERAL DISCUSSION

The results obtained from this survey of a selected area along the Little Osage river in Allen county, Kansas indicate that the soil and climatic conditions are favorable for the growth of the vegetation observed and identified in this section.

The trees that were observed in the extreme western limits of the area were smaller in size and height than those immediately east of them. The soil in this particular area is a white ashy soil, known as Oswego Silt Loam. This soil lacks depth and richness in organic materials. A small association of hickory trees, with a few small hackberries and elms, are scattered here and there throughout this small area. Along the small tributary that flows into the main stream from the northwest, small societies of dogwoods, buttonbrushes, and willows are found growing very close to the edge of the water. A single specimen of bladdernut, which is ordinarily classed as a shrub, was found in this same area, but in this instance the plant had the proportions of a small tree. This shrub gets its name because of its peculiarly shaped fruit which is a thin membranous pod divided into three divisions, each division producing from one to four small, hard, brown seeds.

Wild grapes are found growing in this area, twining around the trees and producing fruit that is eaten by birds

and other animals. Wild Prairie Roses are scattered here and there along the edges of this entire area. Presumably they were carried in by birds and other animals that use their fruit as food. The Missouri Gooseberry grows profusely throughout this area. The gooseberry prefers a shady habitat, deep, well-drained soil, and abundant moisture. The fruit is a round green berry changing to dark-red when ripe. It makes excellent food for birds and other animals.

The area that lies east of the first group of plants contains a society of bur oak trees that are approximately fifty to sixty feet in height with a diameter of eighteen to thirty inches. This group of bur oaks might be called an Aspect society, because it is very conspicuous in the spring when the first leaves appear and in the fall when the various autumnal colors may be seen. Adjacent to this oak society is a very large association of pokeweed, covering approximately one-fourth of an acre. These pokeweeds grow to a height of four to five feet with stems at the ground having a diameter of three inches. The stem of this plant has a pale reddish color and the leaves are large and pale green. In the latter part of August and the first part of September the fruit ripens. It is a small berry-like fruit which grows in clusters somewhat like the wild grape. The berries are purple and very juicy. The fruit serves as food for some birds yet is said to be poisonous for live stock.

The third group of plants is an association of black walnut trees that grow on a level tract on the south side of the creek. This tract of land overflows on an average of about twice a year in normal seasons at which time there is deposited a layer of alluvial soil rich in organic material. This causes the vegetation to grow and thrive exceedingly well. However the trees are not as large in diameter because the plants are found growing close to each other. This fact accounts for the great height of seventy to eighty feet.

In this same area are a number of virginia creepers which cling to these tall walnut trees almost to their full height. The virginia creeper is a woody vine that grows wild in the woods of this region. At times it is mistaken for poison ivy, but may be readily distinguished by its leaves. The poison ivy has three leaflets in a cluster while the virginia creeper has five leaflets in a cluster.

North of the creek and somewhat to the east is found an even larger association of black walnut trees. This group of trees is a younger association and therefore not as tall as those on the south side of the creek. They are not as close together and consequently have more branches. Two trees are found at the northern edge of this association, a wild mulberry and an osage orange or "hedge" tree, the only specimen of these two species found in the western half of the area.

The largest society of willows is found growing along the banks in the bend of the creek. Some of these trees extend out into the creek bed, some are on sand bars, and others on rock covered areas. These willows are small trees with a shrub like growth. Willows of this type may be seen on the banks of creeks along most of the streams of southeastern Kansas.

To the east of the area described is found another association somewhat different from any other described. In this association box elders, white and green ashes and willows, with here and there along the northern edge, a honey locust. The box elders in this association are large trees. These trees have a great number of dead and broken branches which is more or less characteristic of this tree when it reaches maturity and has not had special care. The ash trees in this area are not as large as in other associations. This area has a small, rocky formation on which is found growing a small society of hawthorn. The hawthorn is a small tree hardly ever more than ten or twelve feet in height. The limbs are covered with woody thorns or spines for protection. In the spring months this tree may be easily identified by its characteristic white flowers which grow in clusters on the ends of the branches.

South of the hawthorn association on the south side of the creek is a thicket of wild plums. This was the only thicket of these trees observed in the entire area. Wild

plum thickets have peculiar growth characteristics and may be recognized from a distance by one who has observed them previously. The largest trees grow in the center of the group and the other trees gradually diminish in size until at the edge of the thicket the small trees or sprouts are only a few feet high. In the latter part of April and the first part of May the larger trees bloom. The blossom is white and the most fragrant of any of the flowering trees, shrubs, or herbs. The fruit is red, and ripens in August and September.

East of the wild plum thicket is a Kentucky Coffee bean and hackberry association with a few scattered elms. These trees are located on the south side of the creek. This creek sometimes overflows leaving much silt which causes the soil to be very fertile. Because of this fertility the trees are very large. The ground under these tall trees is covered with a heavy growth of indian currents or "huck-brush", a shrub that has an average height of about two feet. The stem of this plant which is covered with a brown, woody, and scaly bark, never exceeds three-fourths inch in diameter. The leaves are pinnately compound; the fruit is a small red berry which ripens in early autumn and remains on the plant until late winter. This shrub is sometimes called coral berry because of the color of its fruit. It propagates by means of seeds and under ground stems.

A small society of horse chestnuts was found growing on the south side of the creek close to the edge of the bank.

These were protected from the extreme sunlight by a cliff of shale and limestone thirty to forty feet high. The trees are small and the first to leaf and bloom in the spring. The flowers are greenish-white and borne on the ends of the shoots in clusters. The leaf is palmately compound and consists of seven leaflets which may vary in size.

East of the group of horse chestnut trees is found a small society, of about twenty, lindens or basswoods. The linden is a tree with light-gray bark and large broad leaves. The wood is soft and very light in color and weight. The linden bears its blossoms and fruit on a wing like growth. The flowers are borne in a cluster on the end of a small stem. The fruit matures in the latter part of July and the first part of August.

North of the linden trees and on the north side of the creek is found one of the most interesting groupings of plants in this area. The trees are mostly hackberries and elms and cover an area of approximately one acre. Under the elms and hackberries is an association of papaw trees which is the largest association of this group found in the area. An association of may apples is found growing in the shade beneath the papaw trees. These plants grow to a height of twelve to eighteen inches. The soil is extremely fertile in this small area and the trees and other plants are very large.

The south bank of the creek at this point rises to form a cliff thirty to forty feet high and about a quarter

of a mile in length. An association of wild columbine about two hundred feet in length is found growing along the north side of the cliff. The greatest growth is in the shaded, damp places. Another interesting plant, jack-in-the-pulpit, or indian turnip was found in this same habitat. It has a peculiar blossom. It is greenish-white and resembles a lily with a large spadix, which when ripened, looks like a cluster of red berries. The bulb or "turnip" from which this plant grows is a whitish bulb about two and one half to three inches in circumference when mature. It is very acrid and pungent to the taste.

The top of the cliff and along the north side is covered with an association of chestnut oaks. The soil at this particular place is more or less rocky and shallow. The trees are rather small. The largest is about thirty feet high with a trunk diameter of fourteen inches. These trees grow very closely together and produce large numbers of acorns which are used by squirrels and other animals as a source of food supply. Flowering dogwoods, dwarfed in size, grow in this rocky soil at the edge of the chestnut oak association.

A small society of persimmon trees is found growing near the group of chestnut oaks. This is the only place in which the persimmon tree is found growing in this area. It is a small tree about ten to fifteen feet tall, close branching with a round top, and bears fruit that grows in clusters. The fruit ripens after the first frost which

usually occurs in October and November. The green fruit of this tree has an acrid taste.

East and north of the chestnut oak and persimmon societies is a large ash-elm association. The white ash and white elm predominate in this large group of trees. The trees do not grow close together consequently they are very large. The largest tree in this area is an elm about four feet in diameter and approximately fifty feet tall with branches that spread to a distance of about twenty five feet in all directions from the trunk of the tree.

The red bud is a tree that was found in all parts of this area. It is a small tree about twelve to twenty feet tall and has rounded, entire leaves. It is very noticeable in the spring because of its showy red flowers that bloom before the leaves appear. The red flowers resemble a bud at a distance and for that reason the tree has been named red bud.

CHAPTER V

SUMMARY

The ecological survey of the woody plants of a selected area in Osage township, Allen county, Kansas, indicated the occurrence of fifty four species of plants. The fifty four species are distributed among fifteen orders, twenty eight families, and forty five genera.

Observations were made regarding the spring, summer, and fall growth, time of leafing, blooming, color of flowers, time of leaf fall, and color of bark and leaves. Twenty six species were found growing in the open areas, fourteen species in shaded areas, seven species on sandy and rocky soil, and seven species in or near the water.

The willow associations were always found near the edge or in the water of the creek. Some were found growing on or near sand bars in the streams. The willows seem to thrive equally well in shaded areas and where there is an abundance of sunlight.

Single specimens, societies, and associations of red bud were always found growing at the margin of the wooded areas. This would indicate that the red bud requires a greater amount of sunlight than any of the other species.

The oak, ashes, walnuts, hackberries, elms, lindens, and hickories, prefer the rich bottom soil, which is found along rivers and creeks of southeastern Kansas.

The papaws prefer shaded habitats with deep, moist soil and were always found in situations where the soil is rich in organic materials.

The virginia creeper, a woody vine, was usually found in the mesophytic areas, where the soil was rich, moist, and well shaded. This vine grows to a height of forty to fifty feet and was usually found climbing on the walnut trees.

The societies of gooseberries were found growing best in the shaded places where the soil was fertile and well drained.

The buttonbushes, sycamores, bladdernuts, and smartweeds were found growing near the stream indicating that a greater amount of moisture was necessary for their growth.

The coral berries, hawthorn, wild plums, persimmons, and poison ivy were found growing some distance from the creek.

The Oswego silt loam soil which comprises the western one-eighth of the area, has an average depth of twelve inches with a "hardpan" subsoil from twelve to thirty six inches deep. The wild plums, hawthorns, dogwoods, and coral berries growing here were small because of the lack of sufficient organic material in the soil. The Yazoo loam soil covers seven-eighths of this area. The soil is deep and contains sufficient organic material for the growth of large walnuts, elms, hackberries, oaks, ashes, and lindens.

The climatic conditions such as heat, light, temperature, and moisture are favorable for the growth of woody plants. Most of the rainfall, which averages over thirty seven inches per year, comes during the growing season which has a length

of one hundred ninety to one hundred ninety-five days.

The winters are fairly mild and the summers are not exceedingly hot. The prevailing winds are from the south with an average hourly velocity of six and ninety six hundredths miles per hour, which is not of sufficient strength to disturb the root systems of the plants. This permits a maximum growth.

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