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The F. B. and Rena G. Ross Natural History Reservation

By Emily L. Hartman

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The F. B. and Rena G. Ross Natural History Reservation

By Emily L. Hartman*

INTRODUCTION

On November 17, 1958, the use of a 1040 acre tract of land in west-central Lyon County and northeast Chase County was made available to the Kansas State Teachers College of Emporia by Mr. and Mrs. F. B. Ross, residents of Emporia. The land area became known as the F. B. and Rena G. Ross Natural History Reservation. Located approximately 4 miles west of Americus or 14 miles northwest of Emporia, the reservation is primarily undulating to rolling bluestem prairie. The upland terrain is broken by several shallow ridges and limestone outcrops. A small seasonal creek and several other drainages cross the area. The total Lyon County area is 960 acres and lies in 3 adjacent sections as follows:

T18; R10—all of Section 7 except the NE quarter of the NW quarter.
—the NW quarter; the W half of the SW quarter and the NE quarter of the SW quarter of Section 8.
—the W half of the NW quarter of Section 18.

The much smaller Chase County area consists of 80 acres in T18; R9; Section 12 (the E half of the SE quarter).

The purpose of this publication is to summarize the past history of the land area since settlement, describe the area physically and biologically on the basis of compiled information, and briefly suggest the future of the reservation in terms of research, teaching, and conservation. The information to follow is by no means complete. It is the starting point for future investigations and publications on more specific aspects of the natural sciences. The latter is an integral part of the research program being carried out by the Department of Biology.

OBJECTIVES AND VALUES

The objectives of the F. B. and Rena G. Ross Natural History Reservation are threefold: to provide an area for research and field study, to aid in the teaching of biological sciences, and to preserve a segment of the Flint Hills-Bluestem biome.

The reservation provides a permanent area for research into dynamic ecology, the interactions between biotic entities and physical factors of environment. Students of biology, local, and regional biologists are welcome to utilize the facilities of the reservation for this purpose. The ultimate goal is that of a thorough understanding of the physical and biological factors in operation on the area and toward that goal, the individual studies will contribute.

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*Assistant Professor of Biology, Kansas State Teachers College, Emporia. Research Coordinator, Ross Natural History Reservation.

Of equal importance is the educational objective. Since the reservation is within easy accessibility of the college campus, field trips and projects may be carried out in conjunction with classroom learning. The reservation is, in essence, an outdoor classroom or laboratory. Actual field contact with subject matter gives the student and potential teacher of biology, a deeper understanding and appreciation of lasting service to him and the community. Similar benefits derived by the students can be extended the public in general. Field trips conducted over certain designated areas can acquaint non-college groups with some representatives of the local flora and fauna. The importance of land management and conservation can also be pointed out. By such service, public cooperation, appreciation and support will be enhanced.

The final objective and value of the reservation lies in its protection from unnecessary human disturbances. As time progresses and population demands, increasing acreage of prairie will be forfeited to cultivation. This biotic community has become a commodity, marketable like all other natural resources. It is not unreasonable to visualize a gradual disappearance and substitution for the prairie. Other biotic units have already witnessed this event.

Through the successful establishment and protection of areas such as the reservation, a remnant of a once dominant and influential biome can be preserved. In view of this, the F. B. and Rena G. Ross Natural History Reservation becomes even more significant for it is the only prairie reservation in existence in the midwestern United States.

HISTORY OF RESERVATION AND ADJACENT AREA

Lyon County Area

The Lyon County area was surveyed in January, 1857. The original field notes described the surface of the township as a rolling prairie with considerable amounts of good farming land. Some sections were said to be too uneven and stoney for cultivation (Derrick, 1857). The brief notations on the sections included within the reservation were "land rolling or land broken; soil third rate."

The early descriptions and attitudes toward the county in general shed some light upon what was to be the eventual fate of the reservation land. Emphasis was always on the timber and the potential productivity of the land (Andreas, 1883; Blackmar, 1912). "Scientific farming" was beginning to change "a desert or open prairie" into a potentially wealthy region (*Emporia Daily Republican*, 1884). This statement clearly indicates that the natural value of the native grass cover was totally incomprehensible at this time. Streams and springs were numerous and furnished adequate water supplies. Wells averaged from 15 to 40 feet deep indicating a generally higher level of ground water than now exists. The timber belts consisting of cottonwood, hackberry, walnut, burr oak, hickory, mulberry, kentucky coffee-tree, elm, locust, and sycamore, were located along the

water courses. Groves of forest trees and orchards were reportedly established and flourishing on the prairie farmlands (*Lyon County Clippings*, 1858-1903). These included peaches, apples, cherries, pears, and other small fruits.

Americus, approximately 4 miles east of the reservation, was at first the center of settlement in the county. The chief occupations of the settlers included farming, stock-raising, and cheese-making (Americus, 1881). A saw mill and several quarries were also located in the vicinity. One of these quarries is found on the major west-facing outcrop of the reservation. It supplied building stone for several buildings including the stadium on the Kansas State Teachers College of Emporia campus.

The first available information on landowners in the reservation sections was published in 1878. The average holdings were 80 acres with two 160 acre plots and several 40's. The most influential settler was a Quaker missionary to the Shawnee and Kaw Indians, T. H. Stanley. In the east half of section 8, Stanley established an orchard of over 1,200 peach trees and 300 apple trees (Andreas, 1883). Because of these impressive orchards, the community became known as Fruitland.

Chase County Area

The original surveyor's notes made in November, 1856, describes the soil as being of "first quality" but emphasized the scarcity of timber and water in the area. The corner of section 12 included within the reservation was level land with second rate soil (Pearce, 1856). The rolling hills were broken only by the occasional formation of limestone bluffs and surfacing outcrops. These hills were covered with prairie extending out in all directions as far as the eye could see. Many diaries and reminiscences contain statements such as: "There was no ground broken and I well remember when I was a boy, the blue-stem grass in the bottoms grew up to my shoulders on a pony" (Sayre, 1940). Other records indicate a more lush type of upland prairie than currently exists today. Prairie fires and grasshoppers were constant plagues to the early settlers (Chase County Historical Sketches, 1940). Summer-long battles with rattlesnakes were also mentioned (Henderson, 1951). Cottonwood, hackberry, sycamore, hickory, walnut, and burr oak were the prevailing kinds of timber skirting the streams. The Chase County portion of the reservation was located in the Toledo township (Chase County Historical Sketches, 1949). What settlement occurred was concentrated around Toledo, in the western part of the township. No records of settlement in section 12 could be found.

In order to account for the present condition of land on the reservation, one must consider some of the trends in agricultural practices for the Flint Hills Region in general. The choice farmsites were located on the rich bottomlands. Farms were small and consumed most of the crops produced. The upland sites were less desirable because of sloping terrain and decreased water supplies. Nevertheless, some of the sod was broken and planted to corn, millet, wheat, oats and potatoes. Such crops drew heavily

upon the subsurface moisture and nutrients that the native grasses had built up. During the seventies, a combination of drought, dust storms, chinch bugs and grasshoppers brought hardship and proverty to many. The greatest subdivision of farms into small units occurred during this period of depression. The 1880's saw a return of prosperous times. Farms were consolidated into larger holdings and large acreages of Flint Hills pasture were purchased and stock raising established. For the first time, the true value of the prairie was realized (*Emporia Daily Republican,* 1884).

The sequence of events which followed this realization is one common in American history. The exploitation and abuse of the prairie continued until its destruction seemed almost inevitable. Today, the future of this natural resource depends upon wise management, conservation and general public education.

DESCRIPTION OF THE AREA

Physical

The Ross Natural History Reservation is located on the east face of the Flint Hills Upland. The prominent topographic feature is the Flint Hills escarpment which derives its name from the large amount of flint or chert occurring in nearly all limestones of the unit (Schoewe, 1949). The Flint Hills Upland is separated on the east from the adjacent Osage Cuesta Plains by the highly dissected east-facing escarpment with its terraced rocky slopes. The over-all surface is gently rolling to hilly.

There is some general disagreement concerning the inclusion of Lyon County within the Flint Hills Region. According to Fly (1946), only the extreme northwest and southwest corners of the county (confined to the Council Grove group of rocks) are in the Limestone-Flint Hills Region. The areal geology map and publication on rock formations of Lyon County (O'Connor, 1953b) substantiate this opinion in part but also reveal the presence of the Council Grove group of rocks in the connecting west central portion of the county. This portion is a triangular wedge formed and isolated from the adjacent northwest and southwest corners by the intersecting flood plains of the Cottonwood and Neosho rivers. The reservation is located within this wedge and is therefore a homogenous unit in that parts of both Chase and Lyon Counties are underlain by the Council Grove group of rocks associated with the Flint Hills Region. The name Bluestem Region is often used in referring to the Flint Hills Upland. This term is descriptive of the predominant agricultural feature, the bluestem pastures. In constructing physiographic units within Kansas, Frye and Schoewe (1953) stress the correlation of both physical and biological factors whenever possible. Following this suggestion, the most descriptive term possible would be the Flint Hills Upland-Bluestem Region. Most biologists, however, seem to prefer the shorter Flint Hills Upland.

Geology of Lyon County Area

On the basis of a core sample taken from the quarry, the major west-facing outcrop of the reservation is a Cottonwood limestone member of the Beattie limestone in the Council Grove group of rocks (O'Connor, Goebel and Plummer, 1953). This fossiliferous limestone averages 6 feet in thickness and commonly has scattered nodules of chert occurring in a zone near the middle of the bed. It is one of the important aquifers, supplying numerous stock and domestic wells in the region. Solution channels and cavernous zones are seen in many exposures. The rock is light gray and weathers nearly white. It has long been regarded as an important building stone in Kansas because of its durability, even texture, and ease with which it can be quarried.

The specific reservation outcrop of Cottonwood limestone consists primarily of $CaCO_3$ and CaO. Very little magnesium salts are present. The rock formations underlying the remainder of the reservation are shown in Fig. 1. A detailed description of each stratum is found in O'Connor (1953b), however a brief characterization is outlined as follows:

Easly Creek Shale. Average thickness 10 feet; nonfossiliferous; consists chiefly of red and green shale; zone of nodular limestone occurs near the middle.

Bader Limestone. Thickness is about 33 feet; consists of 3 members:

Middleburg limestone member. Average thickness 7 or 8 feet fossiliferous; upper band of tan to gray platy limestone; middle zone of tan, gray or black shale; basal band of gray shaly limestone.

Hooser limestone member. Thickness 9 feet; tan or gray shale in the upper part; green and red shale in middle and lower parts.

Eiss limestone member. Thickness about 17 feet; consists of limestone and shale beds; upper bed of light to dark-gray limestone; lower bed of gray, olive, green or nearly black shale.

Stearns Shale. Thickness about 11 feet; upper part consists of gray and olive shale with a thin coal bed or abundant carbonized plant remains; lower part is green shale with occasional streaks of red.

Beattie Limestone. Average thickness 21 feet; consists of 2 limestone members separated by a shale:

Morrill limestone member. Thickness ranges from 3-5 feet; fossiliferous; consists of gray, tan and brown limestone with one or more shale partings.

Florena shale member. Thickness ranges from 11 to 14 feet; fossiliferous; blue-gray or tan calcareous shale.

Cottonwood limestone member. Average thickness 6 feet; fossiliferous; light gray weathering nearly white; scattered chert nodules in middle zone.

Eskridge Shale. Thickness 34 feet; considerable variations exhibited over short distances; upper zone of gray or tan calcareous shale; middle

and lower parts consist of green and red shale with 2 fairly persistent thin limestones.

Grenola Limestone. Average thickness 35 feet; consists of 3 limestone and 2 shale members:

Neva limestone member. Thickness ranges from 9 to 15 feet; upper bed of hard gray limestone is separated from the middle bed by gray or tan shale; middle bed of pitted, rough-weathering limestone; lower bed consists of several thin limestone layers separated by tan, gray or black shales; limestones are always fossiliferous; shales are frequently fossiliferous.

Salem Point shale member. Thickness 7 feet; gray to olive, silty, calcareous shale; weathers tan.

Burr limestone member. Average thickness 8 feet; fossiliferous; consists of several thin limestone beds separated by shales; shale layers vary from olive or gray to black.

Legion shale member. Thickness ranges from 5-9 feet; unfossiliferous; gray, olive and tan shale.

Sallyards limestone member. Only several feet in thickness in northern county; fossiliferous; gray, silty or shaly bed.

Roca Shale. Thickness ranges from 18-21 feet; upper zone of red, green and olive shale; lower part contains one or more beds of dense gray limestone and limy nodules.

Johnson Shale. Thickness 20 feet; upper zone of gray or tan shale with carbonized plant remains; middle zone of unfossiliferous, dense limestone or platy mudstone; lower zone varies in composition from calcareous tan, gray and green shales to impure limestone to locally thin beds of gypsum.

The Lyon County portion of the reservation lies within a single ground water resource region. This region is primarily supplied with water from jointed, fractured and cavernous limestones (O'Connor, 1953a). Some calcareous shales furnish small amounts of water to the region. The important aquifers found specifically on the reservation are the Beattie and Grenola limestones. Wells in the region range from a depth of about 12 feet to 90 feet and yields range from less than 1 gallon to more than 40 gallons per minute. Supplies are usually adequate for stock and domestic use, however many stock ponds are used as a supplementary water source. Numerous springs and seeps are found along the creeks. The quality of the water is generally good.

Geology of Chase County Area

The rock formations underlying the 80 acres in Chase County are shown in Fig. 2. A detailed description of these is found in Moore, Jewett, and O'Connor (1951), however a brief outline follows:

Speiser Shale. Thickness about 18 feet; upper fossiliferous zone consists of gray calcareous shale; middle and lower unfossiliferous zones consist of red and purple shale with lesser amounts of green shale.

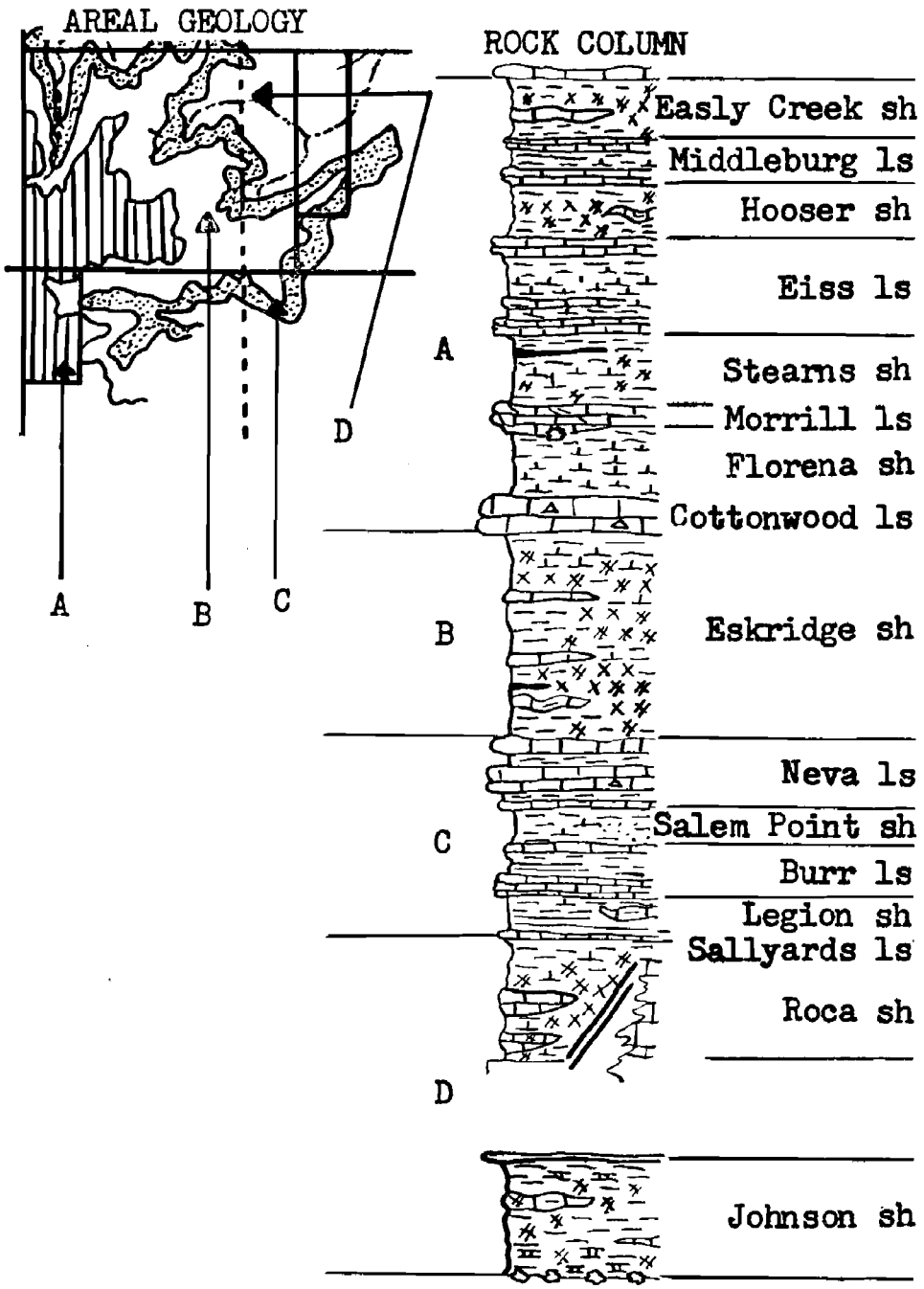


Fig. 1 LYON COUNTY AREA OF RESERVATION

Adapted from Areal Geology of Lyon County Map, State Geological Survey of Kansas, 1952.

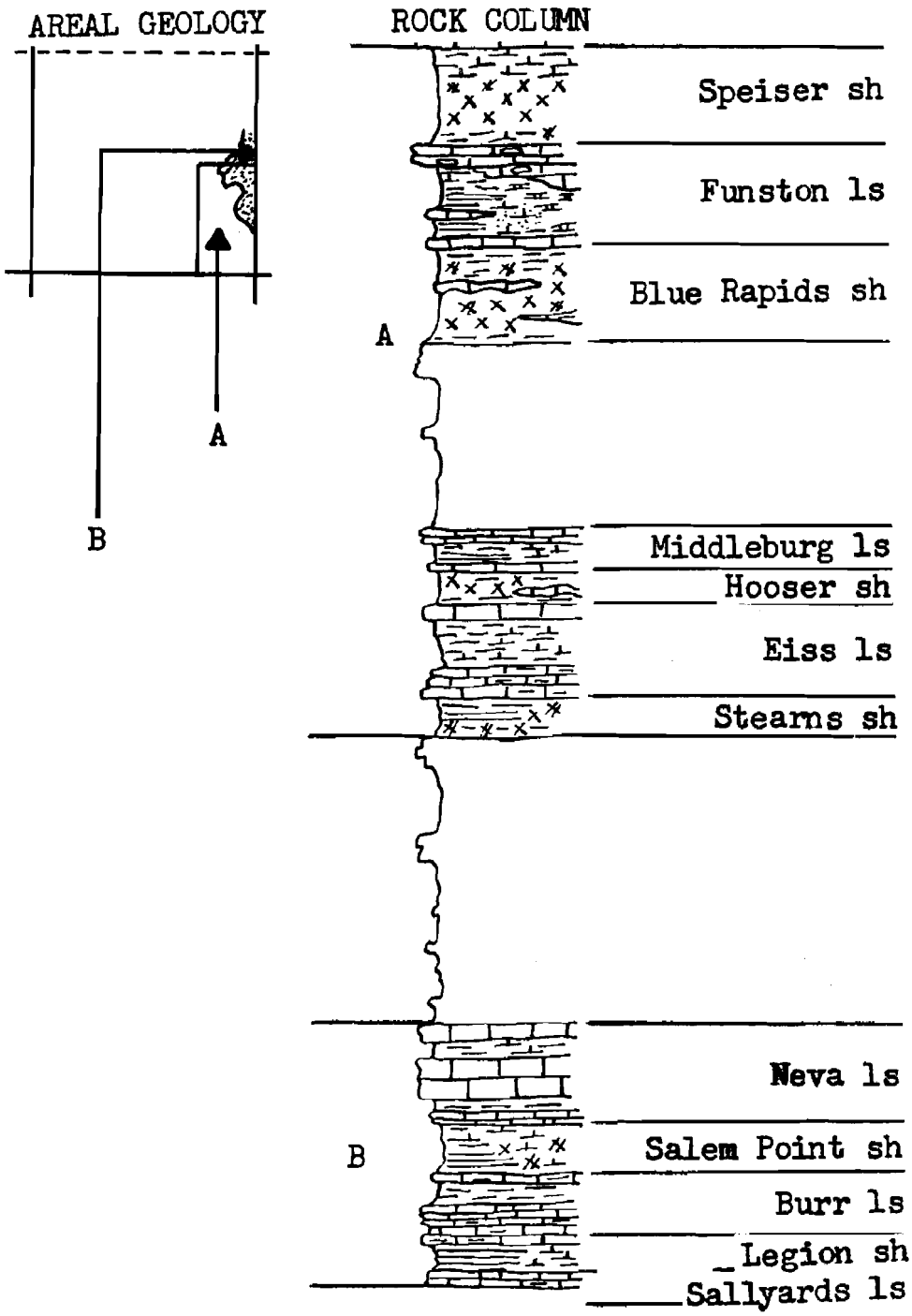


Fig. 2 CHASE COUNTY AREA OF RESERVATION
Adapted from Areal Geology of Chase County Map, State Geological Survey of Kansas, 1951.

Funston Limestone. Average thickness 17 feet; upper zone of platy gray fossiliferous limestone which weathers buff or brown; middle zone consists of fossiliferous gray, gray-black or green shales; lower zone of fossiliferous massive limestone.

Blue Rapids Shale. Average thickness is 15-17 feet; consists of gray, green and red shale with some thin limestone beds and zones of limestone nodules.

Bader Limestone. Thickness averages 28 feet; composed of 3 limestone members:

Middleburg limestone member. Thickness about 7 feet; upper part of light-gray platy to slabby limestone underlain by dark-gray or black platy shale; middle zone of dark-gray slabby limestone or calcareous shale; lower part of light-gray massive to slabby or nodular limestone; all but the shale is fossiliferous.

Hooser shale member. Thickness about 6 feet; consists of green and gray shales with a zone of nodular limestone near the middle.

Eiss limestone member. Thickness 16 feet; upper zone of gray siliceous bench-making limestone with crystalline fossils; middle part of gray and olive fossiliferous shale; lower zone of dark-gray to nearly black fossiliferous shaly limestone.

Stearns Shale. Average thickness 7 feet; consists of gray, black and green shales underlain by gray-green shales.

Grenola Limestone. Thickness about 45 feet; composed of 3 limestone and 2 shale members:

Neva limestone member. Thickness ranges from 7-25 feet; uppermost zone of limestone underlain by gray fossiliferous shale; middle part or main ledge of massive gray fossiliferous limestone followed by a thin bed of gray or black fusuline-bearing shale and a brownish-gray fusuline limestone; lower zone of fossiliferous shale and pitted algal limestone.

Salem Point shale member. Average thickness 9 feet; consists of buff-colored limy nodular shale followed by gray-green or black thin-bedded to fissle shale.

Burr limestone member. Average thickness about 12 feet; upper zone of limestone underlain by unfossiliferous gray or gray-green shale; middle part of extremely platy limestone; lower zone of fossiliferous gray and mottled shaly to slabby limestone.

Legion shale member. Thickness ranges from 3-8 feet; generally consists of gray seemingly unfossiliferous shale.

Sallyards limestone member. Thickness ranges from 1-5 feet; composed of gray platy to shaly limestone and gray shale; fossiliferous.

There has been no utilization of potential mineral resources on the Chase County plot of land.

The Chase County acreage of the reservation is located in the Elmdale ground water resource region (O'Connor, 1951). The principal aquifers are the Neva limestone member and the Speiser Shale. Since this region is composed primarily of native grassland, wells are not abundant. Those found, vary from a depth of several to more than 100 feet and yields range from less than 1 gallon to more than 100 gallons per minute. The best wells are adjacent to the main drainages in the valleys. Stock water is supplied by creeks and springs supplemented by some stock ponds. The quality of the water is variable.

Soil

The characteristics of a soil depend upon various factors: kind of geologic parent material, length of weathering time, relief, climate, natural vegetation and the activities of man. Soils are constantly changing in response to climatic factors as well as the removal of natural vegetation and agricultural practices. Probably no other region of Kansas has been altered as much as the Flint Hills Upland in regard to the latter two. The land included in the reservation is in the Sogn, Summit, Florence, Idana group (Bidwell, 1956). These soils are dark grayish-brown and grayish-brown, stony, silty clay loams. Their geologic parent materials are limestone, cherty limestone, calcareous shales, and loess. Mineral nutrients are adequately supplied. The subsoil permeability is generally moderate or slow and the soil slope is undulating, rolling to hilly. Most of the soils are best adapted to native pastures particularly those covering steep slopes and surfacing the upland ridges of limestone outcrops. Cultivation should be limited to stream valleys, smooth gentle slopes and high divides where the soil depth is 10 inches or more. Fig. 3 is a modification of a map and report prepared by Eikleberry, Fly and Dodge (1956).

Region A

These soils are deep, dark and moderately friable over tight clay or claypan subsoils. Although suitable for cultivation, constant efforts must be made to prevent sheet and gully erosion. There is a 2-6 percent slope occurring on this land.

Region B

The surface soil is deep and moderately deep, dark, friable, and silty to clayey in composition. The land covered by this region includes the sloping uplands and short colluvial slopes below the outcrops on the reservation. This type of region is the most extensively cultivated one found elsewhere in the county.

Region C

These grayish-brown, silty or gravelly soils are only 3-4 inches thick. They occur on steep, rough, broken slopes which are frequently littered with limestone boulders. Past grazing or burning of these areas has resulted in extensive gully erosion.

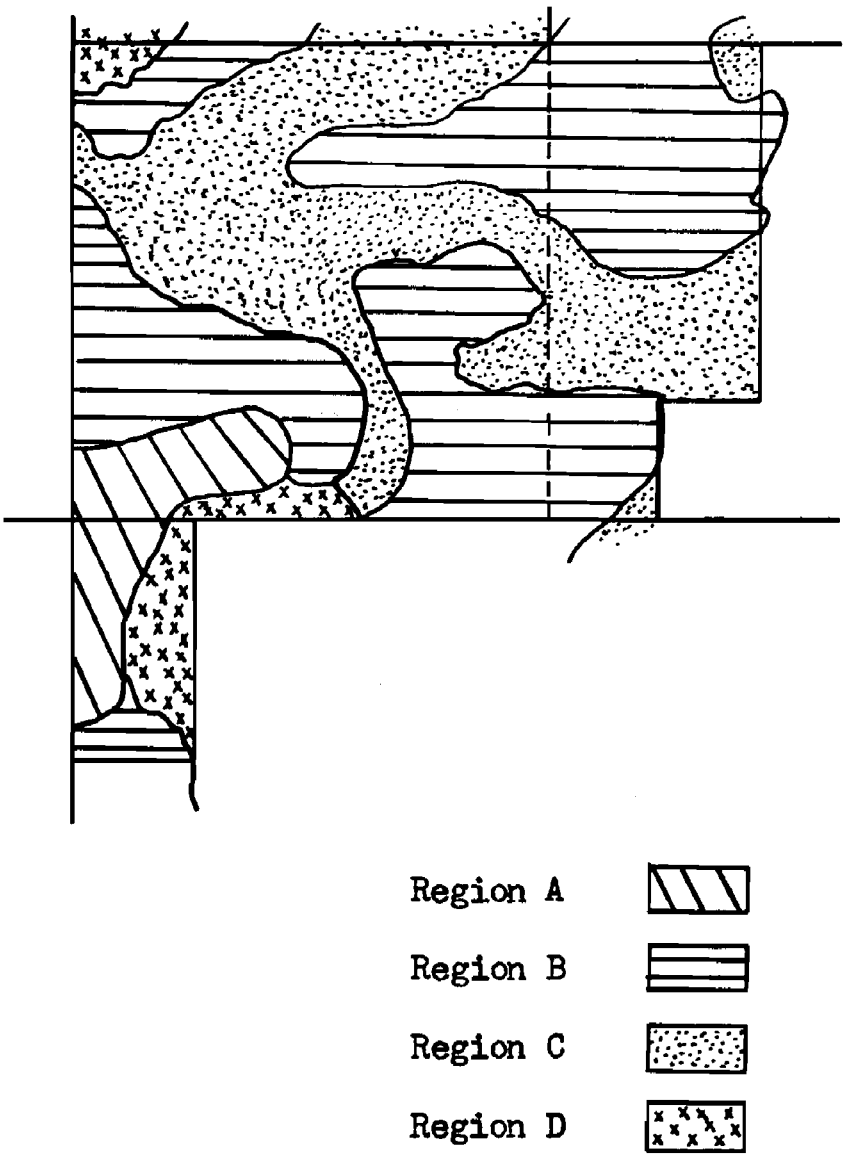


Fig. 3 SOIL REGIONS OF THE RESERVATION.

Adapted from Soil Survey Map, 1941 of the Soil Conservation Service, U.S.D.A.

Region D

The surface soils are light-brown, silty, clay loams with an average depth of 3 to 5 inches. The subsoils are gravelly or cherty. Since these soil areas are still undergoing development, proper land management to decrease erosion is extremely important.

Climate

The general sources of climatic information lists an annual rainfall of 30 to 38 inches with 72 percent of the precipitation occurring during the normal growing season of 186 days. Average temperature for July is 79° F as compared to an average January reading of 31° F. The average July and January humidity is 60 to 70 percent. Summers are warm to hot with warm nights and winters are usually mild to moderate with occasional severe cold spells.

Ecological

Prairie

For many years, grassland ecologists divided Kansas into the tall grass or true prairie lying east of the 96-98 meridians; the mixed grass prairie west of the 98 meridian; and the short grass prairie lying west of the 100 meridian. The much-disputed mixed grass prairie was supposedly a transition from tall grass to short grass country (Malin, 1947). This erroneous concept is still frequently encountered today. Ecological studies correlated with the geology of the grasslands have resulted in a newer, more accurate concept in which the grasslands are subdivided into the True Prairie and the Mixed Prairie coinciding in part, with the Great Plains (Blake, 1935; Weaver, 1954; Weaver and Albertson, 1956).

The western boundary of the True Prairie is topographically indistinct. Since the deciding factors are primarily climatic, the line of 20 inch rainfall or the 97 meridian is often used. West of this region is a transition zone in which local topography greatly influences the prairie aspect. The largest remaining tract of True Prairie in Kansas is the western half of the eastern one-third of the state or the Flint Hills region. As previously located in the Flint Hills Upland, the reservation lies within the True Prairie. Representatives of both warm and cool-season grasses are present. The warm-season perennials renew activity in middle or late spring and grow continuously until early fall. This midsummer foliage is important to stock producers. They flower and seed from midsummer until late autumn but do not make additional fall growth. Big and little bluestem, Indian grass and switchgrass are examples of warm-season grasses of semitropical origin, having entered the area from the east and southeast. On the other hand, blue grama, side-oats grama and buffalo grass originated in the mountain plateaus of Mexico and Central America, entering from the southwest. The cool-season perennials of northern origin renew growth in early spring, reaching maximum development from late March to early June. At this time, they flower and seed becoming semidormant during the

hot summer months. Since they resume vegetative growth during the fall, they provide excellent forage even after frost. Wild-rye and bluegrass are examples.

Since the reservation is chiefly prairie or modified prairie, a brief description of the dominant and subdominant grasses seems necessary.

Big bluestem (*Andropogon gerardi*)

Warm-season, tall-grass, perennial.
Roots 5-7 feet in depth.
Normally forms a sod but tillers into bunches on dry slopes and also in wet, poorly aerated soil.
Seedlings are shade tolerant.
Occurs on moist, well-drained lowlands; lower hillslopes; well-watered and level uplands; and deep prairie ravines.
Provides excellent pasture and hay being preferred by cattle over any other grass.

Little bluestem (*Andropogon scoparius*)

Warm-season, mid-grass, perennial.
Forms interrupted sods but tillers into bunches on steep slopes or drier uplands.
Because of lower moisture requirements and intolerance to shade, it dominates the upland prairie.
Provides excellent pasture and good hay if cut early.

Indian grass (*Sorghastrum nutans*)

Warm-season, tall-grass, perennial.
Normally forms sods however in association with big bluestem, it forms bunches due to poor development of tillers.
Seedlings are tolerant of drought and can invade disturbed areas in prairie that other lowland species cannot.
Occupies moist lowlands; deep prairie ravines; and well-watered, level uplands.
Provides excellent pasture and hay.

Tall dropseed (*Sporobolus asper*)

Warm-season, mid-grass, perennial.
Bunch-grass.
Although drought resistant, it usually occurs in only scattered amounts.
Occurs most abundantly on dry uplands.
Low forage value.

Side-oats grama (*Bouteloua curtipendula*)

Warm-season, mid-grass, perennial.
Normally grows in bunches but may form an open sod on shallow, rocky soil.
Drought resistant and shade tolerant.
Occurs on steep ravine banks; dry ridges; disturbed areas in big bluestem communities and little bluestem communities of the uplands.
Provides nutritious forage.

Hairy grama (*Bouteloua hirsuta*)

Warm-season, short-grass, perennial.
Sod-former.
Locally abundant on dry, thin soils and rocky ridges; common around outcrops.

Blue grama (*Bouteloua gracilis*)

Warm-season, short-grass, perennial.
Sod-former.
Drought resistant and intolerant of shade.
Occurs in very dry areas of upland prairie; crests of hills and ridges where competition with mid-grasses is minimal.
Provides excellent forage particularly in a dried state during drought and winter.

Buffalo grass (*Buchloe dactyloides*)

Warm-season, short-grass, perennial.
Forms sods or only small tufts in poor, dry areas.
Extremely drought resistant and intolerant of shade.
Limited in True Prairie to only the western edge where it occurs on very dry, thin soils of upland ridges or occasionally as relics resulting from overgrazing.
Provides nutritious forage.

Switchgrass (*Panicum virgatum*)

Warm-season, tall-grass, perennial.
Sod-former.
Less tolerant of shade than big bluestem.
Occurs in moist lowlands; prairie ravines and draws; and disturbed areas in upland prairies.
Provides good pasture and hay.

Canada Wild-rye (*Elymus canadensis*)

Cool-season, tall-grass, perennial.
Grows in loose clumps or open sods.
Occurs in lowlands but may become locally abundant in moist denuded areas such as gopher holes, ravines or swales in upland prairies.
Provides good forage and hay if cut before stems become woody.

Sloughgrass (*Spartina pectinata*)

Tall-grass, perennial.
Dense sod-former.
Shade-tolerant.
Occupies local areas of wet, poorly-aerated soils such as roadside ditches; margins of sluggish streams and ponds; springs; and moist lowlands.
Insignificant as forage producer.

Major Habitats of Open Prairies

There are probably no prairie areas on the reservation that have not been grazed during the past 10 years. The extent of grazing has varied considerably as shown by the contrast between lightly grazed and overgrazed areas (Figs. 4, 5). The best stands of native grasses are found on the western two-thirds of section B and the northern half of section D. Here little bluestem and Indian grass dominate the unbroken upland. Washes and shallow gulleys formed by erosion are invaded by switchgrass, arrowfeather (*Aristida purpurascens*), side-oats grama, muhly (*Muhlenbergia brachyphylla*), witch grass (*Panicum capillare*), and yellow bristlegrass (*Setaria lutescens*). A typical prairie wash is shown in Fig. 6.

The scattered moderately-grazed areas have a thinner cover of little bluestem, side-oats grama and tall dropseed. The latter species provides an early warning of disturbance. Some stands of little bluestem contain an equal amount of side-oats grama and indicate recovery rather than degeneration of prairie. In both types of areas, arrowfeather, goosegrass (*Eleusine indica*), Virginia wild-rye (*Elymus virginicus*), muhly, witch grass, and yellow bristlegrass are locally concentrated in denuded areas, ravines and broad washes. On shallow ridges of outcrops, a marginal community of side-oats grama, blue grama, dropseed (*Sporobolus neglectus*), and some buffalo grass dominates (Fig. 7). Completely denuded areas particularly around the base of rocks are invaded by hairy grama and dropseed. The major prairie ravines (Fig. 8) are capped on the ridges by clones of

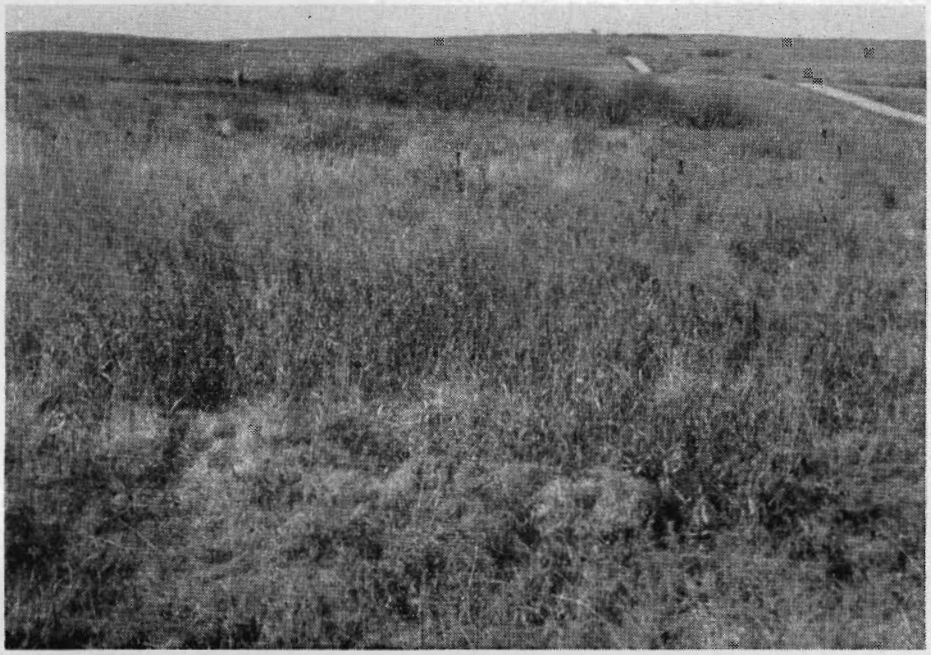


Fig. 4 Lightly grazed upland prairie of little bluestem and Indian grass.

Fig. 5 Overgrazed upland prairie with extensive broomweed invasion.

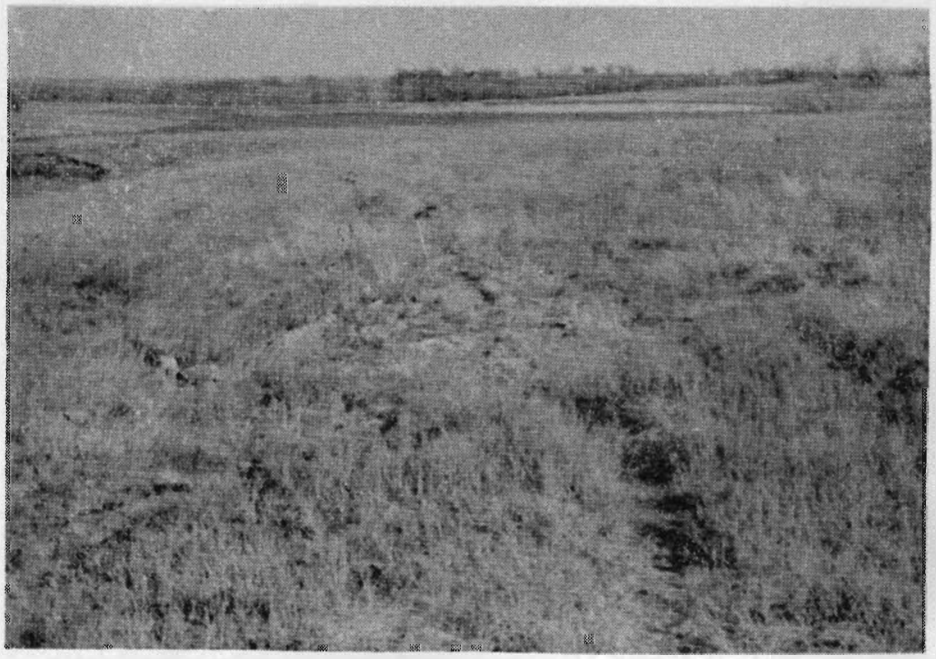


Fig. 6 Prairie wash. Note rocky open area forming in center of photograph.

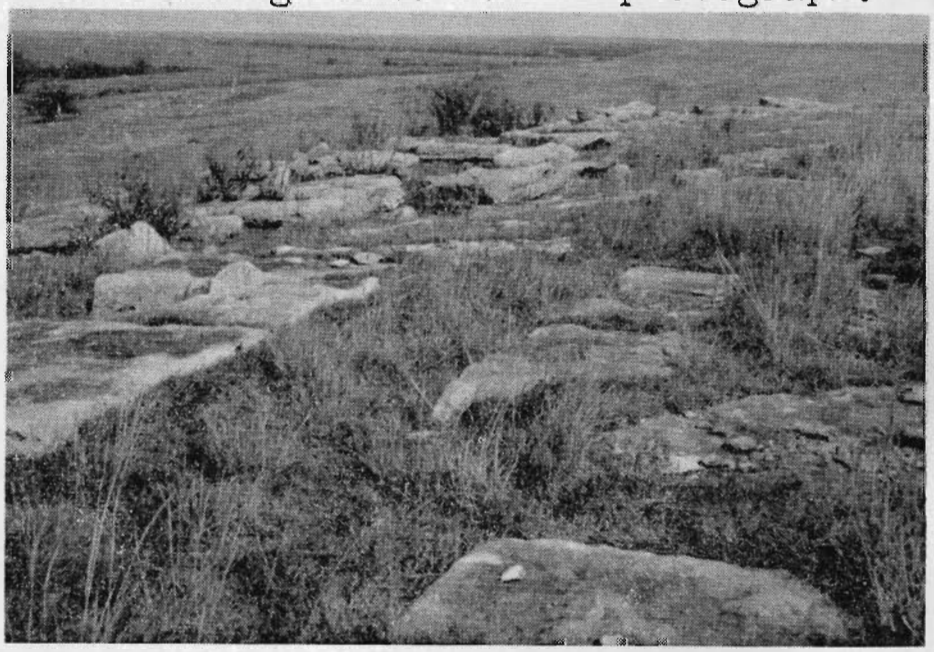
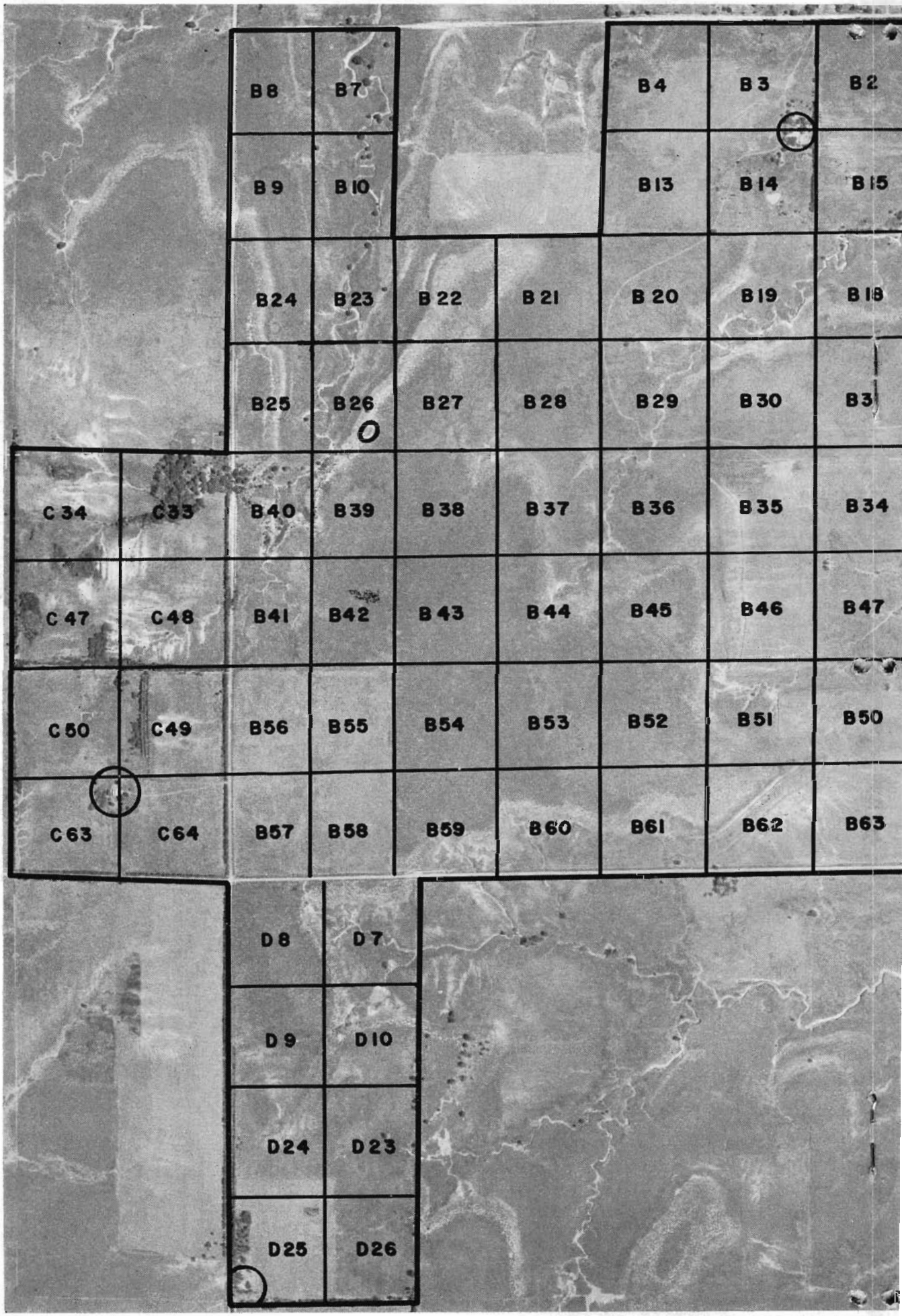


Fig. 7 Ridge of west-facing outcrop. A steep rocky slope lies west of shrubs.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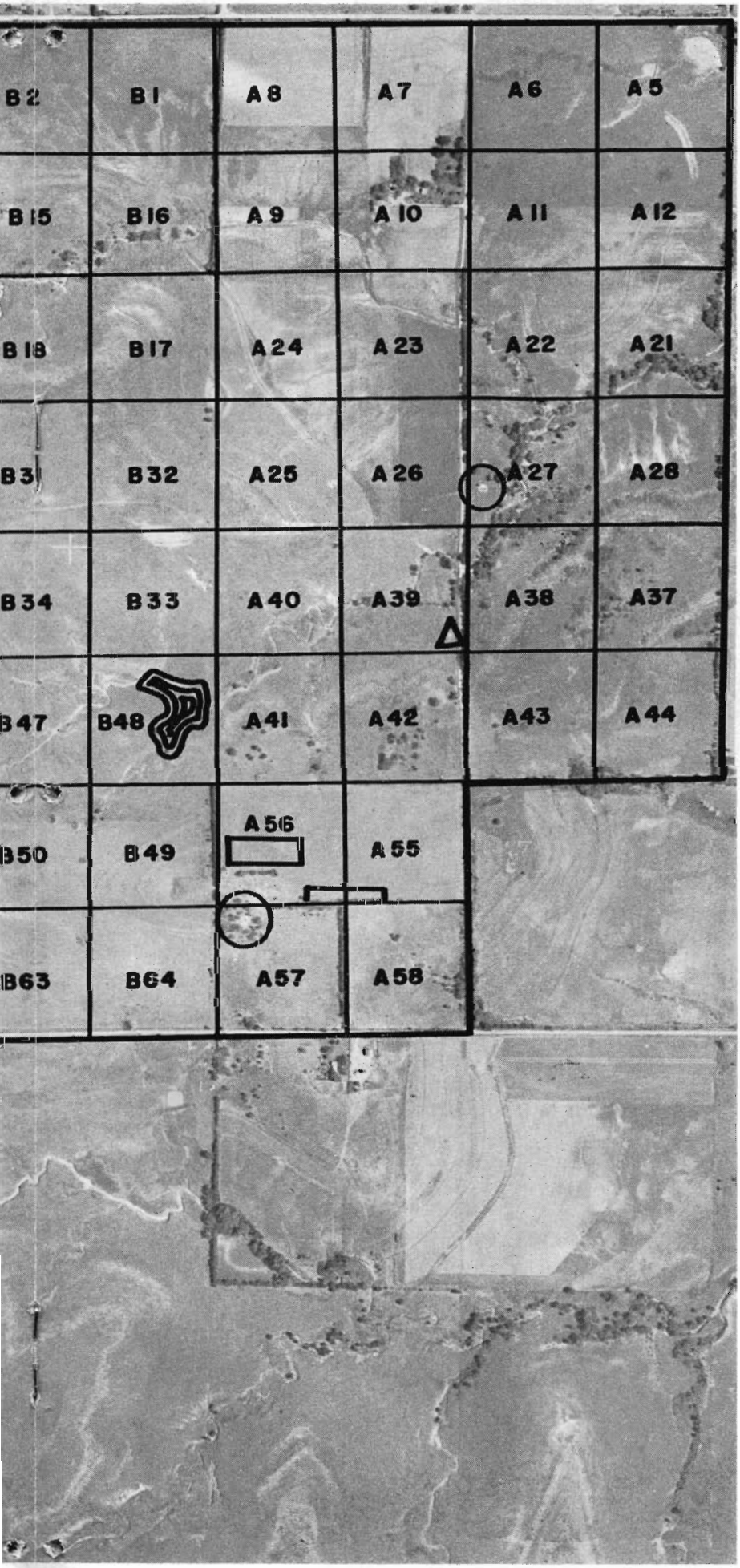

AERIAL PHOTO

F. B. AND RENA G. ROSS
NATURAL HISTORY
RESERVATION

Legend

○ old farmsites

△ in A 39—spring

▭ in A 56—windbreak

▭ in A 56 and A 55—feed patch

⬭ in B 26—old quarry

Darkened area in B 48
Gladfelter Pond

Sections and numbers of the 10-acre grid sections are shown in outline.

smooth sumac (*Rhus glabra*) and fragrant sumac (*Rhus aromatica* var. *serotina*). The latter frequently fan out into the adjacent prairie. Some of these are supplied by springs which trickle intermittently throughout the year. Clumps of big bluestem and Indian grass occur around small areas of permanently-trapped water.

The old quarry located on the major west-facing outcrop has a depression of about 4 to 5 feet in which winter and early spring precipitation accumulates. Protected from severe evaporation by the winds sweeping the prairie from the southwest, it provides a unique moist habitat for clumps of big bluestem, switchgrass, barnyard grass (*Echinochloa crusgalli*), and Virginia wild-rye.

Major Aquatic Habitats of the Prairie

The largest pond on the reservation, Gladfelter Pond (Fig. 9), was constructed in June, 1958. The dam and spillway bank were seeded with bermuda grass (*Cynodon dactylon*). Around the margins of several older stock ponds are side-oats grama, Canada wild-rye, dropseed, and buffalo grass. These frequently migrate up the small ravines feeding into the ponds.

The reservation is traversed by 3 drainages. One of these originates in the wooded ravine in Chase County and flows east, then north. The second forms on the east slope of the prairie upland and flows northeast. The third consists of the watershed for the Gladfelter Pond and flows northeast along a scrubby and wooded course. These creeks vary in amount and duration of flow through the year. For the most part, their banks are abrupt and bare (Fig. 10). Occasionally they fan out into small local flood plains which are seepy in places and dotted with permanent pools. In such areas, the tall grasses of the lowlands find a suitable habitat. The most extensive spring is located in A 39 (Fig. 11, insert). At its source and scattered along its course are solid mats of watercress (*Nasturtium officinale*) along with water plantain (*Alisma subcordatum*), great bulrush (*Scirpus validus* var. *creber*), clumps of Indian grass, and big bluestem. A marshy community of slough-grass (*Spartina pectinata*) and great bulrush occupy a midway position on its downward course to the east wooded creek.

Major Habitats of Abandoned Homesteads

The most extensive building remains are located in B 14, D 25, A 27, A 57, and C 64 (insert). Fig. 12 shows the shell of a farmhouse still standing on the Chase County land. Escaped cultivated grasses such as chess (*Bromus secalinus*), Japanese chess (*Bromus japonicus*), and bluegrass (*Poa pratensis*) form the major ground cover in these areas. Some native migrants include yellow bristlegrass, stinkgrass (*Eragrostis cilianensis*) and *Panicum scribnerianum*. Broomweed (*Gutierrezia dracunculoides*), cocklebur (*Xanthium pensylvanicum*), three-seeded mercury (*Acalypha virginica*) and buffalo-bur (*Solanum rostratum*) also occur in abundance.

Fig. 8 Rocky prairie ravine showing marginal migration of sumac on left.

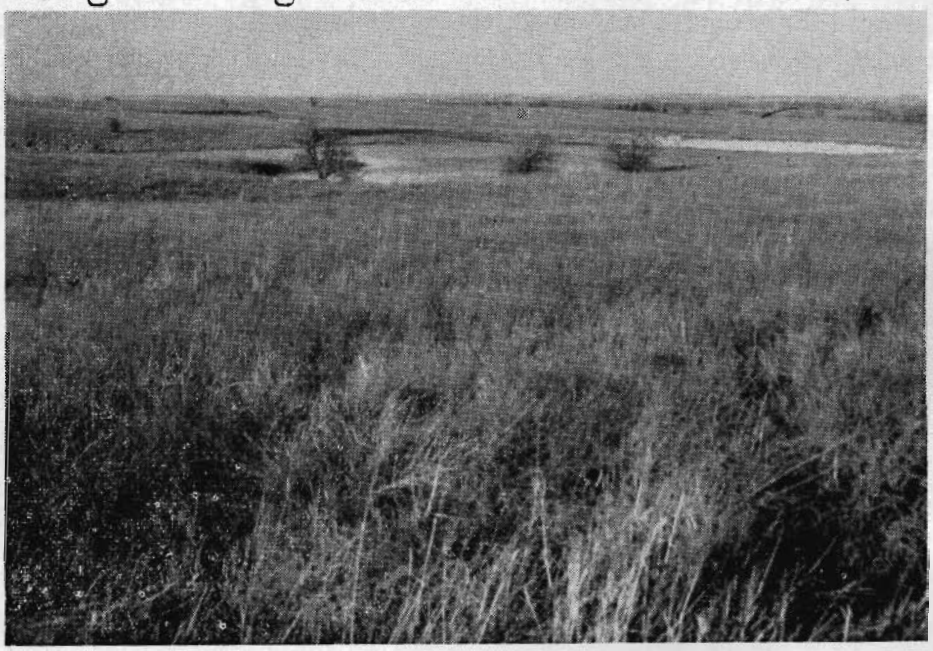

Fig. 9 Gladfelter Pond. The dam is visible in the right background.

Fig. 10 Creek showing abrupt bank capped by overhanging grass clumps.

Fig. 11 Spring area. Water flows from under rock in left foreground.

Several stands of chess have been planted in recent years but there are no cultivated fields of legumes.

Woodlands

The natural treelessness of the prairies is a well established fact. Many single explanations have been proposed only to be rejected in light of subsequent ecological studies. Like most biological phenomena, a number of factors is involved. The low winter rainfall, unreliable snow cover, and occasional severe summer droughts are definitely unfavorable to tree growth (Borchert, 1950). The drought years of the 1930's resulted in the death of inestimable numbers of trees (Transeau, 1935; Albertson and Weaver, 1945; McComb and Loomis, 1944). Since the onset of prairie settlement, numerous observations and records have been made concerning the restriction of trees or woodlands to the water courses and deep, protected ravines usually associated with outcrops. The introduction of trees by the settlers was successful at first as evidenced by records of extensive orchards in some localities. The reservation, at one time, was a locally famous fruit-producing community. Despite care and cultivation, the orchards could not withstand the drying winds which evaporated the surface and subsurface moisture. Eventually, the deeper water supplies were exhausted and death followed (Wiggans 1936, 1937).

Most of the orchard species planted required clean cultivation and this left the valuable top soil vulnerable to wind erosion. The result was not only soil loss but also decreased fertility. The natural restoration of soil fertility proceeds too slowly for the maintenance of trees. Thus through a cyclic series of events, the broken sod was reduced to such a state that only grasses could compete and survive.

The water courses and deep ravines are still today the principal habitats of woody plants in the prairies and these areas have been greatly thinned as a result of settlement.

Major Wooded Habitats

The wooded ravine beginning in Chase County and extending eastward across the county line is the most heavily wooded area on the reservation (Fig. 13). Thick stands of smooth and fragrant sumac, coralberry (*Symphoricarpos orbiculatus*), and dogwood (*Cornus drummondi*) cover the rock-strewn slopes; crest the outcrops; and migrate marginally out into the adjacent prairie. Also scattered along the ridges are osage orange (*Maclura pomifera*), red haw (*Crataegus mollis*) and honey locust (*Gleditsia triacanthos*). The largest trees in this area are hackberry (*Celtis occidentalis*), red elm (*Ulmus rubra*), american elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica* var. *subintegerrima*), black walnut (*Juglans nigra*), and red cedar (*Juniperus virginiana*). Core samples of 3 trees in this area revealed the following approximate ages: hackberry, 35 years old; black walnut, 38 years old; and red cedar, 55 years old.

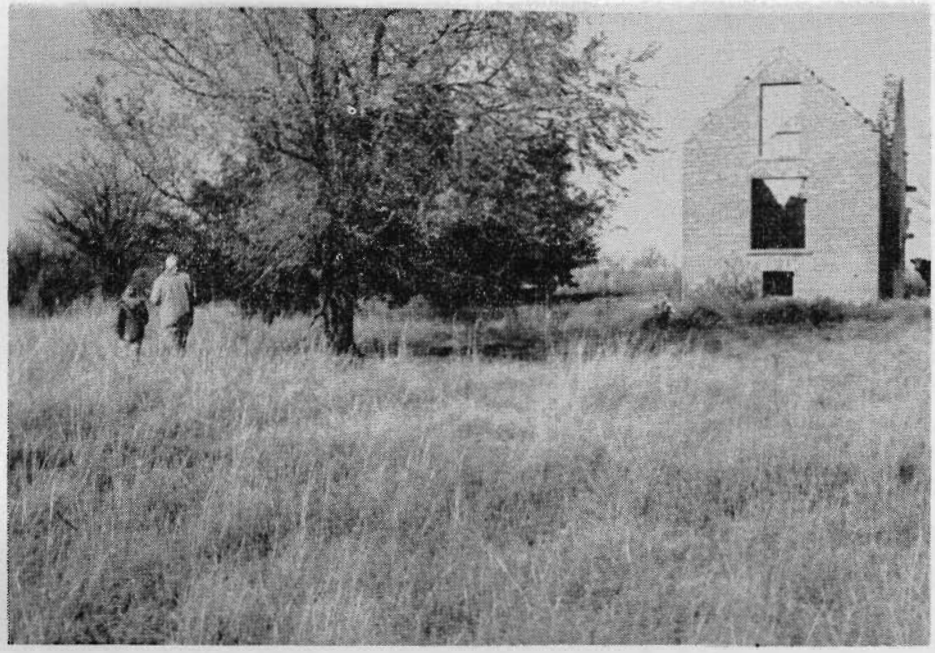

Fig. 12 Limestone shell of farmhouse in Chase County area, C64.

Fig. 13 Looking east along major wooded ravine and outcropping.

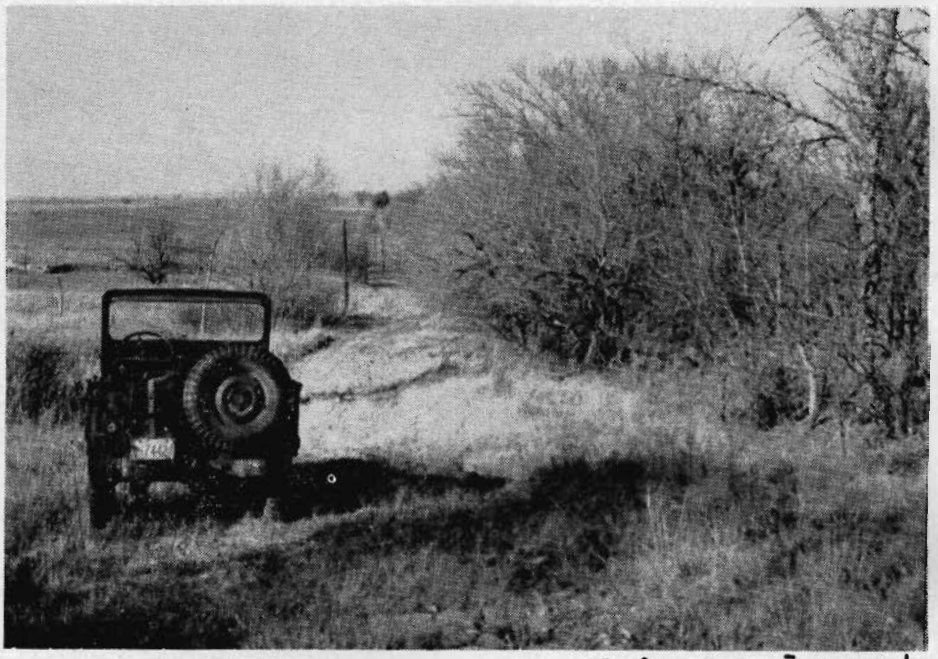

Fig. 14 Osage-orange and honey locust fencerow along abandoned roadway, A38.

Fig. 15 Old Catalpa windbreak or woodlot near Chase County farmsite.

Clumps and scattered trees of cottonwood (*Populus deltoides*), osage orange, green ash, and box elder (*Acer negundo*) occur along the wooded creek in section A. Dogwood, sumac and red cedar seedlings occupy the lower slopes adjacent to the creek. One large cottonwood sampled was over 103 years old. The most common fencerow consists of osage orange and honey locust (Fig. 14). The grass understory is usually sparse but adjacent banks and roadsides are often covered with muhly and *Panicum scribnerianum*. Several clumps of black locust (*Robinia pseudo-acacia*) occur in section D, near the fencerow. The most diverse fencerow is located along the abandoned roadway of A 58. It consists of osage orange, honey locust, red elm, american elm, and hackberry with dogwood, coralberry, and sumac thickets intespersed. An old windbreak or possible woodlot composed of cigar tree (*Catalpa speciosa*) and green ash is shown in Fig. 15. Scattered between the rows are fragrant sumac and coralberry. The trees found around the old farmsites include red cedar, green ash, hackberry, kentucky coffee-tree (*Gymnocladus dioica*), black locust, and honey locust. Plum (*Prunus americana*) thickets also remain in some areas. The largest tree on the reservation is a silver maple (*Acer sac-*

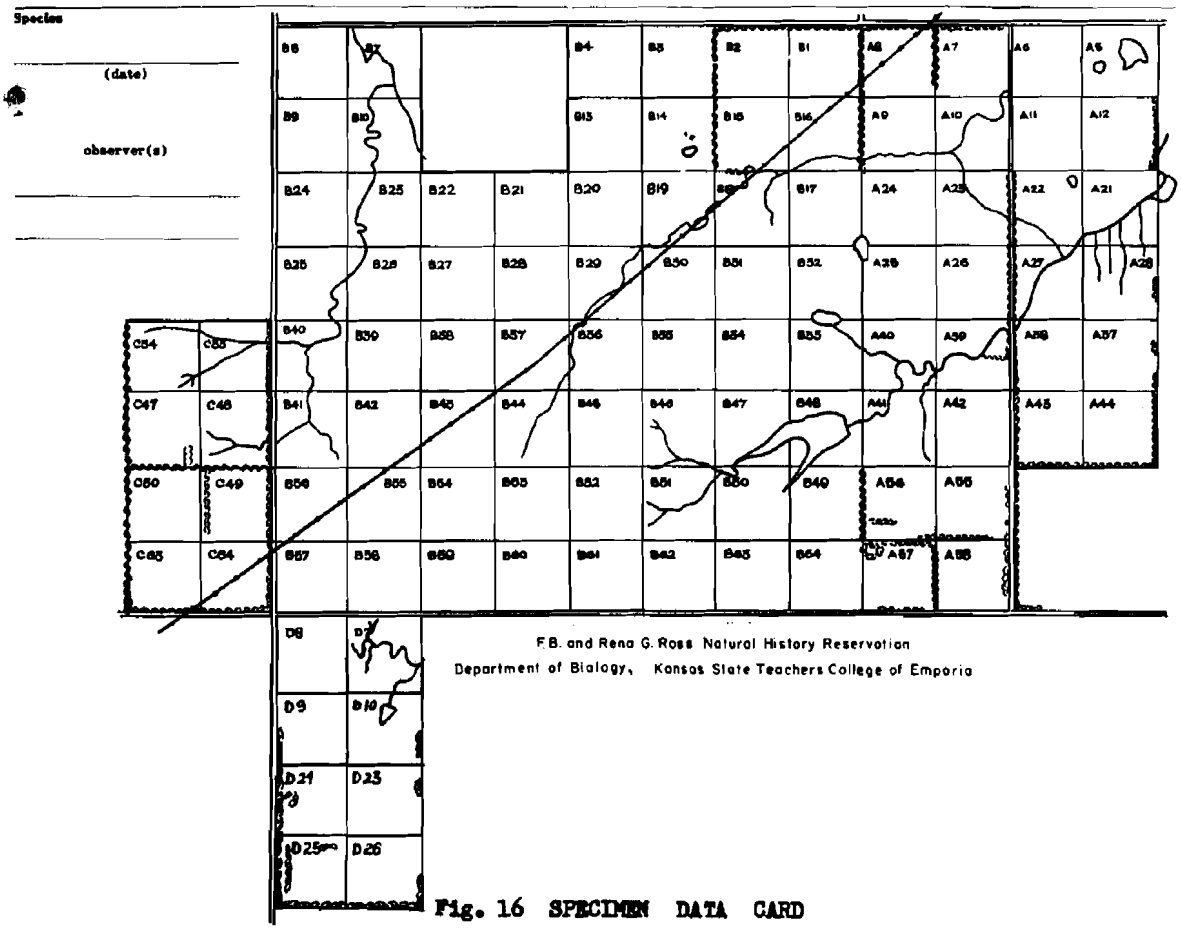

Fig. 16 SPECIMEN DATA CARD

Original drawn by Robert F. Clarke

charinum) over 79 years old located in A 27. A green ash and *Pinus nigra* var. *nigra* from the Chase County farmsite are 50 and 65 years old respectively. One of the green ashes in the headquarters region is over 57 years old.

ACCUMULATION OF FIELD DATA

The accumulation of recorded field observations and sight records of plants and animals will contribute toward a more thorough understanding of dynamic ecology over a period of years. This is particularly essential to the long-range program of the reservation. Although such data might seem fragmentary and irrelevant, it is impossible to predict the extent to which it might be used in future studies conducted on the area.

To facilitate the specific location of field observations and study areas, the reservation is divided into 10-acre grid sections. These sections are lettered and numbered according to the standard numbering system of townships. Data cards showing the grid sections, drainages, and landmarks (Fig. 16) are used in making sight records. All field notes and sight records are on permanent file and available to investigators. Complete reference collections of all native plants and animals will be assembled by authorized personnel as time progresses. Although primarily intended for research reference, the collections may also serve to stimulate local interest in the native plants and animals on the part of non-college groups visiting the reservation.

In keeping with the terms of contract, several types of land improvements have been constructed or planted as part of class projects. Using large limbs and brush, 2 natural exclosures (Fig. 17) and 2 lean-to shelters (Fig. 18) were constructed. These offer protection to wildlife and should provide interesting study areas in the future. A 1-acre feed patch of milo (Fig. 19) is located east of the headquarters area. Potential feeding grounds for migratory waterfowl were also established around the margins of Gladfelter Pond and the first pond north. A windbreak north of the headquarters is to be re-established this spring. Late planting and unfavorable weather conditions during the past summer resulted in a high mortality among the deciduous seedlings that were planted. In order to check erosion by surface run-off, several brush dams (Fig. 20) and a multiflora rose gully planting were made. These natural barriers may also serve as a food source, nesting site and protective shelter for animals.

Over a period of years, the accumulated field data will provide an insight into such problems as ecological succession and its effect upon animal populations; the interactions of fauna and flora in an undisturbed area; and the biotic responses to climatic change. Studies on natural grassland recovery as well as studies correlating soil factors with range sites and biotic associations will provide a basis for the interpretation of land conditions adjacent to the reservation. Not all of the important studies are in themselves of such extended duration. Many of them can be completed in

Fig. 17 Natural exclosure. Brush dam spans intersecting ravines in foreground.

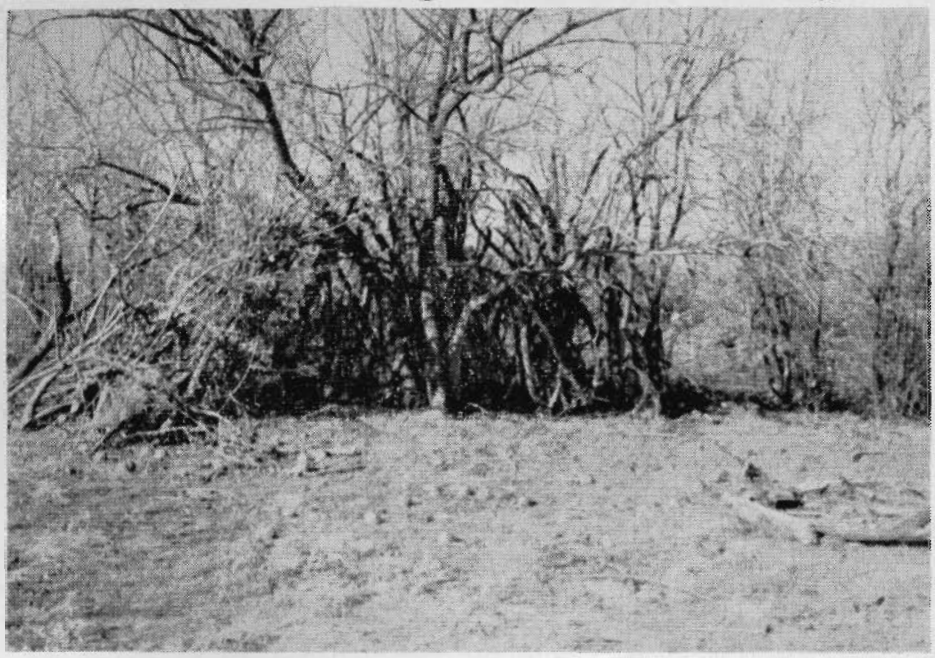

Fig. 18 Lean-to shelter constructed around an osage-orange.

Fig. 19 1-acre milo feed patch east of headquarters area.

Fig. 20 Brush dam. This land was once terraced and cultivated.

1 or 2 years and thus serve as excellent research problems for graduate students. Plant and animal surveys are needed in order to establish the present flora and fauna of the area. Life histories and animal behavioral studies are valuable particularly when correlated with the composition and distribution of biotic communities. A great deal is yet to be learned about environmental factors in general. Microclimates are believed to be as variable as microhabitats however, verification of this is needed. One of the most potential aspects of prairie ecology is that of prairie microbiology. All of these problems have virtually inexhaustible facets.

PRELIMINARY ANNOTATIONS OF PLANT SPECIES

The annotated list of plant species at this time is quite precursory. It includes only some of the common summer and early fall flowering plants with the exception of 1 fern and 2 conifers. The nomenclature for the grasses follows that of Hitchcock (1950); all other taxa after Fernald (1950).

Polypodiaceae: *Pellaea glabella* Mett. Smooth Cliff-brake
Rock crevices and fissures of west-facing outcrop.

Pinaceae: *Juniperus virginiana* L. Red cedar
Scattered seedlings in prairie; fencerows; roadways; along creeks; wooded ravine; farmsites.

Pinus nigra Arnold var. *nigra* Aschers. & Graebn.
One tree at farmsite in C 64.

Alismataceae: *Alisma subcordatum* Raf. Water plantain
Along course of spring.

Gramineae: *Andropogon gerardi* Vitman Big bluestem
Scattered clumps in quarry depression; seepy prairie ravines; upland prairie; along spring.

Andropogon scoparius Michx. Little bluestem
Open prairie; rocky soil cresting ridges; swales.

Aristida purpurascens Poir. Arrowfeather
Bare areas in prairie; along ravines and washes.

Bouteloua curtipendula (Michx.) Torr. Side-oats grama
Open prairie; rocky soil cresting ridges; swales; margins of pond.

Bouteloua gracilis (H.B.K.) Lag. ex Steud. Blue grama
Open prairie; rocky soil cresting ridges; swales.

Bouteloua hirsuta Lag. Hairy grama
Open rocky prairie; rocky soil cresting ridges; denuded areas around outcrops; swales.

Bromus japonicus Thunb. Japanese chess.
Escaped cultivation; waste areas; depressions and ravines in rocky prairie.

Bromus japonicus Thumb. Japanese chess
Escaped cultivation; waste areas and roadways.

Buchloe dactyloides (Nutt.) Engelm. Buffalo grass
Margin of pond; small ravines; shallow soil around outcrops.

Echinochloa crusgalli (L.) Beauv. Barnyard grass
Scattered plants in quarry depression.

167935

Eleusine indica (L.) Gaertn. Goose grass
Scattered in denuded areas of rocky prairie.

Elymus canadensis L. Canada wild-rye
Denuded areas in prairie; around margin of ponds; shallow ravines.

Elymus virginicus L. Virginia wild-rye
Scattered clumps in quarry depression; ravines and washes; along fencerows.

Eragrostis cilianensis (All.) Lutati Stink grass
Waste areas; roadsides; bare soil around outcrops; farmsites.

Muhlenbergia brachyphylla Bush. Muhly
Ravines and washes near fencerows; roadsides.

Panicum capillare L. Witch grass
Ravines and washes; scattered in rocky prairies.

Panicum scribnerianum Nash.
Scattered in washes; along windbreak and fencerows; farmsites.

Panicum virgatum L. Switchgrass
Quarry depression; seepy ravines; along fencerows and roadsides.

Poa pratensis L. Kentucky bluegrass
Escaped cultivation; waste areas; farmsites.

Setaria lutescens (Weigel.) Hubb. Yellow bristle grass
Ravines and washes; scattered in rocky prairie; along fencerows and roadsides; farmsites.

Sorghastrum nutans (L.) Nash. Indian grass
Open prairie; swales; ravines and washes; seepy margins of spring; scattered clumps in quarry depression.

Spartina pectinata Link Slough grass
Marshy area around spring.

Sporobolus asper (Michx.) Kunth. Tall dropseed
Scattered throughout open prairie; shallow ravines and washes.

Sporobolus neglectus Nash. Dropseed
Margin of ponds; bare soil around outcrops.

Cyperaceae: *Carex frankii* Kunth.
Seepy slopes of outcrops; along creeks.

Scirpus validus Vahl. var. creber Fern. Great bulrush
Along spring.

Juncaceae: *Juncus interior* Wieg. Inland rush
Margin of ponds.

Juncus torreyi Coville Torrey rush
Along creeks; seepy depressions.

Salicaceae: *Populus deltoides* Marsh. Cottonwood
Along creeks.

Juglandaceae: *Juglans nigra* L. Black walnut
Wooded ravine; ridge of outcrop.

Ulmaceae: *Celtis occidentalis* L. Hackberry
Along creeks; wooded ravine; fencerows.

Ulmus americana L. American elm
Fencerows; wooded ravine.

Ulmus pumila L. Siberian elm
Planted at farmsite in C 64.

Ulmus rubra Muhl. Red elm
Fencerows; wooded ravine.

Moraceae: *Maclura pomifera* (Raf.) Schneid. Osage orange
Fencerows; wooded ravine; along creeks; ridges of outcrops.

Polygonaceae: *Rumex altissimus* Wood Pale dock
Quarry depression; seepy areas; moist washes.

Rumex crispus L. Yellow dock
Quarry depression; scattered in seepy areas.

Cruciferae: *Nasturtium officinale* R. Br. Watercress
Spring; several permanent pools along creek.

Rosaceae: *Crataegus mollis* (T. & G.) Scheele Red haw
Wooded ravine; ridges of outcrops.

Prunus americana Marsh. Wild plum
Scattered thickets around farmsites.

Rosa arkansana Porter var. *suffulta* (Greene) Cockerell Wild rose
Rocky slopes of ravine.

Leguminosae: *Amorpha canescens* Pursh. Leadplant
Scattered in upland prairie.

Baptisia leucantha T. & G. White false indigo
Scattered in upland prairie.

Baptisia leucophaea Nutt. False indigo
Upland prairie.

Baptisia minor Lehm. False indigo
Rocky upland prairie; swales.

Gleditsia triacanthos L. Honey locust
Fencerows; wooded ravine; along creek.

Gymnocladus dioica (L.) K. Koch Kentucky coffee-tree
Scattered in fencerows and wooded ravine; around farmsites.

Lespedeza capitata Michx. Bush-clover
Scattered in rocky prairie.

Lespedeza virginica L. Britt. Bush-clover
Scattered in rocky prairie.

Petalostemum multiflorum Nutt. Prairie-clover
Scattered in dry, rocky prairie; rocky slopes below outcrops.

Robinia pseudo-acacia L. Black locust
Several clumps near fencerow; planted around farmsites.

Euphorbiaceae: *Acalypha virginica* L. Three-seeded mercury
Waste areas; scattered in rocky prairie; around outcrops; farmsites.

Croton capitatus Michx. Wooly croton
Scattered in washes and denuded areas in prairie.

Croton monanthogynus Michx. Prairie-tea
Rocky prairie washes and ravines.

Euphorbia marginata Pursh. Snow-on-the-mountain
Waste areas; scattered in prairie washes.

Anacardiaceae: *Rhus aromatica* Ait. var. *serotina* (*Greene*) Rehd. Fragrant sumac
Rocky slopes and ravines; ridges of outcrops; along fencerows and roadside banks.

Rhus glabra L. Smooth sumac
Rocky slopes and ravines; cresting ridges of outcrops; along fencerows and roadside banks; scattered clones in rocky prairie; farmsites.

Aceraceae: *Acer negundo* L. Box elder
Scattered along creek; several trees in windbreak.

Acer saccharinum L. Silver maple
One tree planted at farmsite in A 27.

Acer saccharum Marsh. Sugar maple
Planted along roadway in fencerow.

Guttiferae: *Hypericum mutilum* L. St. John's-wort
Moist areas in quarry depression; moist prairie swales.

Onagraceae: *Gaura parviflora* Dougl. Gaura
Waste areas; upland prairie washes.

Oenothera biennis L. Evening primrose
Scattered in open upland prairie.

Cornaceae: *Cornus drummondi* Meyer Dogwood
Rocky slopes and ravines; ridges of outcrops; fencerows.

Oleaceae: *Fraxinus pennsylvanica* Marsh. var. subintegerrima (Vahl.) Fern. Green ash
Wooded ravine; farmsites.

Apocynaceae: *Apocynum cannabinum* L. Indian hemp
Scattered on rocky slopes; ravines.

Boraginaceae: *Onosmodium occidentale* Mackenz. False gromwell
Scattered in open prairie; washes; ridges of outcrops.

Verbenaceae: *Verbena hastata* L. Blue verbena
Scattered in open prairie.

Verbena simplex Lehm. Narrow-leaved verbena
Rocky soil in open prairie; on ridges of outcrops.

Labiatae: *Monarda fistulosa* L. var. *mollis* (L.) Benth. Wild bergamot
Ridges of outcrops; local populations in open prairie.

Nepeta cataria L. Catnip
Rocky slopes below outcrops; ravines.

Solanaceae: *Solanum rostratum* Dunal. Buffalo-bur
Waste areas; farmsites; roadsides.

Scrophulariaceae: *Verbascum thapsus* L. Mullein
Rock crevices and dry, rocky soil around outcrops.

Bignoniaceae: *Catalpa speciosa* Warder Cigar-tree
Planted in windbreak.

Caprifoliaceae: *Symphoricarpos orbiculatus* Moench. Coralberry
Rocky slopes and ravines; ridges of outcrops; around spring; fencerows and roadside banks.

Compositae: *Ambrosia artemisifolia* L. var. *elatior* (L.) Descourtilis Ragweed
Scattered in open prairie.

Artemisia ludoviciana Nutt. White sage
Ravines; ridges of outcrops; scattered in rocky prairie.

Aster ericoides L. White heath aster
Scattered in open prairie.

Cacalia tuberosa Nutt. Indian plantain
Scattered in open rocky prairie.

Cirsium altissimum (L) Spreng. Field thistle
Open prairie.

Cirsium undulatum (Nutt.) Spreng. Wavy-leaved thistle
Scattered in rocky prairie.

Echinacea angustifolia D. C. Purple coneflower
Scattered in prairie.

Gutierrezia dracunculoides (D.C.) Blake Broom snakeroot
Abundant in overgrazed pastures; waste areas; ravines and washes; along spring; farmsites.

Helianthus annuus L. Common sunflower
Roadsides; waste areas; scattered in moist prairie washes.

Helianthus laetiflorus Pers. var. rigidus (Cass.) Fern. Prairie Sunflower
Scattered in open, rocky prairie; washes.

Helianthus maximiliani Schrad.
Along roadsides and fencerows.

Helianthus mollis Lam.
Scattered in open, rocky prairie.

Kuhnia eupatorioides L. var. *corymbulosa* T. & G. False boneset
Rocky slopes below outcrops; denuded areas in prairie.

Liatris angustifolia (Bush) Gaiser Narrow-leaved blazing-star
Scattered in open rocky prairie.

Liatris aspera Michx.
Rocky prairies.

Ratibida columnifera (Nutt.) Wooton & Standl. Prairie coneflower
Scattered in rocky prairie; washes.

Solidago canadensis L. Goldenrod
Scattered in open, rocky prairies.

Solidago gigantea Ait. Giant goldenrod
Rocky prairie ridges.

Solidago petiolaris Ait.
Scattered in rocky areas and ridges in prairie.

Solidago rigida L. Stiffleaf goldenrod
Scattered in open, rocky prairie.

Vernonia baldwini Torr. var. *interior* (Small) Schub. Ironweed
Scattered in rocky areas of open prairie.

Xanthium pennsylvanicum Wallr. Cocklebur
Waste areas; prairie washes; roadsides; farmsites.

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APPENDIX

LEASE AGREEMENT

The lease agreement was made and entered into on November 17, 1958. The parties concerned were F. B. Ross and Rena G. Ross of Emporia (parties of the first part) and the Board of Regents of the State of Kansas (party of the second part).

The real estate was specifically defined as follows:

> **"All of Section Seven (7), Township Eighteen (18), Range Ten (10), except the Northeast Quarter of the Northwest Quarter (NE ¼ NW¼); The Northwest Quarter (NW ¼) and the West Half of the Southwest Quarter (W ½ SW¼) and the Northeast Quarter of the Southwest Quarter (NE ¼ SW ¼) of Section Eight (8), Township Eighteen (18), Range Ten (10); Also West Half of the Northwest Quarter (W ½ NW ¼) of Section Eighteen (18), Township Eighteen (18), Range Ten (10), all consisting of 960 acres in Lyon County, Kansas. Also the East Half of the Southeast Quarter (E ½ SE ¼) of Section Twelve (12), Township Eighteen (18), Range Nine (9), in Chase County, Kansas, making a total of 1040 acres."**

The land area is to be known as the "F. B. and Rena G. Ross Natural History Reservation."

As specifically designated, the land is leased "to the party of the second part for the use of the Kansas State Teachers College, Emporia, Kansas . . . . . for the purpose of scientific research and instruction in the training of students in said college to become public school teachers."

The payment of one dollar along with the agreement of the second party to comply with the specified restrictions of the lease provides that:

"Said rights hereunder to continue from year to year until this Lease Agreement is terminated by either party giving to the other notice of the termination thereof at least six (6) months in advance of the annual date of the execution of this Lease Agreement."

The rights and privileges granted the Kansas State Teachers College, Emporia, Kansas are:

1) to foster and develop, maintain and improve plant life upon the premises.
2) to encourage wildlife in the area.
3) to plant native trees and shrubs as long as no noxious plants are introduced or maintained.
4) to construct a fence to enclose 1 or 2 acres upon which temporary buildings or other equipment is located.

The privileges and obligations granted the party of the second part and/or the Kansas State Teachers College, Emporia, Kansas are:

1) furnish all necessary farming or other equipment to maintain and improve the plant and animal life and to carry out research.
2) to remove such equipment from the premises upon the termination of the lease agreement, leaving the premises in the same or better condition than at the onset of agreement.
3) to construct a building or move a building upon the premises to be used in connection with the scientific program contemplated by the college.
4) to take a trailer or any other vehicle on the premises that may be necessary to carry out the scientific program.
5) to exercise the option of removing any temporary building or equipment of the college at any time.

6) to post the area informing the public that the land is leased for scientific purposes and prohibiting trespassing, hunting, fishing or other use by the public in general.
7) not to interfere with the use of the premises being grazed or farmed in any way.
8) to prevent fence destruction.
9) to keep gates closed at all times.
10) to cooperate with the party of the first parts' tenant and to cooperate with the tenant's use of the premises.
11) to be responsible for replacing any fence destroyed by its agents and invitees.
12) to permit other organizations, groups or individuals to use the premises for scientific purposes.
13) to remove from the premises any specimen of plant life or wild animal, planted or growing in the area to carry out the scientific program of the Biology Department of the Kansas State Teachers College, Emporia, Kansas.

The lease contract is binding upon "the parties of the first part, their heirs, executors, administrators and assigns."

RESTRICTIONS AND REGULATIONS

In order to accomplish the objectives of the reservation and promote maximum utilization of its facilities, certain restrictions and regulations must be followed by all persons currently using or contemplating future use of the reservation.

The reservation is under the direction of the Ross Natural History Reservation Committee of the Department of Biology. This group formulates the policies; approves all research proposals; enforces the regulations; and directs all general activities of the area. Two committee members serve as coordinators of research and physical facilities.

A detailed outline of policies and procedures is available to all prospective investigators. The following points merely exemplify the extent to which the reservation is protected from unnecessary disturbances:

1) **All forms of trespassing, hunting, fishing, and commercial trapping are prohibited.**
2) **Camping and picnic activities are prohibited.**
3) **All classes making field trips to the reservation must be accompanied by a Biology Department staff member. There are no restricted areas on the reservation to these groups.**
4) **All non-college groups or classes must be accompanied by a Biology Department staff member. These groups are restricted to the east half of the reservation (all of section A and a strip of section B formed by the 2 easternmost grid plots).**
5) **All research proposals, project studies, and physical plant alterations must be outlined and submitted to the committee for approval.**

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