KANSAS GEOLOGICAL SURVEY
OPEN-FILE REPORT 92-22

Fall Field Trip to the Natural Areas
of Southeast Kansas

Kansas Academy of Science
Multidisciplinary Guidebook 5

by

Joseph A. Arruda, Editor

KANSAS GEOLOGICAL SURVEY
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KANSAS ACADEMY OF SCIENCE

MULTIDISCIPLINARY GUIDEBOOK 5

FALL FIELD TRIP TO THE NATURAL AREAS OF SOUTHEAST KANSAS

Department of Biology
Pittsburg State University
Pittsburg, Kansas 66762

October 17, 1992

Kansas Geological Survey Open-File Report 92-22

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Hosted by

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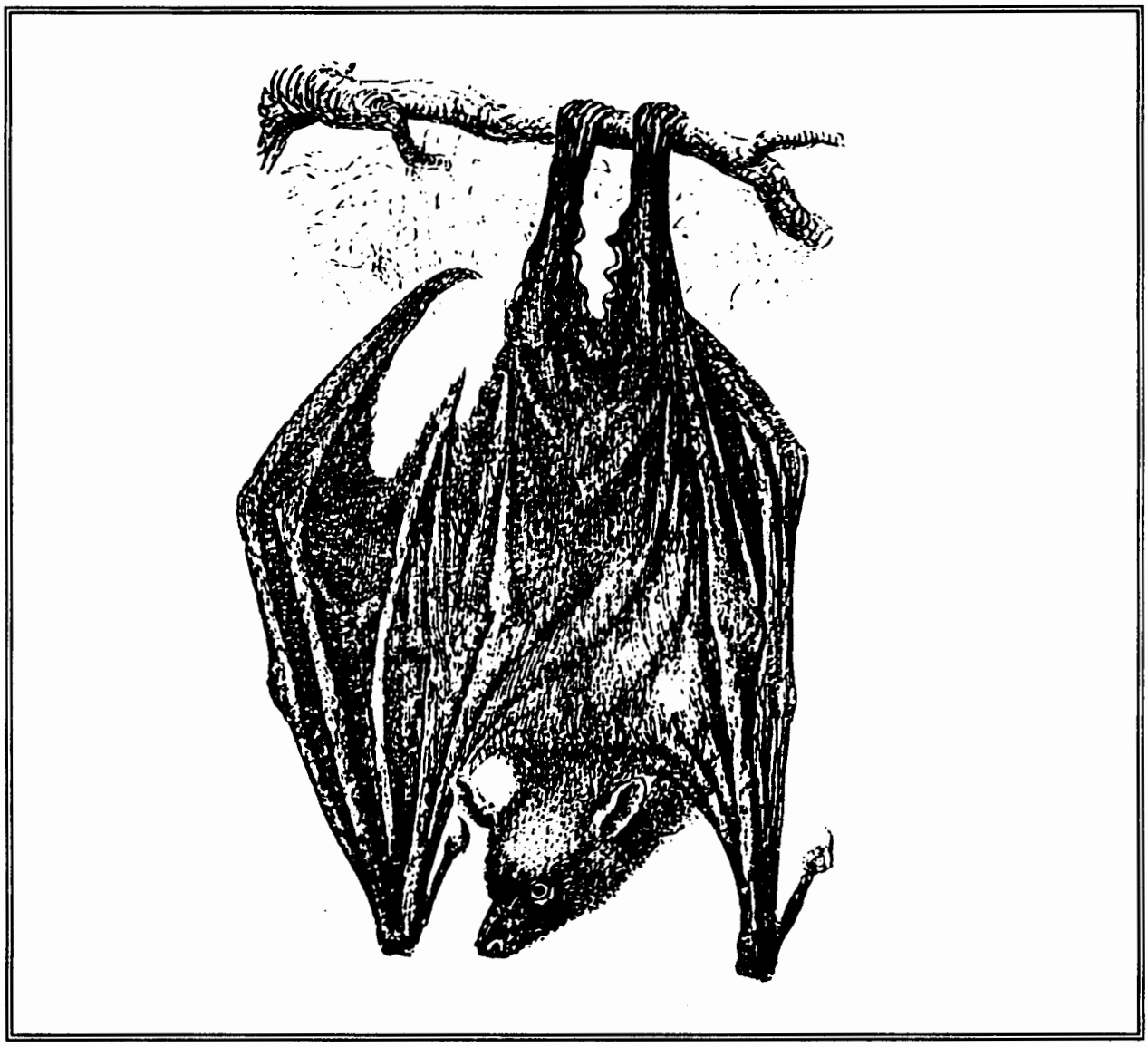

October 17, 1992

Kansas Geological Survey Open-File Report 92-22

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Department of Biology
Pittsburg State University
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TABLE OF CONTENTS

Chapter 1

ITINERARY

FIFTH ANNUAL FALL FIELD TRIP OF THE KANSAS ACADEMY OF SCIENCE

October 16-17, 1992

Biology Dept., Pittsburg State University

Friday night

5:00 pm Executive Council Meeting

Saturday morning (8:00 am to 12:00 pm)

8:00 am (meet behind Heckert-Wells on Joplin Street)

8:00 Robb Prairie (S. Ford)
8:45 Natural History Reserve (J. Triplett)
9:30 O'Malley Prairie (S. Timme)
10:00 Monahan Outdoor Education Center (S. & C. Ford)

Saturday afternoon (1:00 pm to 3:00 pm)

1:00 pm (meet behind Heckert-Wells on Joplin Street)

1:00 travel to: Schemerhorn Park, Galena (Triplett)
1:45 arrive: visit cave, stream, and hike bluff
3:00 leave, tour lead mine waste areas
3:45 return to campus, optional *Nature Reach* tour

Kansas Geological Survey

Open File Report 1992-22

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Chapter 2

INTRODUCTION

Dr. Joseph A. Arruda
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Pittsburg State University

The Fall Field trip of the Kansas Academy of Science is now in its fifth year and is being held in southeast Kansas for the first time. But what is southeast Kansas?

At a minimum, southeast Kansas includes the 9 county area (Fig. 2-1) of Woodson, Allen, Bourbon, Wilson, Neosho, Crawford, Montgomery, Labette, and Cherokee counties. Some workers include the three counties to the north and others (as Timme does in Chapter 10 of this volume) include the three western bordering counties of Greenwood, Elk, and Chautauqua. The core nine counties, with Woodson at the northwest corner, probably comprises a more reasonable definition of Southeast Kansas for social and ecological reasons.

Parts of four physiographic features are found in southeast Kansas (Fig. 2-2). Along the western border is a sliver of the Chautauqua Hills. In the extreme southeast corner of Cherokee county is a wedge of Ozark Plateau bordered to the west into Labette, Crawford, and Bourbon counties by the Cherokee Lowlands. The remainder of the area, the majority, includes the Osage Cuestas.

The people of southeast Kansas are, at times, more closely aligned with Springfield, Missouri or Tulsa, Oklahoma - cities closer to some of us than Wichita or Kansas City. Ecologically, three of the physiographic regions of southeast Kansas lie more in Oklahoma and Missouri than in Kansas.

At times, this unique context of political and biogeographical borders creates problems. The Broadhead Skink became an issue recently due to its threatened status (in Kansas, not Missouri) and its presence in the Bone Creek watershed to be impounded for a 540 acre water supply lake.

The greatest problem we face here is the identification of critical resources needing protection and programs to protect them. The desire for economic development here, in an area where economic development is needed, potentially endangers our natural resources. The poultry industry promises jobs to this area, but also tons of manure and chicken corpses needing disposal. In Crawford and

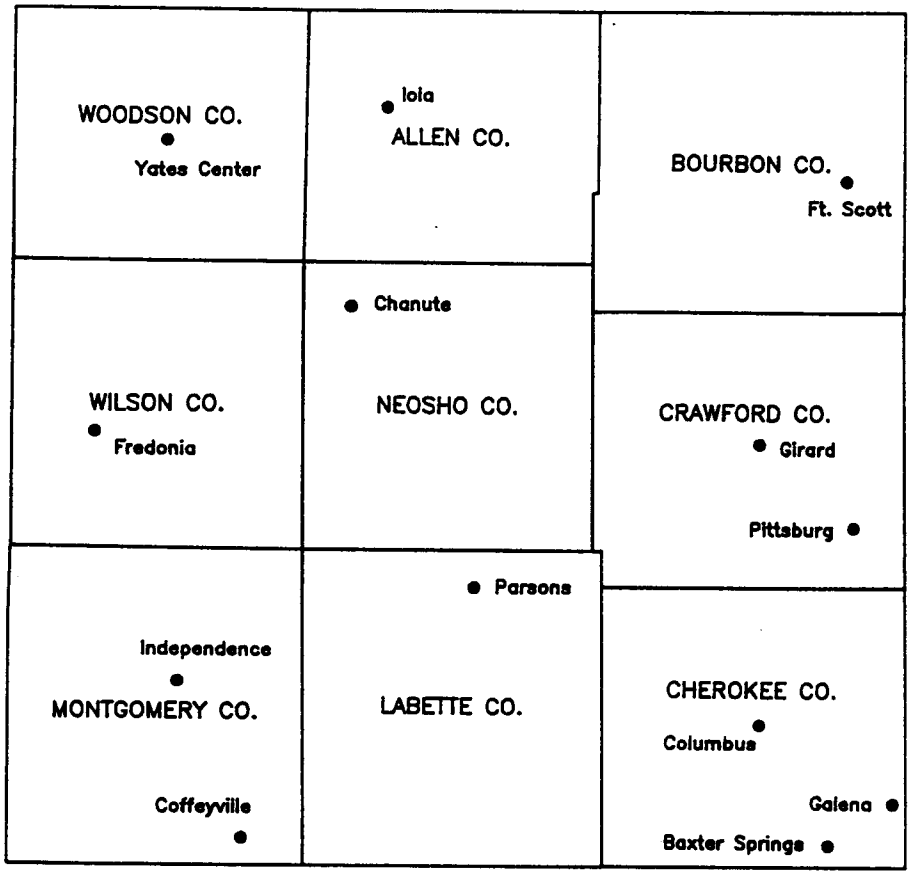

Fig. 2-1. Counties and major cities of southeast Kansas.

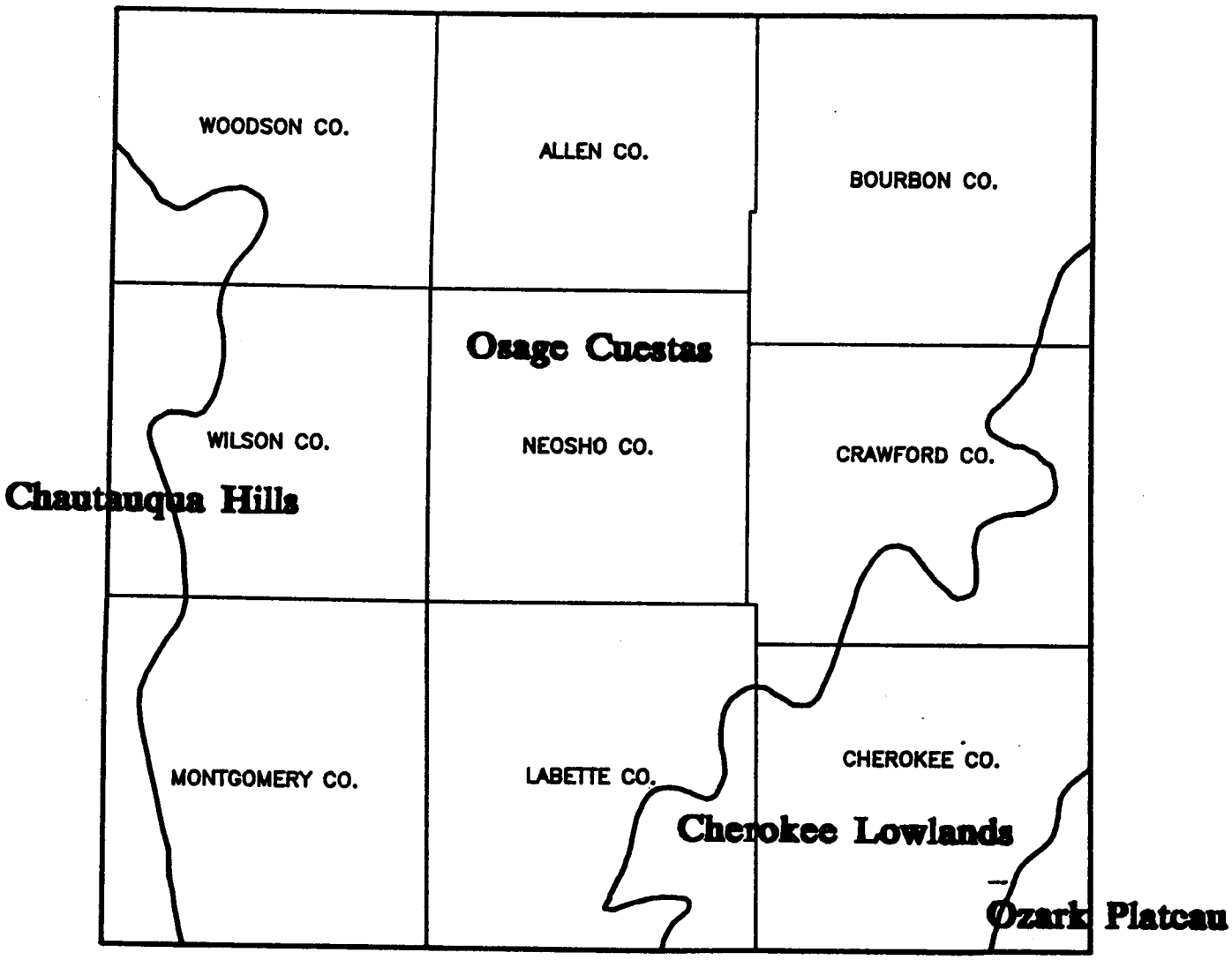

Fig. 2-2. Physiographic regions of southeast Kansas.

Cherokee counties, the legacy of strip and shaft mining has left thousands of acres out of productive use. These old holes and maligned land are now points of interest for those wishing to find places to dispose of trash from eastern states. Sitings of hazardous or medical waste incinerators in the area have also been proposed. New highway development, felt to be so crucial to the region, potentially threatens wetlands, woodlands, streams, and rivers. The subsequent development associated with roadways presents its own threats.

The remaining chapters in this guidebook focus on the natural areas of Pittsburg State University and the surrounding area. Some areas, such as Prairie State Park near Mindenmines, Missouri and area lakes and wildlife management areas were omitted from the field trip due to distance and time constraints.

Chapter 3

THE ROBB PRAIRIE

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Pittsburg, Kansas 66762

The Robb Prairie is a 5.5 acre (2.2 ha) natural prairie at the southwest edge of Pittsburg on State Highway 69 just south of the bridge over Cow Creek. A sign is visible from the highway. The ground was donated to Pittsburg State University in 1986, by the heirs of the late Ernest Robb who recognized its natural value and grazed and hayed it, but never plowed it. It is a low prairie lying on the floodplain of Cow Creek. Water stands in part of the eastern half in the early spring, and after heavy rainfall, its heavy McCune silt loam and clay pan allows water to percolate only very slowly. During a flood in 1987, the entire prairie was underwater, the eastern portion to a depth of nearly six feet.

So far a hundred species of plants have been recorded from this area, but more are sure to be found. Dominant and showy vegetation includes big bluestem, Indiangrass, switchgrass, sedges, false dragonhead, and blazing star. The west half is higher than the east and supports most of the big bluestem, which has grown to a height of ten feet.

The density of crayfish on this parcel is enormous. About a week after a spring burn in 1987, there was scarcely a square meter of charred ground that didn't have at least one crayfish chimney sprouting from it.

The wet nature of the land makes prairie management problematical at times. Spring burning is on a "when we can" basis. Often it is too wet to burn throughout the spring. The last prescribed burn was in May, 1991. Haying has been an alternative management tool, and some grazing by a neighbor's horses may be allowed in the future. Invasive green ash in the low east side continues to be a problem.

The plot is small and is surrounded by the sights, sounds, and smells of agriculture and commerce, and so is not exactly the "sea of grass" that lends such character to expansive prairie landscapes. Rather it is a "postage stamp" ecosystem, a small sample of what used to be. Its greatest value perhaps is the fact that this tiny natural museum piece is so accessible. It is a five-minute drive from the PSU campus, so that even classes of

fifty-minutes duration can afford to make a quick foray to a natural prairie community. Its proximity to Pittsburg also makes it convenient for groups of younger children visiting the campus to run out for a prairie tour.

In keeping with the educational use of this land, an information board has been erected with periodically changing displays that are often constructed by education classes at PSU. A path is maintained for use by the general public. The county has built a parking lot across the road from the entrance.

Recently, there has been some speculation that the prairie community on this piece of ground may not be terribly old. The vegetation must be mowed and/or burnt quite frequently, otherwise woody species proliferate quickly. Whether natural fires and grazing in presettlement times could have been frequent enough on this floodplain to hold an advancing riparian woodland at bay is questionable. An analysis of the soils of this and other small prairie "remnants" in southeast Kansas may shed some light on their history.

Whatever its history, "The Robb" is a nice little natural community that is highly visible and easily accessible to people in Pittsburg, and indeed is utilized often by various groups. The University was delighted to receive this generous gift.

Chapter 4

THE NATURAL HISTORY RESERVE

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The Natural History Reserve is a 79 acre (32 ha) site of partially reclaimed strip-mined land located 4.5 miles southwest of Pittsburg State University. The Reserve is not open to the public except by appointment or as part of a tour. Hunting and fishing are not allowed.

The Reserve was originally covered by tall-grass prairie, subsequently converted to agricultural land, then strip-mined for coal in 1932. As was the practice of the day, the site was not reclaimed after mining, but left as a series of parallel "spoil banks" with some 67 long, narrow strip-pit lakes of various sizes between them. Four large pits also occur on the site, three more or less bordering the property, and one central pit - the largest - which is about one-third of a mile long.

The property was deeded to the Kansas Forestry, Fish, and Game Commission in 1936. In the late 1930s, part of the land was leveled and planted in apple, pear, black walnut, pecan, grape, pine, cedar, bald cypress, and other species, both native and ornamental. These plantings did not thrive, although a few old apple trees and remnants of a vineyard still can be found just north of the central pit. A few cypress trees have also survived.

The land was transferred to Pittsburg State University (then the Kansas State College of Pittsburg) in 1949, and used for a few years as a veterans' vocational training center in agriculture. The orchard trees were cared for and a few cattle grazed on the western portion of the site.

Natural succession since the late 1930s has resulted in a brushy woodland type of complex in which cottonwood, American elm, sycamore, sumac, poison ivy, Japanese honeysuckle, amur honeysuckle, and gray and red-osier dogwood are common. Many of the smaller pits hold water only intermittently. The larger pits hold water permanently, but are subject to water level fluctuations of three to four feet depending on rainfall.

The area is inhabited by a number of wildlife species including white-tailed deer, eastern cottontails, raccoons,

woodrats, and beavers, which have girdled many trees in recent years. Male woodcocks display in spring over the open, grassy area just inside the entrance gate. Large flocks of cedar waxwings visit every winter and feed on honeysuckle berries. Few waterfowl visit the area, but wood ducks do nest, and it is possible that Canada geese nest on or near the property. Many green-backed herons and several great-blue herons feed in the area. Frequently heard owls include the great-horned, barred, and screech.

Four buildings constructed in the 1940's (prior to PSU acquiring the property) stand on the site; one a house occupied by graduate students, two barns, and a quonset hut. The barns have been used intermittently in the decades since the veterans' vocational schools were terminated. In the late 1960's, the south barn was converted into a classroom and laboratory serving field biology classes. The other barn was used mostly for storage. A picnic pavilion was built, but was used so infrequently that it was torn down.

Both barns are aging, but continue to serve. The primary use of the barns - and the property in general for the last five years - has been as the center for the bird-of-prey segment of the Biology Department's *Nature Reach* natural history public education program. *Nature Reach* uses many live animals in its outreach presentations and tours. Almost all of its birds are raptors that were once part of the raptor rehabilitation segment of *Nature Reach*, and for one reason or another cannot be returned to the wild. A bald eagle from Montana and a Harris' hawk from Texas in addition to several native Kansas birds are held at the Reserve.

As both the rehabilitation and the education segments of *Nature Reach* are quite active, and because all the raptors, of course, require daily care, the comings and goings of staff and volunteers helps keep the activity level at the Reserve the highest it has been for years. Various classes use the property frequently as well, including classes in fisheries, limnology, ecology, ornithology, wildlife management, and plant taxonomy.

Several projects resulting in publications have been conducted here, most recently a Master's project involving the cage culture of catfish. Currently, an experiment is being conducted by the Psychology Department to ascertain color perception in deer. (A deer in a pen behind the south barn pushes a bar for food in response to certain colors displayed on a computer screen). Two large concrete tanks for fish culture were built in the 1960s, and are currently being revamped.

Occasionally, conservation officers temporarily house animals involved in law enforcement investigations at the *Nature Reach* facilities, for example several caimans retrieved from a farm pond near Fort Scott. A "Pig Stick" for faculty and students is held on Halloween. Finally, the area is used to store various equipment.

The history of the Natural History Reserve has been quite varied, and no doubt its future will continue to be likewise. Vegetation succession is slow on the poor mine spoils, but in the some 60 years since mining operations ceased, the Reserve has changed from a hot, scrubby site to one decidedly more forest-like. Annual leaf-fall slowly helps to add humus to and deepen the soil. How many generations must pass before a climax community is reached (or <u>if</u> one is reached before another use for such land is found),the nature of that climax, and the thoughts of those future generations toward a fossil-fuel-hungry 20th century can only be speculative.

[NOTE: Most of the historical information presented herein was extracted from Theodore Sperry's "The Natural History Research Reserve of the Kansas State College of Pittsburg," Transactions of the Kansas Academy of Science, Vol. 66, No. 1, 1963. Dr. Sperry is Emeritus Professor of Botany at PSU.]

Chapter 5

FRANCIS A. MONAHAN OUTDOOR EDUCATION CENTER

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Dedication

The Monahan Outdoor Education Center was formally dedicated on a beautiful late fall afternoon, November 6, 1988. The dedication marked a real milestone in southeast Kansas mined land reclamation -that of turning an ecologically devastated "pig's ear" into, if not quite a "silk purse," at least ground headed in that direction. The center's namesake had passed away only a few years earlier, but certainly his spirit was there listening to the speeches of university and public officials and family members.

Frank Monahan's father was a mining engineer from Scotland, one of thousands of Europeans who immigrated to southeast Kansas to work in the coal, lead, and zinc mines in the early years of the century. They founded dozens of "camp towns," such as Cherokee, lying only a few hundred yards southwest of the property's border - boomtowns now mostly busted and crumbling. Frank, or "Mac" as his friends called him, used the mining skills learned from his father in the coal fields of Crawford and Cherokee Counties, including those of the Commercial Fuel Company No. 2.

The Commercial Fuel Company washed its high-sulphur coal on this site until the mid 1940s. The site became an abandoned ecological nightmare after that, much more than even the spoil bank areas because so much acid-forming coal gob left over from grading and washing was exposed to constant weathering that vegetation could not - and did not - grow. Monahan purchased the 156-acre tract in the early 1950s, believing it still held salvageable quantities of coal and hoping to see much of the land reclaimed. (He was always concerned about the impact mining had on the land, and was even appointed by the governor to serve on a state commission that studied the environmental impact of strip mining.) The decline in use of high-sulphur coal made Monahan's thoughts concerning the mineral value of the land unfeasible, and his hopes for reclamation unfortunately were not realized until after his death.

Monahan's only child, Norma, married Dr. William Reals, now Dean of the Kansas University Medical School at Wichita State

University. After the Federal government established RAMP funds for reclaiming old mining areas, the Reals initiated the extensive and expensive ($400,000 for on-site work, excluding of-site technical planning and coordination fees) reclamation process, then donated the site to the Department of Biology at Pittsburg State University to use as a natural area. The final step in reclamation was the planting of native prairie vegetation in spring 1985. The 1988 dedication ceremony took place in a mowed area amidst the tall golden grasses of that successful planting.

Management

The fact that a 40-year-old tract of acidic wasteland now has the appearance of a prairie meadow bordered by forests is gratifying, but much is left to be done. The management and long-term planning are the responsibilities of the Department of Biology, but a partnership exists between that department and the Crawford County Conservation District which has input into such planning and also has responsibilities in the physical maintenance and development of the site.

One of the first endeavors of the Department of Biology was a vegetative analysis of the 80-acre reclaimed area two years after the native flora was planted. While 30 species were found in 1987 and 1988, few were of high frequency. Of the seven native grass species planted in 1985, only two, switchgrass and sideoats grama, contributed significantly to the vegetative community, and most of the planted trees and shrubs were missing - a fire of unknown origin killed most of these seedlings in March, 1988 (Vickers, 1989).

Vickers' (1989) analysis was a base-line study of a very young artificially planted grassland. It will be interesting to monitor the changes that are sure to come as time passes. No formal vegetative studies have been conducted in the last four years, but one can easily see that switchgrass is dominant. Indiangrass, sideoats grama, and big bluestem are still relatively abundant in some areas. Yellow sweetclover is abundant at times, but it is the only forb of any frequency currently in the grassy, reclaimed area. Late summer haying operations in 1991 and 1992 revealed almost no vegetative growth between the clumps of native grasses other than the sweetclover.

Not all the acid runoff problems have been eliminated. On both the north and south slopes of the reclaimed gob pile acidic seeps kill vegetation - patches of dead plants are getting larger on the north slope, and once again an eyesore is developing. Bright orange streamflow from iron oxide precipitate resulting from low pH is the norm from the two tributaries running east off the property into Brush Creek. Even rainwater drained by the pipes in the five terrace basins is highly acidic. The university and the SEK Rural Conservation and Development District (RC&D) currently

are assessing means by which to deal with this problem, including diverting the acid runoff on the north via a ditch or pipe into a shallow impoundment where it can be treated periodically with a buffering agent. Such a buffered marsh potentially would attract a diversity of wildlife.

Renewal and Diversity

One of the most positive features of the Monahan Center as a whole is its diversity. There is a small native prairie at the northeast corner of the property that somehow escaped the dragline. It is only about an acre in size, but its vegetative diversity provides a nice contrast to the much larger, but much less rich reclaimed "prairie" meadow. This small upland plot is burned about every three years.

South and west of the native prairie plot is a brushy/woody area that has grown up over what was once an approximately 30-acre settling pond where sediment-laden wash water from the coal processing was conveyed, and sand-sized particles allowed to settle to the bottom. The depth of this sediment, about 50 percent of which is coal "fines," is about six feet. Cottonwoods, green ash, pin oaks, shrub dogwoods, and sumacs dominate. The two tributaries that drain from the site into Brush Creek pass through this low area.

The 80-acre reclaimed grassland lies west of this wooded area. As noted, tall stands of switchgrass are the prominent vegetation, although a short line of autumn olive is doing well. The grassland begins low at the edge of the woods on the east, then stairsteps to the west in a series of terraces and rainwater catchment basins as mentioned. The north side of the fifth terrace is the highest point on the property and affords a good view of much of the site to the south. It overlooks farmland and old, naturally vegetated spoil bank to the north.

From this high point the grassland slopes to the west, flattens out, and extends to a line of old spoil banks running north and south. West of these brushy spoil banks lies a long, curving, attractive lake called Razor Pit that marks the west boundary. (Actually the line dissects the pit longitudinally.) Razor Pit extends nearly to the county road and has a convenient slope that fishermen use as a boat ramp. Consequently it is fished frequently.

A small cattail marsh lies near the south end of the pit, and is confluent with it when the water is high. The marsh drains northeastward, this creek marking the grassland's southern border. South of the creek and marsh lies a railroad track (SEK Railroad) that also runs northeast-southwest. It intersects another track at an angle just west of the property, with that track (Burlington) extending back eastwardly. The resulting wedge-shaped piece of

land bordered by the two tracks has been called, descriptively (and for lack of a better name), The Land Between the Tracks.

This "Land" is interesting country. Most of it is old, unreclaimed spoil bank having a good stand of maturing trees, mostly cottonwood, green ash, and pin oak. It is isolated enough to afford one the pleasurable feeling of being in a deep, secluded woods. A beautiful little lake lies within this woodland. The lake connects by way of a narrow isthmus to another strip-pit lake that parallels the east-west Burlington track. This track marks the southern property border.

West of the wooded area, and in stark contrast to its cool shade, is a two- to three-acre gob field that is as black, hot, and devoid of vegetation as was the larger reclaimed "desert" across the tracks. Kids use it occasionally as a dirt bike track.

Of course, the two tracks that cross the Monahan property provide another landscape in themselves, and serve as corridors of travel for hikers and coyotes, as well as for locomotives. Birding is good along the brush and trees through which they pass.

The remnants of the buildings on the site were torn down and buried, but a few foundations and footings can still be found. One can infrequently find small pieces of old mining debris. The grade of the track that ran parallel to the current SEK railroad track is still evident, but not obvious. Otherwise little that could be called cultural or archaeological remains of what was once a bustling, dusty concern.

Interpretation

The university and community utilize the Monahan with some frequency. Several of the Biology Department's field biology classes travel to the site for field trips and projects - a current project involves establishing an interpretive walking trail. Last year a Pittsburg Middle School shop class mass-produced 40 bluebird boxes with funding from the Kansas Department of Wildlife and Parks for use at the Monahan. Various workshops for both adults and children have included this area. Quail hunters visit the site in the fall, and fossil hunters have no trouble finding crinoid stems and brachiopods.

In 1988, a graduate student agreed to move her trailer onto the site and serve as caretaker and security. She has since moved on, but the trailer remains to house caretakers. A pole barn was constructed near the trailer. Long-term plans include removing the trailer, but using the utilities installed for it to serve a small campground.

A pavilion is being established in the wooded area near the east edge of the grassland. It will serve as a center for field

trips, workshops, and other events. An all-weather road to the pavilion site is nearly complete. Construction of the pole barn, the road, and the pavilion site could not have been possible without the generosity of many local businesses and agencies.

Several exciting ideas have been forwarded regarding the construction of a multidimensional nature center just south of the pavilion site. There are no such facilities in the southeast Kansas region, and while the region is not as populous as the large urban centers currently enjoying nature centers, the rich cultural and natural history of southeast Kansas calls for one. It would be the final stitch in the Monahan silk purse.

Perspective

Over the last two centuries, the land that is now "the Monahan" has undergone tremendous changes - good and bad depending on your point of view - and lend themselves to some rather philosophical considerations that might play well in a multi-purpose nature center. Suffer a brief indulgence in this regard.

The grasses that bend in the breeze over the Monahan terraces today do not just look nice, they are nice - quite an improvement over the 40-year moonscape underlying their roots. Even without lunar comparisons they are beautiful, yet indeed they are not the grasses that, as Leopold wrote,"tickled the bellies of buffalo." Most of those grasses were of a different species, and did their bending some 30 feet below, not atop a gob pile. Still, a buffalo from two centuries ago - at a distance and at dusk - might be fooled. So might a biologist.

The bison might eventually approach and begin to graze. The biologist might approach and begin to gripe: "Not a prairie...not the flora...not the richness...not the soil." True enough, but in the farm field just north there is the soil, or the bottom part of it anyway, but still no richness, no flora, no prairie, and in addition, no nothin' that would fool even a buffalo at a distance at dusk. We didn't lose the "real" prairie, formerly blanketing the Monahan to mining, we lost it to farming. We lost the farming to mining. And when mining lost out to air pollution statutes we got back prairie. Not real prairie, but at least in looks it beats the beanfield across the road. (The beanfield could potentially, but not in probability, ever look like a prairie again - not while it is growing cash.) At this stage we have to take what we can get and, I guess, be glad of it.

In one sense, the old acid-bleeding gob pile was a monument to man's environmental insensitivity, but a dollar was to be made and we did need the coal. Can more be said of farming? Too, we did finally take a long step toward treating that open wound. Frank Monahan would be pleased. Perhaps; however, the Monahan legacy can be extended beyond its silk purse analogy to that of an inducer, an

inducer to avoid making pig's ears in the first place - a soap-box for sustainability. We need what we need, but some mines cannot be reclaimed.

LITERATURE CITED

Vickers, Jeff L. 1989. Vegetative analysis of the Monahan reclaimed mined land area. Unpublished Master's Thesis, Pittsburg, KS. 44pp.

Chapter 6

RECLAMATION OF THE MONAHAN SITE

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Mining Activities

The Monahan Outdoor Education Center is being developed on an abandoned mine land site located in southeast Crawford County, approximately one-half mile north and one-half mile east of Cherokee (see Ford in Chapter 5, this document). The reclamation of 80 acres of strip-mined land on the Monahan site is the subject of this chapter.

Southeast Crawford County is classified as the Cherokee lowlands. It has relatively flat topography with a MSL of 930-940 feet (USDA 1981). Historically, beds of coal are common occurrences within sequences of sedimentary rocks that formed in the floodplain environments (Freeze and Cherry 1979). Before mining, the Monahan was underlain by bedstrata of the Cabiness Formation. The Cabiness Formation is Middle Pennsylvanian in age, around 200 million years old, and is comprised of a succession of shale, limestone, sandstone, and coal beds.

Kansas coal mining was limited to the southeast corner of the state, with most activity being in Crawford and Cherokee Counties. Coal mining in Kansas began about the year 1872. Early production of coal in Kansas was mostly from underground mines (Marcher et al. 1984). According to Lindberg and Provose (1977), peak coal production for the country was in 1920, while peak production in Kansas occurred about 1918. After the peak of the 1920's, coal production decreased, except for a temporary increase during World War II, and a lesser increase in the 1970's due to the oil shortage (Marcher et al. 1984). Since the early 1900's many practices in the coal mining industry have changed, including the way coal is extracted. Coal is still taken from deep mines in some parts of the country, but from the 1930's through the present, the most usual method of extracting coal in Kansas is by strip mining which is safer and more economical (Marcher et al. 1984).

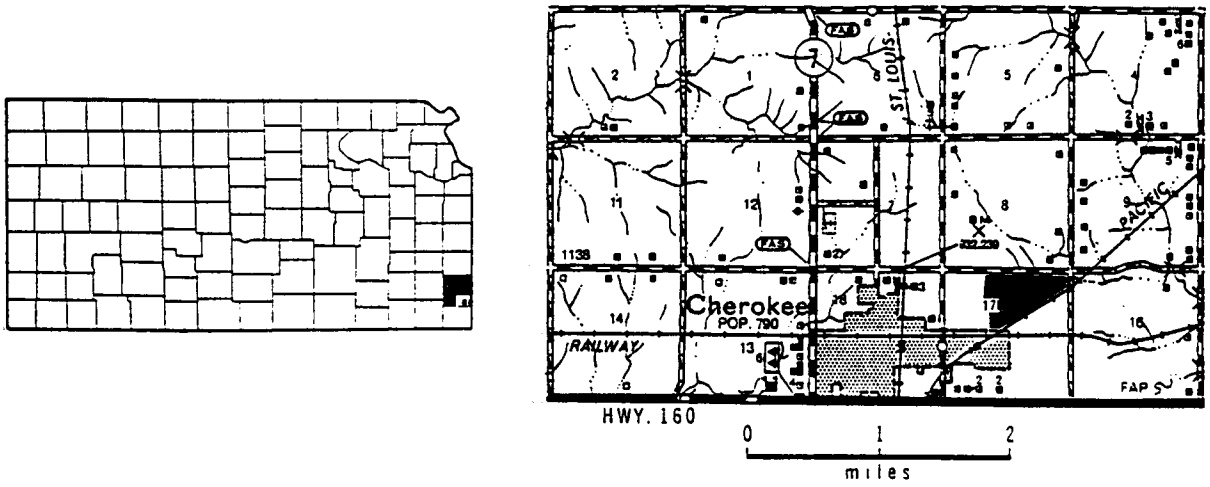
Strip mining became the desired method of extraction because of the size and depth of the coal seams in southeast Kansas. Some of the coal seams were not deep enough to leave a safe roof in the traditional "room and pillar" method of deep mining. The overburden was stripped by power shovels of various types and sizes. Some of

the shovels had booms more than 100 feet in length, and dippers that could hold 50-60 tons (Wells 1953).

The Monahan was shaft mined (deep mined) about by the Western Coal and Mining Company from about 1899-1918. The coal seam mined by shaft mining was the Weir-Pittsburg coal bed, about one hundred feet below ground surface and approximately three feet thick. From 1933-1937, the same area was strip mined by Commercial Fuel and Clemens Coal and Fuel Company. The coal mined this time was the Mineral coal seam. It was twenty-five feet below the ground and was eighteen inches thick (USDA 1981). At the time of strip mining activity the mine was called Commercial Mine #10. Commercial Mine #10 was also the site of a tipple, or coal processing plant. At the tipple, mine cars were tipped and emptied of their coal. Later the term tipple came to include all surface structures of the mine including the processing plant (Thrush et al. 1990).

Coal from Commercial Mine #10 and other mines in the vicinity was brought to the tipple for washing and screening (USDA 1981). The washing plant was located near the railroad tracks on the south side of the area and shaped somewhat like a grain elevator. The coal was conveyed to the top, and then passed through various sizes of shaker screens, all the while being washed with water. The sediment-laden wash water was then conveyed into a settlement pond (Fig. 6-1), sometimes called a slurry pond. The sand-sized sediment in this slurry eventually would settle out, and the water would be reused for washing. The sediment being conveyed to the pond accumulated to a depth of about six feet and covered approximately thirty acres with about fifty percent of the sediment being coal fines (USDA 1981). The gob consists of all other waste material too large to be carried away in the wash water. This waste material was hauled to a dump area to the northwest of the tipple and eventually covered seventeen acres to a height of twenty to thirty feet. The relatively flat topography of the pre-mining days was replaced with a big pile of gob which soon eroded into hills and valleys (USDA 1981). The off-site impacts of these remains, the slurry pond and the waste material making up the gob pile, prompted the reclamation project.

Most of the dumps that we see while traveling around Crawford County are well-vegetated with both ground cover and plenty of trees. Why was Commercial Mine #10 different? The well-vegetated dumps are spoil dumps or spoils piles. They consist of the overburden, the material which is removed from over the coal seam to gain access to the coal. This may include some calcareous materials such as limestone (Thrush et. al 1990). Usually, when mining activities ceased, these spoil piles would revegetate rather quickly, but a tipple site is a different situation. The gob pile consist of material that is separated from the coal itself and may contain shales, pyrites, and bits and pieces of coal. The gob pile at the Monahan contained an abundance of pyrite and virtually no limestone. Pyrite is found within shale, sometimes running vein



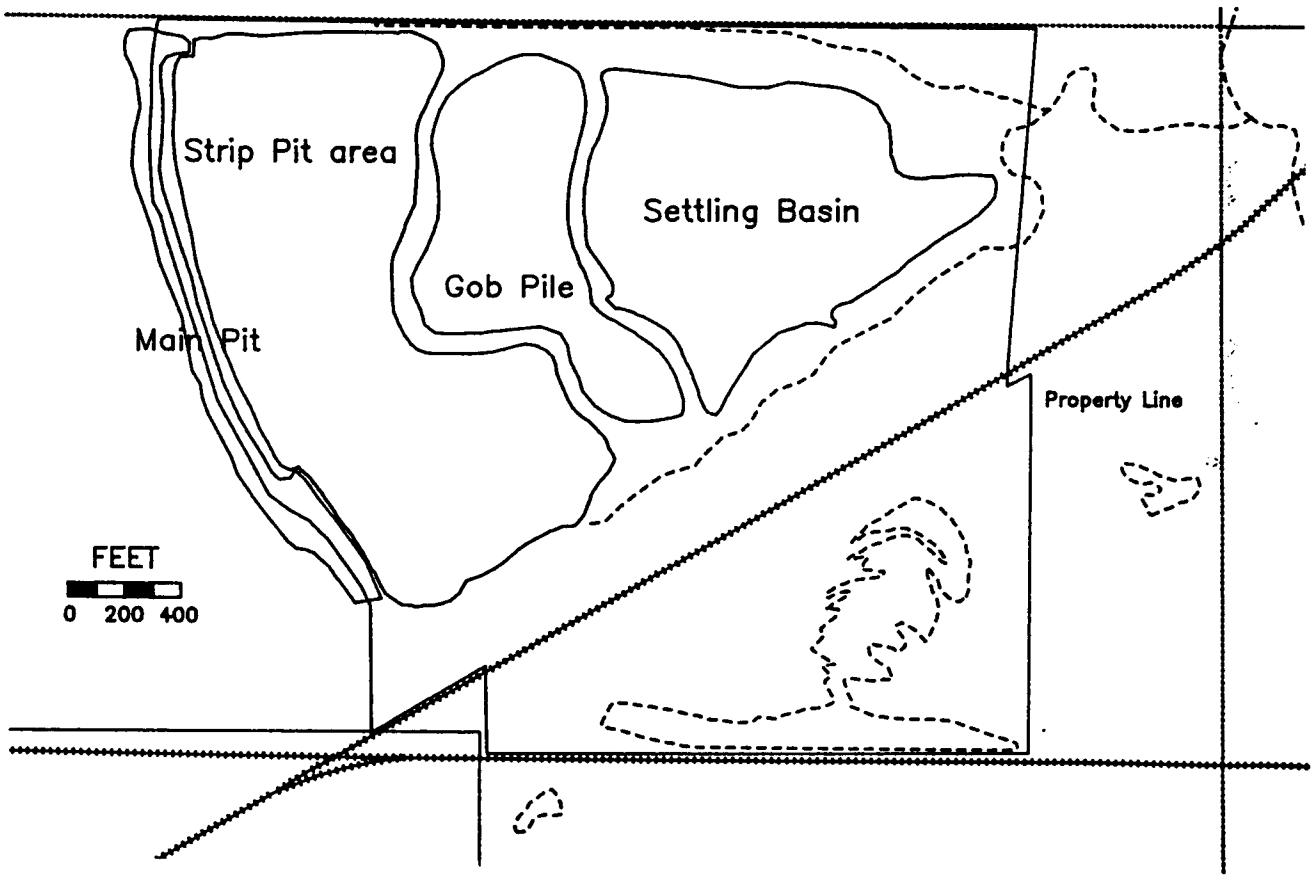


Fig. 6-1. Pre-reclamation site use.

like between layers of the rock (Pulford et al). Gob material is often said to be 'hot', and well so. The gob pile at the Monahan, according to local residents, burned for many years.

Gob often burns because of spontaneous combustion, which is the heating and slow combustion of coal and coal material. This is initiated by the absorption of oxygen. When air leaks through the coal and shale material and supplies the needed oxygen for combustion, and conditions are right that do not allow dissipation of heat, there is a subsequent rise in temperature. This rise in temperature ignites the coal and shale materials (Thrush et al. 1990). Evidence that spontaneous combustion had occurred at the Monahan is present. A substance called "red dog" was found over much of the gob pile area. Red dog is a material of reddish-brown color resulting from the combustion of shale and other mine wastes (Thrush et al. 1990).

Surface water running over and through spoil material with m ore limestone might be neutralized and have a low metal concentration. But surface water at the Monahan was highly acid, with high concentrations of iron and sulfate (Caruccio and Geidel 1984).

Thus the shales and coal were oxidizing as well as the pyrite present in the Monahan gob pile. Grasses, shrubs, and trees are not tolerant of these conditions. After years of continuous oxidation of the pyrite and the burning out of the exposed coal and shales, the condition of the surface improved very little (USDA 1981b).

Pre-reclamation Conditions

As strip mining operations increased, more and more land was taken out of production, and more and more streams were being affected by acid mine drainage. Citizens became concerned about the future of the environment and the early years of reclamation began. Studies took place in order to gain knowledge of such things as spoilbank structure, spoil texture, acidity and alkalinity in spoil, and the nutrient content of spoil. Also, comparative studies of plant production on partially leveled versus undisturbed spoilbanks were implemented using various trees, shrubs, and grass species (Wells 1953).

Local agencies quickly became involved with these efforts. This included groups such as the Reclamation Committee of the Pittsburg Chamber of Commerce, and some of the local coal companies such as the Mulberry Coal Company and The Clemens Coal Company. State and national groups included the Civilian Conservation Corps, the Soil Conservation Service, and the United States Forest Service (Wells 1953).

The early years of reclamation spanned from the late 30's through the early 50's (Wells 1953). By the 60's, state governments

were becoming involved in reclamation efforts. In 1968 the state of Kansas passed the Mined Land Reclamation and Conservation Act. This act provided regulatory guidelines for reclamation of land mined after January 1, 1969. In 1969, Governor Docking appointed an Action Task Group, which was in charge of encouraging redevelopment of approximately 50,000 acres that had been strip-mined for coal prior to the 1968 Act. Cost-sharing of the program was aided by grants from the Ozarks Regional Commission to the Kansas Geological Survey, the See-Kan RC&D, and the Soil Conservation Service's REAP Program. The establishment of these programs shows concern for both presently mined land, and for problem areas left by pre-law mined lands.

In the early 70's the energy crisis brought about a new interest and surge in coal mining. The output of surface mines rose a dramatic 46% from 1976-1984. Also on the rise was a world of people more aware of their environment and more concerned about its welfare. How could strip-mining for coal be justified if it involved the destruction of land and the degradation of water quality in our ground water and streams? In 1977, Public Law 95-87 the Surface Mining Control and Reclamation Act (SMCRA) was passed. The main objectives of SMCRA were to regulate present mining operations and to reclaim those abandoned mine lands that were a danger to the public.

Objectives for new and present mining were: avoid loss of site productivity, maintain energy-efficient agriculture production, and prevent off-site environmental problems. It was thought that if the soil was returned to its prior productivity, then mine-related environmental problems would cease (McCormack 1986). The passage of SMCRA required miners to fill in excavated mines with the original overburden stripped from them, and to return the land to its approximate original contour. This practice has eliminated most of the acid mine drainage from newly mined sites (Klienmann and Erickson 1986).

Title IV, Section 401 of SMCRA, dealt with the objectives of reclaiming Abandoned Mine Lands (AML Program). Under Title IV a reclamation fund was set up which allows states to receive funding to help with their reclamation projects. 80% of the reclamation funds are used to reclaim those areas that endanger the health and safety of the public. 20% of the funds are transferred to the Secretary of Agriculture under Section 406 (Rural Abandoned Mine Program, RAMP). These funds are used to provide control and prevention of erosion and sediment damages, to improve water quality and aesthetic values to both unreclaimed mined lands and lands affected by mining.

Under the Surface Mining Control and Reclamation Act of 1977, the Monahan was a prime candidate to receive Title IV funds. As reported by the Environmental Assessment (USDA 1981), there was hazardous toxic waste, unstable gob piles with steep banks, and

several small, acid water impoundments. A water sample taken in the preliminary study, from the tributary running along the north boundary of the property, had a pH of 2.1. This tributary ultimately empties into Brush Creek which was void of aquatic life for a mile upstream (USDA 1981a). Gore and Bryant (1988) say that the reestablishment of good water quality is a prime concern in stream restoration, and that a desirable aquatic community will follow the attainment and maintenance of that good water quality. The gob pile was the source of highly acid material that contaminated the area around it. The site presented a hazard to local residents as well as being an eyesore.

When the Monahan was first assessed for reclamation the site was described in the following manner. There were approximately 80 acres of coal refuse and mine spoils. The remains of the coal processing plant still lay close to the railroad tracks on the south border. And between the gob pile and the dumps that separated Razor pit, there were several small acid pits (USDA, 1981a).

At the time of the assessment, weathering and erosion had been at work for about forty years, leaving a number of very steep and unstable slopes. Besides the acid conditions which no vegetation could tolerate, an iron hydroxide crust had formed on the gob pile, making it impossible for plant roots to penetrate (USDA geology report, 1981b). To the east of the gob pile was the slurry pond which it had not revegetated either, but the rest of the area was not as destitute. Around the slurry pond a dike had been built to keep the slurry in its place. The dike and everything east to the property fence had revegetated.

The acid water produced was not a threat to deep water supplies since the ground directly under the gob had not been strip mined and the subsurface materials were not permeable. The subsurface materials underlying the gob pile were a deep residual clay soil extending from the ground surface to a depth of about 15 feet. Under the clay soil was a weathered clay shale -- brown to light gray in color, extending from about 15 to 25 feet below the ground surface. Underlying the weathered shale, a succession of shales, sandstones, and thin limestones occurred. This bedrock strata also contains a few coal layers at 25 to 30 foot intervals (USDA 1981b).

Although acid mine drainage could not get into the ground water it did threaten the surface water. A concentrated seep issuing from the base of the gob pile on the north side was estimated to be running about 0.5 gallons per minute (USDA 1981b) and seemed to be the beginning of the drainage ditch on the north border of the Monahan.

Runoff from the gob pile gathered into several small pits to the east of Razor pit. The water in those small pits was highly

acid, pH 2.2 to 2.6 (USDA, 1981a). There were a few vegetated dumps between the acid pits and Razor Pit. These dumps and the slope of the land kept Razor from being affected by the acid drainage. According to the USDA (1981a), Razor Pit was high in sulfates, but had a fairly diverse aquatic ecosystem.

Any surface water that did not infiltrate the gob or find its way to the acid pits, went into the two drainage ditches or streams. The drainage ditch on the north, where the seep emptied into, and a drainage ditch on the south side where over-flow from Razor Pit emptied both contributed to downstream flow into a tributary of Brush Creek. This tributary was void of life below the site to its confluence with Brush Creek 2 miles east (USDA 1981b).

Cattails were growing in the marshy area (aprox. 2.7 acres) at the south end of Razor Pit. The cattails continued to establish themselves east down the South drainage ditch until it received too much acid runoff from the gob pile for them to tolerate.

Local residents called the old Commercial Mine #10 "Devil's Mesa" and "The Desert". There were deep ravines eroded in the surface and small pools of red water. The hydroxide crust made the surface crunchy and mineral salts crystallized into pure whites and yellows. Numerous fossils could be found; people liked to walk there, drive their off-road vehicles there, and take target practice against the gob pile. It was not a pretty site, but its strangeness made it acceptable.

Reclamation of the Monahan

The Reals Abandoned Mine Land Project No. KS-001-80 was established under a cooperative agreement between the Office of Surface Mining (U.S. Dept. of Interior) and the Soil Conservation Service (U.S. Dept. of Agriculture). The site reclamed consisted of 80 acres on a 420 acre area owned by Dr. William J. Reals, M.D., of Wichita.

Reclamation began in 1984 and ended eight months later in the spring of 1985 (Fig. 6-2). According to the Soil Conservation Service the sequence of events were:

The reclamation began with the construction of an erosion control dam. Preliminary land work included covering exposed concrete, cleaning up the tipple site, and constructing diversions. Brush was removed from the acid pit area and acid water from these small pits was pumped and sprayed over the gob pile. The acid pits were then filled with mine spoils from the west of the gob pile.

A main drainage ditch was constructed on west side of the site and the gob pile was shaped to a 3% slope to the east. Topsoil was placed to a depth of one foot over non-productive areas. Crushed rock was placed over the 34 acres which was underlain with gob

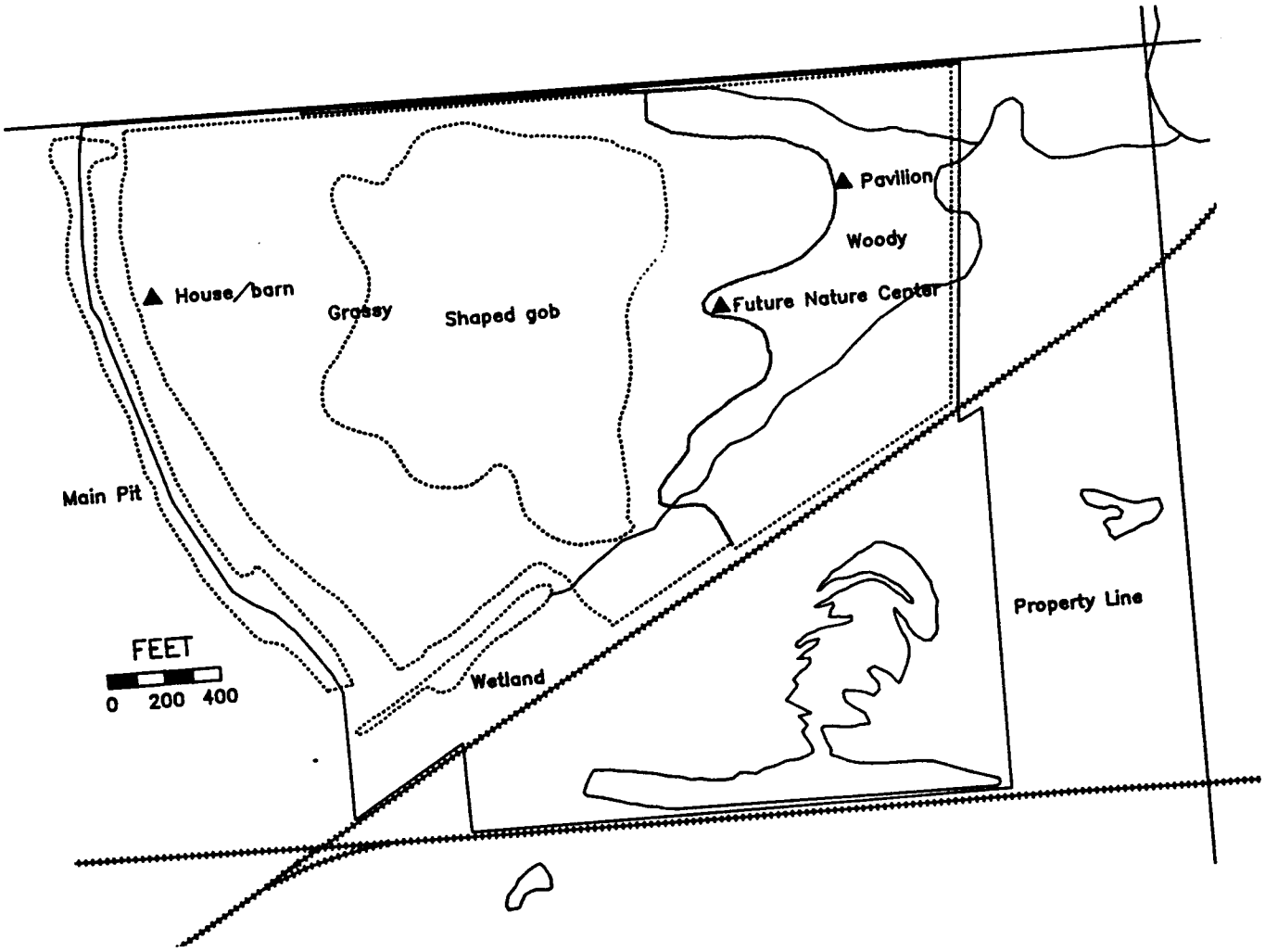


Fig. 6-2. Approximate post-reclamation site use.

material (17,000 tons used) and an additional foot of topsoil was placed over that.

The major feature of the reclamation of the gob pile area was the construction of a tile outlet system. The tile system was put directly on top of the gob, topped with the cap of limestone and then mine spoil material. Total depth from surface to tile drainage system is two feet. The tiles direct surface water away from the gob and into a central drain outlet. The drainage system along with the limestone and mine spoil cap and seeding of native grasses stabilized the top of the gob pile and helped to minimize erosion.

The gob pile was flattened from a 1 1/2:1 slope to a 3:1 slope (USDA 1981b), making the final grade 2% (SCS 1983). The gob pile was then terraced into five ridges with the depth of the ridges not to exceed nine inches before compaction (SCS 1983). There are five terrace outlets connected to a main conduit. The main conduit starts out with a 10" diameter PVC pipe and changes to a 12" diameter PVC pipe at terrace #3. From terrace #1 to terrace #5 the main conduit has a 3% grade and then turns 45 degrees into a 6% grade. Another 45 degree turn brings the end of the conduit to the north side of the Monahan.

At the valley of each terrace, rising about 2.5 feet above the ground, is a pipe 8" in diameter that is connected 2 feet underground with the main conduit. The part of the pipe that is exposed above ground is perforated. These pipes were installed in trenches that had been cleared of vegetative matter for at least an 8" diameter from the pipe (USDA 1983). The trenches are supposed to encourage surface waters to run into the tile outlets and keep the water from contacting buried waste material.

Initially, the cover was disced, fertilized, and planted to oats for a cover crop. In the spring of 1985, a mixture of native grass species were planted. These included Little Bluestem, Big Bluestem, Sideoats Grama, Wheatgrass, Switchgrass, Buffalograss, Prairie Coneflower, Purple Prairie Clover, and Prairie Sunflowers. Planting the native mixture was a fairly new venture as most reclamation projects at this time were planted to pasture. Trees and shrubs planted were Pin Oak, Russian Mulberry, Walnut, Pines, Sumac, Autumn Olive, Plum, and Cherry (SCS 1983).

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Chapter 7

THE O'MALLEY PRAIRIES

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Two tallgrass prairie tracts of approximately 5 acres each and located in the southcentral portion of Crawford County, Kansas, were preserved in 1990 by Charles and Elizabeth O'Malley of Weir, Kansas. An agreement with the Department of Biology, Pittsburg State University allows the department to manage the two small prairies. The prairies are floristically diverse as determined from field observations, but no detailed study has yet to be initiated. Table 7-1 is an initial list of plants collected from the two prairies.

Table 7-1. Preliminary list of plants collected from the O'Malley prairies.

Scientific Name	Common Name
Achillea milefolium ssp. lanulosa (Nutt.) Piper	Yarrow
Amorpha canescens Pursh	Leadplant
Antennaria plantaginifolia (L) Richards.	Plainleaf Pussytoes
Andropogon gerardi Vitman	Big Bluestem
Andropogon saccharoides Sw.	Silver Bluestem
Andropogon scoparius Michx.	Little Bluestem
Asclepias hirtella (Penn.) woods.	Prairie Milkweed
Asclepias tuberosa var. interior Woods.	Butterfly Milkweed
Asclepias veridiflora Raf.	Green Milkweed
Asclepias viridis Walt.	Green Flowered Milkweed
Aster ericoides L.	White Aster
Aster pilosus Willd.	Aster
Baptisia austalis var. minor (Lehm.) Fern.	Wild Blue Indigo
Baptisia leucantha T. & G.	Wild White Indigo
Baptisia leucophaea Nutt.	Long-bracted Wild Indigo
Callirhoe alcaeoides (Michx.) Gray	Pink Poppy Mallow
Cassia chamaecrista L.	Partridge Pea
Castilleja coccinea (L) spreng.	Indian Paint Brush
Dalea candida Michx. ex Willd.	White Prairie Clover
Dalea purpurea Vent.	Purple Prairie Clover
Daucus carota L.	Wild Carrot
Delphinium virescens Nutt.	Prairie Larkspur
Desmanthus illinoensis (Michx.) MacM.	Illinois Bundle Flower
Desmodium illinoense Gray	Illinois Tickseed
Dianthus armeria L.	Deptford Pink
Dodecatheon meadia L.	Shooting Star
Echinacea pallida (Nutt.) Nutt.	Pale Echinaceae
Elymus canadensis L.	Canada Wild Rye
Erigeron strigosus Muhl.	Daisy Fleabane
Eryngium yuccifolium Michx.	Button Snakeroot
Erythronium albidum Nutt.	White Dog's-tooth Violet
Euphorbia corollata L.	Flowering Spurge
Gnaphalium obtusifolium L.	Fragrant Everlasting
Gaura longiflora Spach	Gaura
Helenium autumale L.	Sneezeweed
Helianthus mollis Lam.	Ashy Sunflower
Heliotropium tenellum (Nutt.) Torr.	Pasture Heliotrope
Hieracium longipilum Torr.	Longbeard Hawkweed
Krigia dandelion (L.) Nutt.	Potato Dandelion
Lespedeza capiata Michx.	Bush Clover
Liatris aspera Michx.	Gay-feather
Liatris pycnostachya Michx.	Tall Blazing Star
Lithospermum canescens (Michx.) Lehm.	Indian paint
Lithospermum incisum lehm.	Narrow-leaved Puccoon
Lobelia spicata Lam.	Pale-spike Lobelia
Nothoscordum bivalve (L.) Britt.	False Wild Garlic
Penstemon digitalis Nutt.	Smooth Penstemon
Penstemon tabaeflorus Nutt.	Tube Penstemon
Phlox pilosa L.	Prairie Phlox
Physostegia virginiana (L.) Benth.	False Dragonhead
Polygala sanguinea L.	Blood Polygala
Polytaenia nuttallii DC.	Prairie Parsley
Potentilla recta L.	Cinquefoil
Potentilla simplex Michx.	Old Field Cinquefoil

Table 7-1. Preliminary list of plants collected from the O'Malley prairies - continued.

Scientific Name	Common Name
Psoralea esculenta Pursh.	Breadroot Scurf Pea
Psoralea tenuiflora var. floribunda (Nutt.) Rydb.	Wild Alfalfa
Pycnanthemum tenuifolium Schrad.	Mountain Mint
Ranunculus fascicularis Muhl.	Prairie Buttercup
Ratibida pinnata (Vent.) Barnh.	Grayheaded Coneflower
Rosa carolina L.	Carolina Rose
Rosa setigera Michx.	Prairie Rose
Rudbeckia hirta L.	Black-eyed Susan
Ruellia humilis Nutt.	Fringeleaf Ruellia
Senecio plattensis Nutt.	Prairie Ragwort
Schrankia nuttallii (DC.) Standl.	Sensitive Briar
Silphium laciniatum L.	Compass Plant
Sisyrinchium campestre Bickn.	White-eyed Grass
Solidago nemoralis Ait.	Gray Goldenrod
Solidago rigida L.	Rigid Goldenrod
Spiranthes vernalis Engelm. & Gray	Twisted Ladies' tresses
Tidens flavus (L.) Hitchc.	Purpletop
Tripsacum dactyloides L.	Gamagrass
Teucrium canadense var. virginicum (L.) Eat.	American Germander
Verbena canadensis (L.) Britt.	Rose Vervain
Verbena stricta Vent.	Hoary Vervain
Viola pedata L.	Bird's Foot Violet
Zizia aurea (L.) Koch	Golden Alexanders

Chapter 8

SCHERMERHORN PARK

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Located about a mile and half south from downtown Galena, Kansas, Schemrerhorn Park is one of the best examples of the Ozark Plateau. Shoal Creek, one of the major tributaries to the Spring River, flows through the park. This spring fed, Ozarkian stream has been the major force shaping the basin and producing the physiographic features so common to the Ozark region.

The park proper sits at the west end of a tall limestone bluff on the north side of the river. A large draw enters to the north from Shoal Creek through the middle of the park and follows a small, wet weather stream to another small stream which originates in a cave. Although the spring from the cave is always flowing, the water frequently moves underground and may only be evident in the mouth of the cave.

Throughout the history of the region, Schermerhorn has been a popular gathering place for picnicking, swimming, and fishing. At various times during its history, particularly during the active lead and zinc mining period, the park would receive heavy use and attract people from all around the four state area. Still evident are many structures built during the first part of this century by the Civilian Conservation Corps (CCC). Picnic shelters, rest rooms, and a dance pavilion are ever present reminders of past popularity.

Managed by the City of Galena, the amount of attention and upkeep has varied a little from year to year, but overall the park has fared well, particularly in recent years. Its remote location from the city has made monitoring difficult. Vandalism is an on-going problem. Concerns for safety led to sealing the cave off at the mouth with a concrete wall. However, even that effort has met with limited success, and it has been opened and closed frequently over time.

As a unique habitat, the cave alone provides one of the few known locations in Kansas for the Dark-sided Salamander (Eurycea longicauda melanopleura), Cave Salamander (Eurycea lucifiga), Graybelly Salamander (Eurycea multiplicata griseogaster), and the Grotto Salamander (Typhlotriton spelaeus). Shoal Creek also harbors several species of fish listed at some level of concern (see Chapter 12). All in all, it is a very special part of Kansas with a very interesting culture as well as natural heritage.

Chapter 9

THE VASCULAR FLORA OF SOUTHEAST KANSAS

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There are approximately 1678 species of vascular plants representing 145 families recorded for the state of Kansas. Of this number, 127 families and 1312 species are reported for the southeast corner of the state. This represents 88% of the known families and 78% of the known species for the state. The counties for which the below list of species cover in southeast Kansas are Allen, Bourbon, Cherokee, Crawford, Chautauqua, Elk, Greenwood, Labette, Montgomery, Neosho, Wilson, and Woodson. Information for the following list was obtained from the Atlas of the Flora of the Great Plains (Great Plains Flora Assoc. 1977), Flora of the Great Plains (Great Plains Flora Assoc. 1986), and the T. M. Sperry Herbarium. The families are presented phylogenetically following Cronquist (1981). Genera are alphabetically arranged for each family, and species are presented alphabetically for each genera (Great Plains Flora Assoc. 1986).

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Table 9-1. Vascular flora of southeast Kansas.

SELAGINELLACEAE

Selaginella rupestris (L.) Spring

ISOETACEAE

Isoetes butleri Engelm.
I. melanopoda Gay & Durieu.

EQUISETACEAE

Equisetum arvense L.
E. X ferrissii Clute
E. hyemale L.
E. laevigatum A. Br.

OPHIOGLOSSACEAE

Botrychium dissectum var. obliquum (Muhl.) Clute
B. virginianum (L.) Sw.
Ophioglossum engelmannii Prantl

OSMUNDACEAE

Osmunda regalis L.

POLYPODIACEAE

Adiantum pedatum L.
Asplenium platyneuron (L.) Oakes ex D. C. Eat.
A. resiliens Kunze
A. trichomanes L.
Camptosorus rhizophyllus (L.) Link
Cheilanthes alabamensis (Buck.) Kunze
C. feei Moore
C. lanosa D. C. Eat.
C. tomentosa Link
Cystopteris fragilis (L.) Bernh.
C. protrusa (Weath.) Blasd.
C. tennesseensis Shaver
Dryopteris marginalis (L.) Gray
Nothloaena dealbata (Pursh) Kunze
Onoclea sensibilis L.
Pellaea atropurpurea (L.) Link
P. glabella Mett. ex Kuhn
Polystichum acrostichoides (Michx.) Schott
Pteridium aquilinum var. pseudocaudatum (Clute) Heller
Thelypteris hexagonoptera (Michx.) Weath
T. palustris Schott
Woodsia obtusa (Spreng.) Torr

MARSILEACEAE

Marsilea quadrifolia L.
M. vestita Grev. & Hook

SALVINIACEAE

Azolla mexicana Presl.

CUPRESSACEAE

Juniperus virginiana L.

LAURACEAE

Lindera benzoin (L.) Blume
Sassafras albidum (Nutt.) Nees

ACCONACEAE

Asimina triloba (L.) Dom.

SAURURACEAE

Saururus cernuus L.

ARISTOLOCHIACEAE

Aristolochia serpentaria L.
A. tomentosa Sims

NYMPHACEAE

Nuphar luteum ssp. macrophyllum (Sm.) Beal
Nymphaea odorata Ait.
N. tuberosa Paine

NELUMBONACEAE

Nelumbo lutea (Willd.) Pers.

CERATOPHYLLACEAE

Ceratophyllum demersum L.

RANUNCULACEAE

Anemone caroliniana Walt.
A. virginiana L.
Anemonella thalictroides (L.) Spach
Aquilegia canadensis L.
Clematis pitcheri T. & G.
C. maximowicziana Levl. & Van.
C. virginiana L.
Delphinium ajacis L.
D. tricorne Michx.
D. virescens Nutt.

Table 9-1. Vascular flora of southeast Kansas - continued.

RANUNCULACEAE - continued

Isopyrum biternatum (Raf.) T. & G.
Myosurus minimus L.
Ranunculos abortivus L.
R. fascicularis Muhl.
R. hispidus Michx.
R. micranthus Nutt.
R. recurvatus Poir
R. sceleratus L.
Thalictrum dasycarpum Fisch. & Lall.

BERBERIDACEAE

Podophyllum peltatum L.

MENISPERMACEAE

Calycocarpum lyonie (Pursh) Gray
Cocculus carolinus (L.) DC.
Menispermum canadense L.

PAPAVERACEAE

Argemone polyanthemos (Fedde) G. Ownbey
Papaver rhoeas L.
Sanguinaria canadensis L.

FUMARIACEAE

Corydalis crystallina Engelm.
C. flavula (Raf.) DC.
C. micrantha (Engelm.) Gray
Dicentra cucullaria (L.) Bernh.

PLATANACEAE

Platanus occidentalis L.

ULMACEAE

Celtis laevigata Willd.
C. occidentalis L.
C. tenuifolia Nutt.
Ulmos alata Michx.
U. americana L.
U. pumila L.
U. rubra Muhl.

MORACEAE

Broussonetia papyrifera (L.) Vent.
Maclura pomifera (Raf.) Schneid.
Morus alba L.
M. rubra L.

CANNABACEAE

Cannabis sativa L.
Humulus lupulus L.

URTICACEAE

Boehmeria cylindrica (L.) Sw.
Laportea canadensis (L.) Wedd.
Parietaria pensylvanica Muhl.
Pilea pumila (L.) Gray
Urtica chamaedryoides Pursh
U. dioica ssp. gracilis (Ait.) Seland

JUGLANDACEAE

Carya cordiformis (Wang.) K. Koch
C. illinoensis (Wang.) K. Koch
C. laciniosa (Michx. f.) Loud
C. ovata (Mill.) K. Koch
C. texana Buckl.
C. tomentosa Nutt.
Juglans nigra L.

FAGACEAE

Quercus alba L.
Q. borealis var. maxima (Marsh.) Ashe
Q. imbricaria Michx.
Q. macrocarpa Michx.
Q. marilandica Muenchh.
Q. muhlembergii Engelm.
Q. palustris Muenchh.
Q. prinoides Willd.
Q. shumardii Buckl.
Q. stellata Wang.
Q. velutina Lam.

BETULACEAE

Betula migra L.
Corylus americana Walt.
Ostrya virginiana (Mill.) K. Koch

PHYTOLACCACEAE

Phytolacca americana L.

NYCTAGINACEAE

Mirabilis albida (Walt.) Heimerl.
M. linearis (Pursh) Heimerl.
M. nyctaginea (Michx.) MacM.

Table 9-1. Vascular flora of southeast Kansas - continued.

CACTACEAE

Coryphantha missouriensis (Sweet) Britt. & Rose
Opuntia macrorhiza Engelm.

AIZOACEAE

Glinus lotoides L.
Mollugo verticillata L.

CARYOPHYLLACEAE

Agrostemma githago L.
Arenaria patula Michx.
A. serpyllifolia L.
Cerastium brachypodum (Engelm.) Robins.
C. glomeratum Thuill.
C. nutans Raf.
C. vulgatum L.
Dianthus armeria L.
Holosteum umbellatum L.
Paronychia canadensis (L.) Wood
P. fastigiata (Raf.) Fern.
Sagina decumbens (Ell.) T. & G.
Saponaria officinalis L.
Scleranthus annuus L.
Silene antirrhina L.
S. regeia Sims
S. stellata (L.) Ait. f.
Stellaria media (L.) Cyr.

PORTULACACEAE

Claytonia virginica L.
Portulaca mundula I.M. Johnst.
P. oleracea L.
Talinum calycinum Engelm.
T. parviflorum Nutt.

CHENOPODIACEAE

Chenopodium album L.
C. ambrosioides L.
C. berlandieri Moq.
C. bushianum Aellen
C. desiccatum A. Nels.
C. hybridum L.
C. missouriense Aellen
C. pallescens Standal.
C. standleyanum Aellen
Cycloloma atriplicifolium (Spreng.) Coult.
Kochia scoparia (L.) Schrad.
Monolepis nuttalliana (Schult.) Greene

AMARANTHACEAE

Amaranthus albus L.
A. graecizans L.
A. hybridus L.
A. retroflexus L.
A. spinosus L.
A. rudis Sauer
A. tuberculatus (Moq.) Sauer.
Froelichia gracilis (Hook.) Moq.
Iresine rhizomatosa Standl.

POLYGONACEAE

Polygonum arenastrum Jord. ex Bor.
P. bicorne Raf.
P. coccineum Muhl.
P. convolvulus L.
P. hydropiper L.
P. hydropiperoides Michx.
P. lapthifolium L.
P. pensylvanicum L.
P. persicaria L.
P. punctatum Ell.
P. ramosissimum Michx.
P. scandeus L.
P. tenue Michx.
P. virginianum L.
Rumex acetosella L.
R. altissimus Wood
R. crispus L.
R. hastatulus Baldw.
R. mexicanus Meisn.
R. obtusifolius L.
R. patientia L.
R. venosus Pursh
R. verticullatus L.

CLUSIACEAE = HYPERICACEAE

Ascyrum hypericoides var. multicaule (Michx.) Fern.
Hypericum drummondii (Grev. & Hook) T. & G.
H. mutilum L.
H. perforatum L.
H. punctatum L.
H. sphaerocarpum Michx.

TILIACEAE

Tilia americana L.

MALVACEAE

Abutilon theophrastii Medic.
Althaea rosea (L.) Cav.
Callirhoe alcaeoides (Michx.) Gray
C. digitata Nutt.

Table 9-1. Vascular flora of southeast Kansas - continued.

MALVACEAE - continued

Callirhoe - continued
C. involucrata (T. & G.) Gray
C. leiocarpa Martin
C. papaver var. bushii (Fern) Waterfall
Hibiscus lasiocarpos Cav.
H. militaris Cav.
H. trionum L.
Malva neglecta Wallr.
M. parviflora L.
M. rotundifolia L.
Malvastrum hispidum (Pursh) Hochr.
Sida spinosa L.

VIOLACEAE

Hybanthus concolor (T.F. Forst.) Spreng.
H. verticillatus (Ort.) Baill.
Viola missouriensis Greene
V. nephrophylla Greene
V. pedata L.
V. pedatofoda G. Don
V. pratincola Green
V. pubescens Ait
V. rafinesquii Greene
V. sagittata Ait
V. sonoria Willd.
V. sororia Willd.
V. viarum Pollard

PASSIFLORACEAE

Passiflora incarnata L.
P. lutea var. glabrifolia Fern.

CISTACEAE

Helianthemum bicknellii Fern.
Lechea mucronata Raf.
L. tenuifolia Michx.

LOASACEAE

Meutzelia albescens (Gill) Grisb.
M. oligosperma Nutt.

CUCURBITACEAE

Cucurbita foetidissima H.B.K.
Echinocystis lobata (Michx.) T. & G.
Sycyos angularis L.

SALICACEAE

Populus alba L.
P. deltoides Marsh
P. deltoides var. occidentalis Rydb.
Salix amygdaloides Anderss.
S. caroliniana Michx.
S. exigua ssp. interoir (Rowlee) Cronq.
S. humilis Marsh
S. nigra Marsh
S. rigida var. watsonii (Bebb) Cronq.

CAPPARACEAE

Polanisia dodecandra ssp. trachysperma (T. & G.) Iltis

BRASSICACEAE

Alliaria officinalis Andrz.
Arabis canadensis L.
A. shortii (Fern.) Gl.
A. virginica (L.) Poir.
Barbarea vulgaris R. Br.
Brassica campestris L.
B. hirta Moench
B. juncea (L.) Coss
B. kaber (DC.) Wheeler
B. nigra (L.) Koch
Camelina microcarpa Andrz.
Capsella bursa-pastoris (L.) Medic.
Cardamine parviflora var. arenicola (Britt.) Schulz
C. pensylvanica Muhl.
C. draba (L.) Desv.
Coringia orientalis (L.) Dum.
Dentaria laciniata Muhl.
Descurainia pinnata var. brachycarpa (Richards) Fern.
D. sophia (L.) Webb
Draba brachycarpa Nutt.
D. cuneifolia Nutt.
D. reptans (Lam.) Fern.
Erysimum repandum L.
Hesperis matronalis L.
Iodanthus pinnatifidus (Michx.) Steud.
Lepidium campestre (L.) R. Br.
L. densiflorum Schrad.
L. oblongum Small
L. virginicum L.
Lesqurella gracilis ssp. nuttallii (T. & G.) Roll. & Shaw
Nasturtium officinale R. Br.
Raphanus sativus L.
Rorippa palustris ssp. glabra var. fernaldiana (Butt. & Abbe) Stuckey
R. palustris ssp. hispida (Desv.) Jonsell
R. sessiliflora (Nutt.) Hitchc.
R. sinuata (Nutt.) Hitchc.

Table 9-1. Vascular flora of southeast Kansas - continued.

BRASSICACEAE - continued

Selenia aurea Nutt.
Sisymbrium altissimum L.
S. officinale (L.) Scop.
Streptanthus hyacinthoides Hook.
Thlaspi arvense L.
T. perfoliatum L.

ERICACEAE

Vaccinium arboreum Marsh.
V. vacillans Torr.

MONOTROPACEAE

Monotropa uniflora L.

SAPOTACEAE

Brumelia languinosa var. oblongifolia (Nutt.) Clark

EBENACEAE

Diospyrus virginiana L.

PRIMULACEAE

Anagallis arvensis L.
Androsace occidentalis Pursh
Centunculus minimus L.
Dodecatheon meadia L.
Lysimachia ciliata L.
L. hybrida Michx.
L. nummularia L.
Samolus parviflorus Raf.
Penthorum sedoides L.
Samolus cuneatus Small
Sedum nuttallianum Raf.
S. pulchellum Michx.

SAXIFRAGACEAE

Heuchera hirsuticaulis (Wheeler) Rydb.
Hydrangea arborescens L.
Ribes missouriense Nutt.
R. odoratum Wendl. f.

ROSACEAE

Agrimonia parviflora Ait.
A. gryposepala Wallr.
A. pubesens Wallr.
A. rostellata Wallr.
Amelanchier arborea (Michx. f.) Fern.
A. sanguinea (Pursh) DC.
Crataegus berberifolia T. & G.
C. calpodendron (Ehrh.) Medic.
C. collina Chapm.
C. crus-galli L.
C. lanuginosa Sarg.
C. mollis (T. & G.) Scheele
C. pruinosa (Wendl.) K. Koch
C. reverchoni var. discolor (Sarg.) Palmer
C. reverchoni var. stevensians (Sarg.) Palmer
C. succulenta var. pertomentosa (Ashe)E.J. Palm.
C. viridis L.
Fragaria virginiana var. illinoensis (Prince) Gray
Geum canadense Jacq.
G. vernum (Raf.) T. & G.
Gillenia stipulate (Muhl.) Baill.
Physocarpus opulifolius (L.) Maxim.
Potentilla arguta Pursh
P. norvegica L.
P. recta L.
P. rivalis Nutt.
P. simplex Michx.
Prunus americana Marsh
P. angustifolia Marsh
P. hortulana Bailey
P. mahaleb L.
P. mexicana Wats.
P. munsoniana Wight & Hedr.
P. serotina Ehrh.
P. virginiana L.
Pyrus ioensis (Wood) Bailey
Rosa arkansana Porter
R. blanda Ait.
R. carolina L.
R. foliosa Nutt.
R. multiflora Thunb
R. setigera Michx.
R. allegheniensis Porter
R. enslenii Tratt.
R. flagellaris Willd.
R. occidentalis L.
R. ostryifolius Rydb.
R. pensilvanicus Poir

FABACEAE

Acacia angustissima var. hirta(Nutt.) Robins
Amorpha canescens Pursh
A. fruticosa L.
Amphicarpa bracteata (L.) Fern.
Apios americana Medic.
Astragalus canadensis L.
A. crassicarpus Nutt.
A. distortus T. & G.
A. lotiflorus Hook

Table 9-1. Vascular flora of southeast Kansas - continued.

FABACEAE - continued

Baptisia australis var. minor (Lehm.) Fern.
B. leucantha T. & G.
B. leucophaea Nutt.
Cassia chamaecrista L.
C. marilandica L.
C. nictitans L.
Cercis canadensis L.
Coronilla varia L.
Crotalaria sagittalis L.
Dalea canadense (L.) DC.
D. candida Michx. ex Willd.
D. multiflora (Nutt.) Shinners
D. purpurea vent.
Desmanthus illinoensis (Michx.) MacM.
D. leptolobus T. & G.
Desmodium canescens (L.) DC.
D. ciliare (Willd.) DC.
D. cuspidatum (Muhl.) Loud.
D. glutinosum (Muhl.) Wood
D. illinoense Gray
D. marilandicum (L.) DC.
D. nudiflorum (L.) DC.
D. paniculatum (L.) DC.
D. pauciflorum (Nutt.) DC.
D. rigidum (Ell.) DC.
D. rotundi folium (Michx.) DC.
D. sessilifolium (Torr.) T. & G.
Gleditsia triacanthos L.
Glycyrrhiza lepidota Pursh
Gymnocladus dioica (L.) K. Koch
Lathyrus latifolius L.
L. pusillis Ell.
Lespedeza capitata Michx.
L. corniculatus L.
L. cuneata (Dumont) G. Don
L. hirta (L.) Herm.
L. intermedia (Wats.) Britt.
L. procumbens Michx.
L. repens (L.) Bart.
L. stipulacea Maxim.
L. striata (Thunb. H. & A.
L. stuevei Nutt.
L. violacea (L.) Pers.
Lespedeza virginica (L.) Britt.
Lotus purshianus Clem. & Clem.
Schrankia nuttallii (DC.) Standl.
Medicago lupulina L.
M. sativa L.
Melilotus albus Desr.
M. officinalis (L.) Lam.
Psoralea argophylla Pursh
P. esculenta Pursh
P. psoralioides var. eglandulosa (Ell.) F.L. Freeman
P. tenuiflora var. floribunda (Nutt.) Rydb.
Robinia hispida L.
R. pseudoacacia L.
Strophostyles helvola (L.) Ell.
S. leiosperma (T. & G.) Piper
Stylosanthes biflora (L.) B.S.P.
Tephrosia virginiana (L.) Pers.
Trifolium campestre Schreb.
T. carolinianum Michx.
T. dubium Sibth.
T. hybridum L.
T. pratense L.
T. reflexum L.
T. repens L.
Vicia dasycarpa Ten.
V. ludovicianaNutt.
V. villosa Roth

HALORAGACEAE

Myriophyllum heterophyllum Michx.
M. pinnatum (Walt.) B.S.P.
M. spicatum var. exalbescens (Fern.) Jeps.

LYTHRACEAE

Ammannia auriculata Willd.
A. coccinea Rottb.
Cuphea viscosissima Jacq.
Didiplis diandra (Nutt.) Wood
Lythrum californicum T. & G.
L. dacotanum Nieuw.
Rotala ramosior var. interior Fern. & Grise.

ONAGRACEAE

Calylophus serrulatus (Nutt.) Raven
Circaea lutetiana ssp. canadensis (L.) Asch. & Magnus
Epilobium coloratum Biehler
Gaura longiflora Spach
G. parviflora Dougl.
Ludwigia alternifolia var. pubescens Palm. & Steyerm.
L. glandulosa Walt.
L. palustris (L.) Ell.
L. peploides ssp. glabrescens (O. Ktze.) Raven
L. polycarpa Short & Peter
Oenother biennis ssp. centralis Munz
O. grandis (Britt.) Smyth
O. laciniata Hill
O. linifolia Nutt.
O. macrocarpa Nutt.
O. rhombipetala Nutt.
O. speciosa Nutt.
O. strigosa ssp. canovirens (Steel) Munz
O. triloba Nutt.

Table 9-1. Vascular flora of southeast Kansas - continued.

ONOGRACEAE - continued

Stenosiphon linifolius (Nutt.) Heynh

MELASTOMATACEAE

Rhexia mariana var. interior (Penn.) Kral & Bostick

ELAEAGNACEAE

Elaeagnus angustifolia L.

CORNACEAE

Cornus amomum ssp. obliqua (Raf.) J.S. Wils.
C. drummondii Mey
C. florida L.

SANTALACEAE

Comandra umbellata (L.) Nutt.

LORANTHACEAE

Phoradendron tomentosum (DC.) Gray

CELASTRACEAE

Celastrus scandens L.
Euonymus atropurpureus Jacq.

AQUIFOLIACEAE

Ilex decidua Walt.

EUPHORBIACEAE

Acalypha monococca (Engelm.) Mill.
A. ostryaefolia Ridd.
A. rhomboidea Raf.
A. virginica L.
Argythamnia mercurialina (Nutt.) Muell. Arg.
Croton capitatus Michx.
C. glandulosus var. septentrionalis Muell. Arg.
C. monanthogynus Michx.
C. texenis (Klotzsch) Muell. Arg.
Crotonopsis elliptica Willd.
Euphorbia corollata L.
E. cyathophora Murr.
E. dentata Michx.
E. glyptosperma Engelm.
E. humistrata Engelm.
E. maculata L.
E. marginata Pursh
E. missurica Raf.
E. nutans Lag.
E. podperae Croizat
E. prostrata Ait.
E. serpens H.B.K.
E. spathulata Lam.
E. stictospora Engelm.
Phyllanthus caroliniensis Walt.
Stillingia sylvatica L.
Tragia betonicifolia Nutt.

RHAMNACEAE

Ceanothus americanus var. pitcheri T. & G.
C. herbaceus var. pubescens (T. & G.) Shinners
Rhamnus lanceolata var. glabratus Gl.

VITACEAE

Ampelopsis cordata Michx.
Cissus incisa (Nutt.) Des Moul.
Parthenocissus quinquefolia (L.) Planch.
P. vitacea (Knerr) Hitchc.
Vitis aestivalis Michx.
V. cinerea Engelm.
V. riparia Michx.
V. vulpina L.

STAPHYLEACEAE

Staphylea trifolia L.

SAPINDACEAE

Cardiospermum halicacabum L.
Sapindus saponaria var. drumondii (H. & A.) L. Benson

HIPPOCASTANACEAE

Aesculus glabra var. arguta (Buckl.) Robins.

ACERACEAE

Acer negundo L.
A. saccharinum L.
A. saccharum Marsh.

ANACARDIACEAE

Rhus aromatica Ait.
R. aromatica var. serotina (Greene) Rehd.
R. copallina L.
R. glabra L.

Table 9-1. Vascular flora of southeast Kansas - continued.

ANACARDIACEAE - continued

Toxicodendron radicans ssp. negundo (Greene) Gillis.
T. rydberfii (Small ex Rydb.) Greene
T. toxicarium (Salisb.) Gillis

RUTACEAE

Ptelea trifoliata L.
Zanthoxylum americanum Mill.

ZYGOPHYLLACEAE

Kallstroemia parviflora Nort.
Tribulus terrestris L.

OXALIDACEAE

Oxalis dillenii Jacq.
O. stricta L.
O. violacea L.

GERANIACEAE

Erodium cicutarium (L.) L'Her.
Geranium carolinianum L.
G. maculatum L.
G. pusillum L.

BALSAMINACEAE

Impatiens biflora Walt.
I. pallida Nutt.

LINACEAE

Linum sulcatum Ridd.
L. usitatissimum L.

POLYGALACEAE

Polygala incarnata L.
P. sanguinea L.
P. senega L.
P. verticillata L.

APIACEAE

Ammoselinum popei T. & G.
Anethum graveolens L.
Chaerophyllum procumbens (L.) Crantz
C. tainturieri Hook.
Cicuta maculata L.
Conium maculatum L.
Cryptotaenia canadensis (L.) DC.
Daucus carota L.
D. pusillus Michx.
Erigenia bulbosa (Michx.) Nutt.
Eryngium leavenworthii T. & G.
E. prostratum Nutt.
E. yuccifolium Michx.
Limnosciadium pinnatum (DC.) Math. & Const.
Lomatium foeniculaceum (Nutt.) Coult. & Rose.
L. foeniculaceum var. daucifolium (T. & G.) Cronq.
Osmorhiza longistylis (Torr.) DC.
O. longistylis var. villicaulis Fern.
Pastinaca sativa L.
Perideridia americana (Nutt.) Reichb.
Polytaenia nuttallii DC.
Ptilimnium nuttallii (DC.) Britt.
Sanicula canadensis L.
S. gregaria Bickn.
Sium suave Walt.
Spermolepis divaricata (Walt.) Britt.
S. inermis (Nutt.) Math. & Const.
Taenidia integerrima (L.) Drude
Thaspium barbinode (Michx.) Nutt.
T. trifoliatum (L.) Gray
Torilis arvensis (Huds.) Link
Zizia aptera (Gray) Fern.
Z. aurea (L.) Koch

GENTIANACEAE

Centaurium texense (Griseb.) Fern.
Gentiana alba
G. puberulenta Pringle
Sabatia angularis (L.) Pursh
S. campestris Nutt.

APOCYNACEAE

Apocynum cannabinum L.
A. medium Greene
A. sibiricum Jacq.
A. tabernaemontana Walt.

ASCLEPIADACEAE

Asclepias amplexicaulis Sm.
A. asperula var. decumbens (Nutt.) Shinners
A. engelmanniana Woods.
A. hirtella (Penn.) Woods.
A. incarnata L.
A. meadii Torr.
A. purpurascens L.
A. quadrifolia Jacq.
A. stenophylla Gray
A. sullivantii Engelm.
A. tuberosa ssp. interior Woods
A. verticillata L.
A. veridiflora Raf.

Table 9-1. Vascular flora of southeast Kansas - continued.

ASCLEPIADACAEA - continued

A. viridis Walt.
Cynanchum laeve (Michx.) Pers.
Matelea decipiens (Alex.) Woods.
M. gonocarpa (Walt.) Shinners

SOLANACEAE

Datura stramonium L.
Lycium halimifolium Mill.
Physalis angulata L.
P. angulata var. pendula (Rydb.) Waterfall
P. heterophylla Nees
P. pubescens var. integrifolia (Dum.) Waterfall
P. pubescens var. missouriensis (Mack. & Bush) Waterfall
P. pumila Nutt.
P. virginiana Mill.
P. virginiana var. hispida Waterfall
P. virginiana var. sonorae (Torr.) Waterfall
P. virginiana var. subglabrata (Mack. & Bush) Waterfall
Solanum americanum Mill.
S. carolinense L.
S. elaeagnifolium Cav.
S. rostratum Dun.
S. sarrachoides Sendt.

CONVOLVULACEAE

Convolvulus arvensis L.
C. pellitus Ledeb.
C. sepium L.
Evolvulus nuttallianus R. & S.
Iponoea coccinea L.
I. cristulata Hallier
I. hederacea (L.) Jacq.
I. lacunosa L.
I. pandurata (L.) Mey.
I. purpurea (L.) Roth

CUSCUTACEAE

Cuscuta compacta Juss.
C. cuspidata Engelm.
C. glomerata Choisy
C. gronovii Willd.
C. indecora Choisy
C. pentagona Engelm.
C. polygonorum Engelm.

POLEMONIACEAE

Phlox divaricata ssp. laphamii (Wood) Wherry
P. oklahomensis Wherry
P. paniculata L.
P. pilosa L.
P. pilosa ssp. fulgida (Wherry) Wherry
P. pilosa ssp. ozarkana (Wherry) Wherry
Polemonium reptans L.

HYDROPHYLLACEAE

Ellisia nyctelea L.
Hydrophyllum virginianum L.
Phacelia gilioides Brand.
P. hirsuta Nutt.

BORAGINACEAE

Cynoflossum officinale L.
Hackelia virginiana (L.) I.M. Johnst.
Heliotropium indicum L.
H. tenellum (Nutt.) Torr.
Lappula echinata Gilib.
L. redowskii (Hornem.) Greene
Lithospermum arvense L.
L. canescens (Michx.) Lehm.
L. carolinense (Walt.) MacM.
L. incisum Lehm.
Myosotis verna Nutt.
Onosmodium molle var. hispidissimum (Mack.) Cronq.
O. molle var. occidentale (Mack.) I.M. Johnst.

CALLITRICHACEAE

Callitriche heterophylla Pursh
C. terrestris Raf.

VERBENACEAE

Phyla lancelolata (Michx.) Greene
Verbena bipinnatifida Nutt.
V. bracteata Lag. & Rodr.
V. canadensis (L.) Britt.
Verbena hastata L.
V. simplex Lehm.
V. stricta Vent.
V. urticifolia L.

PHRYMACEAE

Phryma leptostachya L.

LAMIACEAE

Agastache nepetoides (L.) O. Ktze.
Ajuga reptans L.

Table 9-1. Vascular flora of southeast Kansas - continued.

LAMIACEAE - continued

Blephilia ciliata (L.) Benth.
B. hirsuta (Pursh) Benth.
Cunilia organoides (L.) Britt.
Dracocephalum parviflorum Nutt.
Glecoma hederacea L.
Hedeoma hispida Pursh
H. pulegioides (L.) Pers.
Isanthus brachiatus (L.) B.S.P.
Lamium amplexicaule L.
L. purpureum L.
Leonurus cardiaca L.
Lycopus americanus Muhl.
L. virginicus L.
Marrubium vulgare L.
Mentha arvensis L.
Monarda bradburiana Beck
M. citriodora Cerv.
M. fistulosa L.
Nepeta cataria L.
Perilla frutescens (L.) Britt.
Physostegia intermedia (Nutt.) Gray
P. virginiana (L.) Benth.
Prunella vulgaris L.
Pycnanthemum albescens T. & G.
P. pilosum Nutt.
P. tenuifolium Schrad.
P. virginianum (L.) Durand & Jacks.
Salvia pitcheri Torr.
S. reflexa Hornem.
Scutellaria lateriflora L.
S. ovata Hill
S. parvula Michx.
S. parvula var. australis Fassett
S. parvula var. leonardi (Epl.) Fern.
Stachys tenuifolia
Tecurium canadense var. occidentale (Gray) McCl. & Epl.
T. canadense var. virginicum (L.) Eat.

PLANTAGINACEAE

Plantago aristata Michx.
P. lanceolata L.
P. major L.
P. patagonica Jacq.
P. patagonica var. spinulosa (Dcne.) Gray
P. pusillo Nutt.
P. rhodosperma Dcne.
P. rugellii Dcne.
P. virginica L.

OLEAEAE

Fraxinus americana L.
F. pennsylvanica var. subintegerrima (Vahl) Fern.
F. quadrangulata Michx.

SCROPHULARIACEAE

Agalinis aspera (Benth.) Britt.
A. fasciculata (Ell.) Raf.
A. gattingerii (Small) Small
A. heterophylla (Nutt.) Small
A. purpurea (L.) Penn.
A. skinneriana (Wood) Britt.
A. tenuifolia (Vahl) Raf.
Aureolaria grandiflora var. cinerea Penn.
Bacopa acuminata (Walt.) Robins.
B. rotundifolia (Michx.) Wettst.
Buchnera americana L.
Castilleja coccinea (L.) Spreng.
C. sessiliflora Pursh
Chaenorrhinum minus (L.) Lange
Collinsia verna Nutt.
C. violacea Nutt.
Gratiola neglecta Torr.
G. virginiana L.
Kickxia elatine (L.) Dum.
Leucospora multifida (Michx.) Nutt.
Linaria canadensis var. texana (Scheele) Penn.
L. vulgaris Hill
Lindernia anagallidea (Michx.) Penn.
L. dubia (L.) Penn.
Mimulus alatus Ait.
M. ringens L.
Pedicularis canadensis L.
Penstemon cobaea Nutt.
P. digitalis Nutt.
P. tubaeflorus Nutt.
Scrophularia lanceolata Pursh
S. marilandica L.
Seymeria macrophylla Nutt.
Tomanthera auriculata (Michx.) Raf.
Verbascum blattaria L.
V. thapsus L.
Veronica agrestis L.
V. arvensis L.
V. perefrina L.
V. peregrina var. xalapensis (H.B.K.) St. John & Warren
Veronicastrum virginicum (L.) Farw.

OROBANCHACEAE

Orobanche fasciculata Nutt.
O. ludoviciana Nutt.
O. uniflora L.

Table 9-1. Vascular flora of southeast Kansas - continued.

BIGNONIACEAE

Campsis radicans (L.) Seem.
Catalpa speciosa Warder

ACANTHACEAE

Dicliptera brachiata (Pursh) Spreng.
Justicia americana (L.) Vahl
Ruellia humilis Nutt.
R. strepens L.

PEDALIACEAE

Proboscidea louisianica (Mill.) Thell.

LENTIBULARIACEAE

Utricularia gibba L.
U. vulgaris L.

CAMPANULACEAE

Campanula americana L.
Lobelia cardinalis L.
L. inflata L.
L. siphilitica L.
L. spicata Lam.
Triodanis biflora (R. & P.) Greene
T. holzingeri McVaugh
T. leptocarpa (Nutt.) Nieuw.
T. perfoliata (L.) Nieuw.

RUBIACEAE

Cephalanthus occidentalis L.
Diodia teres Walt.
Galium aparine L.
G. ciraezans Michx.
G. concinnum T. & G.
G. obtusum Bigel.
G. pilosum Ait.
G. trifidum L.
G. triflorum Michx.
G. virgatum Nutt.
Hedyotis crassifolia Raf.
H. longifolia
H. nigricans (Lam.) Fosb.
Spermacoce glabra Michx.

CAPRIFOLIACEAE

Lonicera dioica var. glaucescens (Rydb.) Butters
L. japonica Thunb.
L. prolifera (Kirchn.) Rehd.
Sambucus canadensis L.
Symphoricarpos orbiculatus Moench
Triosteum angusifolium L.
T. auranticum var. illinoense (Weig.) Palm & Steyerm
T. perfoliatum L.
Viburnum prunifolium L.
V. rufidulum Raf.

VALERIANACEAE

Valerianella rediata (L.) Dufr.

DIPSACACEAE

Dipsacus laciniatus L.
D. sylvestris Huds.

ASTERACEAE

Achillea millefolium ssp. lanulosa (Nutt.) Piper
Ambrosia artemisiifolia L.
A. bidentata Michx.
A. psilostachya DC.
A. trifida L.
Antennaria neglecta Greene
A. plantaginifolia (L.) Richards.
Anthemis cotula L.
Arctium minus Schkuhr
Artemisia biennis Willd.
A. ludoviciana Nutt.
A. ludoviciana var. mexicana (Willd.) Fern.
Aster anomalus Engelm.
Aster azureus Lindl.
A. drummondii Lindl.
A. ericoides L.
A. laevis L.
A. lateriflorus (L.) Britt.
A. novae-angliae L.
A. oblongifolius Nutt.
A. ontarionis Wieg.
A. parviceps (Burgess) Mack. & Bush
A. patens var. patentissumus (Lindl.) T. & G.
A. pilosus Willd.
A. praealtus Poir.
A. sericeus Vent.
A. simplex Willd.
A. simplex var. interior (Wieg.) Cronq.
A. simplex var. ramosissimun (T. & G.) Cronq.
Aster turbinellus Lindl.
Astranthium integrifolium ssp. ciliatum (Raf.) DeJong
Bidens bipinnata L.
B. cernua L.
B. comosa (Gray) Wieg.
B. connata Muhl.
B. frondosa L.

Table 9-1. Vascular flora of southeast Kansas - continued.

ASTERACEAE - continued

Bidens - continued
B. polylepis Blake
Boltonia asteroides var. latisquama (Gray) Cronq.
B. asteroides var. recognita (Fern. & Grisc.) Cronq.
Cacalia atriplicifolia L.
C. tuberosa Nutt.
Carduus nutans L.
Centaurea americana Nutt.
C. cyanus L.
C. solstitialis L.
Chaetopappa asteroides (Nutt.) DC.
Chrysanthemum leucanthemum L.
Chrysopsis pilosa Nutt.
C. villosa var. canescens (DC.) Gray
Cichorium intybus L.
Cirsium altissimum (L.) Spreng.
C. arvense (L.) Scop.
C. undulatum (Nutt.) Spreng.
C. vulgare (Savi) Ten.
Conyza canadensis (L.) Cronq.
C. ramosissima Cronq.
Coreopsis grandiflora Hogg
C. palmata Nutt.
C. tinctoria Nutt.
C. tripteris L.
Dyssodia papposa (Vent.) Hitchc.
Echinacea angustifolia DC.
E. atrorubens Nutt.
E. pallida (Nutt.) Nutt.
Echinacia purpurea (L.) Moench
Eclipta alba (L.) Hassk.
Elephantopus carolinianus Willd.
Engelmannia pinnatifida T. & G.
Erechtites hieracifolia (L.) Raf.
Erigeron annuus (L.) Pers.
E. philadelphicus L.
E. strigosus Muhl.
E. tenuis T. & G.
Eupatorium altissimum L.
E. coelestinum L.
E. perfoliatum L.
E. purpureum L.
E. rugosum Houtt.
E. serotinum Michx.
Gaillardia pulchella Foug.
Galinsoga ciliata (Raf.) Blake
G. parviflora Cac.
Gnaphalium obtusifolium L.
G. purpureum L.
Grindelia lanceolata Nutt.
G. squarrosa (Pursh) Dun.
Gutierrezia dracunculoides (DC.) Blake
Haplopappus ciliatus (Nutt.) DC.
Helenium amarum (Raf.) Rock
H. autumnale L.
Helianthus annuus L.
H. flexuosum Raf.
H. grosseserratus Martens
H. hirsutus Raf.
H. maximilliani Schrad.
H. mollis Lam.
H. petiolaris Nutt.
H. rigidus (Cass.) Desf.
H. salicifolius A. Dietr.
H. strumosus L.
H. tuberosa L.
H. helianthoides var. scabra (Dun.) Fern.
Hieracium gronovii L.
H. longipilum Torr.
Hymenopappus scabiosaeus var. corymbosus (T. & G.) B.L. Turner
Iva annua L.
Krigia biflora (Walt.) Blake
K. dandelion (L.) Nutt.
K. occidentalis Nutt.
K. oppositifolia Raf.
Kuhnia evpatorioides var. corymbulosa T. & G.
Lactuca canadensis L.
L. floridana (L.) Gaertn.
L. ludoviciana (Nutt.) DC.
L. saligna L.
L. serriola L.
Liatris aspera Michx.
L. hirsuta Rydb.
L. mucronata DC.
L. punctata Hook.
L. pycnostachya Michx.
Marshallia caespitosa Nutt.
Matricaria matricarioides (Less.) Porter
Microseris cuspidata (Pursh) Sch. - Bip.
Parthenium hispidum Raf.
P. hysterophorus L.
Pluchea camphorata (L.) DC.
Prenanthes aspera Michx.
Pyrrhopappus carolinianus (Walt.) DC.
P. grandiflorus (Nutt.) Nutt.
Ratibida columnifera (Nutt.) Woot. & Standl.
R. pinnata (Vent.) Barnh.
Rudbeckia amplexicaulis Vahl.
R. hirta L.
R. laciniata L.
R. subtomentosa Pursh
R. triloba L.
Senecio glabellus Poir.
S. imparipinnatus Klatt
S. obovatus Muhl.
S. plattensis Nutt.
S. pseudaureus var. semicordatus (Mack. & Bush) T.M. Barkley

Table 9-1. Vascular flora of southeast Kansas - continued.

ASTERACEAE - continued

Silphium integrifolium Michx.
S. laciniatum L.
S. perfoliatum L.
S. speciosum Nutt.
Solidago canadensis var. hargeri Fern.
S. canadensis var. scabra (Muhl.) T. & G.
S. gigantea Ait.
S. graminifolia var. gymnospermoides (Greene) Croat
S. graminifolia var media (Greene) Harris
S. missouriensis Nutt.
S. nemoralis Ait.
S. petiolaris Ait.
S. radula Nutt.
S. rigida L.
S. speciosa Nutt.
S. ulmifolia Muhl.
Sonchus arvensis L.
S. asper (L.) Hill
S. oleraceus L.
Tanacetum vulgare L.
Taraxacum laevigatum (Willd.) DC.
T. officinale Weber
Thelesperma filifolium (Hook) Gray
T. megapotamicum (Spreng.) O. Ktze.
Tragopogon dubius Scop.
T. porrifolius L.
Verbesina alternifolia (L.) Britt.
V. helianthoides Michx.
Veronica arkansana DC.
V. baldwini Torr.
V. baldwini var. interior (Small) Schub.
V. fasciculata Michx.
V. gigantea (Walt.) Trel.
Veronica missurica Raf.
Xanthium strumarium L.

ALISMATACEAE

Alisma subcordatum Raf.
Echinoforus cordifolius (L.) Griseb.
E. rostratus (Nutt.) Engelm.
Sagittaria ambigua J.G. Sm.
S. cuneata Sheld.
S. engelmanniana ssp. brevirostra (Mack. & Bush) Bogin
S. graminea Michx.
S. latifolia Willd.
S. montevidensis ssp. calycina (Englem.) Bogin

HYDROCHARITACEAE

Elodea nuttallii (Planch.) St. John

NAJADACEAE

Najas guadalupensis (Speng.) Morong.

POTAMOGETONACEAE

Potamogeton amplifolius Tuckerm.
P. crispus L.
P. diversifolius Raf.
P. foliosus Raf.
P. nodosus Poir.
P. pectinatus L.
P. pusillus L.

COMMELINACEAE

Commelina communis L.
C. diffusa Burm. f.
C. erecta L.
C. erecta var. angustifolia (Michx.) Fern.
C. virginica L.
Tradescantia bracteata Small
T. ohiensis Raf.

JUNCACEAE

Juncus acuminatus Michx.
J. brachycephalus (Engelm.) Buch.
J. brachyphylla Wieg.
J. crassifolius Buch.
J. diffusissimus Buckl.
J. dudleyi Wieg.
J. effusus var. solutus Fern. & Wieg.
J. interior Wieg.
J. marginatus Rostk.
Juncus tenuis Willd.
J. torreyi Cov.

CYPERAEAE

Bulbostylis capillaris (L.) Clarke
Carex aggregata Mack.
C. amphibola var. turgida Fern.
C. annectens Bickn.
C. annectens var. xanthocarpa (Bickn.) Wieg.
C. arkansana Bailey
C. artitecta Mack.
C. bicknellii Britt.
C. blanda Dew.
C. brevior (Dew.) Mack.
C. bushii Mack.
C. cephalophora Muhl.
C. conjuncta W. Boott

Table 9-1. Vascular flora of southeast Kansas - continued.

CYPERACEAE - continued

Carex - continued
C. crus-corvi Shuttlew.
C. davisii Schwein. & Torr.
C. emoryi Dew.
C. fissa Mack.
C. frankii Kunth
C. grandularis Muhl.
C. gravida Bailey
C. gravida var. lunelliana (Mack.) Herm.
C. grayii Carey
C. heliophila Mack.
C. hirsutella Mack.
C. hyalinolepis Steud.
C. jamesii Schwein.
C. lacustris Willd.
C. lanuginosa Michx.
C. leavenworthii Dew.
C. lupulina Muhl.
C. meadii Dew.
C. microdonta T. & H.
Carex molesta Mack.
C. muhlenbergii var. australis Olney
C. muhlenbergii var. enervis W. Boott
C. normalis Mack.
C. oklahomensis Mack.
C. oligocarpa Schkuhr
C. retroflexa Muhl.
C. rosea Schkuhr
C. scoparia Schkuhr
C. shortiana Dew.
C. sparganioides Muhl.
C. squarrosa L.
C. stipata Muhl.
C. triangularis Boeckl.
C. vulpinoidea Michx.
Cyperus acuminatus T. & H.
C. aristatus Rottb.
Cyperus erythrorhizos Muhl.
C. esculentus L.
C. ferruginescens Boeck.
C. filiculmis Vahl
C. lupulinus (Spreng.) Marcks.
C. ovularis (Michx.) Torr.
C. pseudovegetus Steud.
C. rivularis Kunth
C. setigerus T. & H.
C. strigosus L.
C. tenuifolius (Steud.) Dandy
Eleocharis acicularis (L.) R. & S.
E. atropurpurea (Retz.) Kunth
E. compressa Sulliv.
E. erythropoda Steud.
E. macrostachya Britt.
E. montividiensis Kunth
E. obtusa var. ovata (Roth) Drapalik & Mohlenbrock
E. parvula var. anachaeta (Torr.) Svens.
E. smallii Britt.
E. tenuis var. verrucosa Svens.
E. wolfii Gray
E. xyridiformis Fern. & Brackett
Fimbristylis autumnalis (L.) R. & S.
F. puberula (Michx.) Vahl
F. vahlii (Lam.) Link
Hemiscarpha drummondii Nees
H. micrantha (Vahl) Pax
Rhynchospora globularis var. recognita Gale
R. harveyi Boott
Scirpus acutus Muhl.
S. americanus Pers.
S. atrovirens Willd.
S. atrovirens var. pallidus Britt.
S. fluviatilis (Torr.) Gray
S. koilopis (Steud.) Gl.
S. olneyi Gray
S. pendulus Muhl.
S. validus Vahl
Sleria ciliata Michx.
S. pauciflora Muhl.
S. triglomerata Michx.

POACEAE

Aegilops cylindrica Host
Agropyron pectiniforme R. & S.
A. smithii Rydb.
Agrostis elliotinana Schult.
A. hyemalis (Walt.) B.S.P.
A. perennans (Walt.) Tuckerm.
A. stolonifera L.
Alopecurus carolinianus Walt.
Andropogon gerardi Vitman
Andropogon ischaemum var. songaricus Fisch. & Mey.
A. saccharoides Sw.
A. scoparius Michx.
A. ternarius Michx.
A. virginicus L.
Aristida basiramea Engelm.
A. dichotoma Michx.
A. dichotoma var. curtissii Gray
A. longespica Poir.
A. oligantha Michx.
A. purpurascens Poir.
Boutelova cortipendula (Michx.) Torr.
B. gracilis (H.B.K.) Griffiths
B. hirsuta Lag.
Bromus inermis Leyss.
B. japonicus Thunb.
B. pubescens Willd.
B. racemosus L.
B. tectorum L.
B. unioloides H.B.K.

Table 9-1. Vascular flora of southeast Kansas - continued.

POACEAE - continued

Buchloe dactyloides (Nutt.) Engelm.
Cenchrus longispinus (Hack.) Fern.
Chloris verticillata Nutt.
C. virgata Sw.
Cinna arundinacea L.
Cynodon dactylon (L.) Pers.
Dactylis glomerata L.
Danthonia spicata (L.) Beauv.
Diarrhena americana var. obovata Gl.
Digitaria adscendens (H.B.K.) Henr.
D. filiformis (L.) Koel.
D. ischaemum (Schreb.) Muhl.
D. sanguinalis (L.) Scop.
D. spicata var. stricta (Torr.) Beetle
Echinochlora crusgalli (L.) Beauv.
E. muricata (Beauv.) Fern.
E. muricata var. microstachya Wieg.
Eleusine indica (L.) Gaertn.
Elymus canadensis L.
E. villosus Muhl.
E. virginicus L.
Eragrostis barrelieri Daveau
E. capillaris (L.) Nees
E. cilianensis (All.) E. Mosher
E. curvula (Schrad.) Nees
E. frankii C.A. Mey.
E. hypnoides (Lam.) B.S.P.
E. intermedia Hitchc.
E. pectinacea (Michx.) Nees
E. reptans (Michx.) Nees
E. spectabilis (Pursh) Steud.
E. trichodes (Nutt.) Wood
Eriochola contracta Hitchc.
Festuca obtusa Biehler
Festuca octoflora Walt.
F. paradoxa Desv.
F. pratensis Huds.
Glyceria striata (Lam.) Hitchc.
Gymnopogon ambiguus (Michx.) B.S.P.
Holcus lanatus L.
Hordeum jubatum L.
H. pusillum Nutt.
Hystrix patula Moench
Koeleria pyramidata (Lam.) Beauv.
Leersia oryzoides (L.) Sw.
L. virginica Willd.
Leptochola fascicularis (Lam.) Gray
L. filiformis (Lam.) Beauv.
Leptoloma cognatum (Schult.) Chase
Lolium perenne L.
L. perenne var. aristatum Willd.
L. temulentum var. leptochaeton A.Br.
Manisuris cylindrica (Michx.) O. Ktze.
Melica nitens (Scribn.) Nutt.
Muhlenbergia bushii Pohl
M. capillaris (Lam.) Trin.
M. cuspidata (Torr. in Hook.) Rydb.
M. frondosa (Poir.) Fern.
M. mexicana (L.) Trin.
M. racemosa (Michx.) B.S.P.
M. schreberi J.F. Gmel.
M. sobolifera (Muhl.) Trin.
M. sylvatica Torr.
Panicum anceps Michx.
P. boscii Poir.
P. capillare L.
P. clandestinum L.
P. dichotomiflorum Michx.
P. flexile (Gatt.) Scribn.
P. lanuginosum var. fasciculatum (Torr.) Fern.
P. lanuginosum var. lindheimeri (Nash) Fern.
P. latifolium L.
P. leibergii (Vasey) Scribn.
P. linearifolium Scribn.
P. malacophyllum Nash
P. oligosanthes var. scribnerianum (Nash) Fern.
P. perlongum Nash
P. philadelphicum Bernh.
P. praecocius Hitchc. & Chase
P. rigidulum Nees
P. sphaerocarpon Ell.
P. virgatum L.
P. distichum L.
Paspalum floridanum Michx.
P. floridanum var. glabratum Engelm.
P. fluitans (Ell.) Kunth
P. laeve var. circulare (Nash) Fern.
P. pubiflorum var. glabrum Vasey
Paspalum setaceum var. muhlenbergii (Nash) D. Banks
P. setaceum var. stramineum (Nash) D. Banks
Phalaris arundinacea L.
P. canariensis L.
P. caroliniana Walt.
Phleum pratense L.
Poa annua L.
P. chapmaniana Scribn.
P. compressa L.
P. pratensis L.
P. sylvestris Gray
Schedonnardus paniculatus (Nutt.) Trel.
Setaria faberii Herrm.
S. geniculata (Lam.) Beauv.
S. glauca (L.) Beauv.
S. italica (L.) Beauv.
S. viridis (L.) Beauv.
Sorghastrum avenaceum (Michx.) Nash
Sorghum halepense (L.) Pers.
Spartina pectinata Link

Table 9-1. Vascular flora of southeast Kansas - continued.

POACEAE - continued

Sphenopholis obtusata (Michx.) Scribn.
S. obtusata var. major (Torr.) Erdman
Sporobolus asper (Michx.) Kunth
S. asper var. clandestinus (Biehler) Shinners
S. asper var. hookeri (Trin.) Vasey
S. cryptandrus (Torr.) Gray
S. heterolepis (Gray) Gray
S. vaginiflorus (Torr.) Wood
S. vaginiflorus var. neglectus (Nash) Scribn.
Stipa spartea Trin.
Tridens flavus (L.) Hitchc.
T. muticus (Torr.) Nash
T. strictus (Nutt.) Nash
Tripsacum dactyloides L.
Uniola latifolia Michx.

SPARGANIACEAE

Sparganium eurycarpum Engelm.

TYPHACEAE

Typha angustifolia L.
T. domingensis Pers.
T. latifolia L.

ARACEAE

Acorus calamus L.
Arisaema dracontium (L.) Schott
A. triphyllum (L.) Schott

LEMNACEAE

Lemna minor L.
L. perpusilla Torr.
Spirodela polyrhiza (L.) Schleid.
Wolffia columbiana Karst.
W. papulifera Thomps.

PONTEDERIACEAE

Heteranthera limosa (Sw.) Willd.
Pontederia cordata L.

LILIACEAE

Allium canadense L.
A. canadense var. lavendulare (Bates) M. Owensby & Aase
A. canadense var. mobilense (Regel) Owensby
A. stellatum Ker.
A. vineale L.
Asparagus offinalis L.
Camassia angustata (Engelm. & Gray) Blank.
C. scilloides (Raf.) Cory
Cooperia drummondii Herb.
Erythronium albidum Nutt.
E. mesochoreum Knerr
E. rostratum C.B. Wolf
Hemerocallis fulva (L.) L.
Hypoxis hirsuta (L.) Cov.
Lilium canadense var. michiganense (Farw.) Boivin & Cody
Melanthium virginicum L.
Nothoscordum bivalve (L.) Britt.
Ornithogalum unbellatum L.
Polygonatum biflorum (Walt.) Ell.
Smilacina racemosa (L.) Desf.
Smilax bona-nox L.
S. ecirrhata (Engelm. ex Kunth) Wats.
S. herbacea L.
S. herbacea var. lasioneuron (Small) Rydb.
Trillium sessile L.
T. viride Beck
Uvularia grandiflora Sm
Yucca smalliana Fern.
Zigadensus nuttallii Gray

IRIDACEAE

Belamcanda chinensis (L.) DC.
Nemastylis geminiflora Nutt.
Sisyrinchium angustifolium Miller
S. campestre Bickn.
S. campestre var. kansanum Bickn.

DIOSCOREACEAE

Dioscorea villosa L.

ORCHIDACEAE

Aplectrum hyemale (Muhl.) Torr.
Corallorhiza odontorhiza (Willd.) Nutt.
C. wisteriana Conrad
Cypripedium calceolus var. pubescens (Willd.) Correll
Habenaria lacera (Michx.) Lodd.
H. leucophaea (Nutt.) Gray
Spiranthes cernua (L.) Rich.
S. lacera (Raf.) Raf.
S. tuberosa Raf.
S. vernalis Engelm. & Gray
Hexalectris spicata (Walt.) Burnh.

Chapter 10

THE ANTHOCEROTAE, HEPATICAE, AND MUSCI OF SOUTHEAST KANSAS

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Anthocerotae and Hepaticae

The most comprehensive work for the Anthocerotae (hornworts) and the Hepaticae (liverworts) in Kansas is that of McGregor (1955), in which 69 taxa are reported for the state. Since that time, a number of taxa have been reduced in synonomy, some nomenclatural changes have been made, and a few taxa have been added to adjust the above total number slightly. Southeast Kansas represents the most bryologically diverse region in the state, in part due to the extension of the Ozarkian region into Cherokee County.

Sixty-one taxa are represented in southeast Kansas, which is 86% of the total number of hornworts and liverworts known for the state. Of the 61 taxa, 27 are thallose, while 34 are leafy.

Tables 10-1 and 10-2 are a checklist for southeast Kansas. The lists in the tables are alphabetical by genus and species within each class. The county abreviations are as follows: Allen - AL; Bourbon - BB; Cherokee - CK; Crawford - CR; Chautauqua - CQ; Elk - EK; Greenwood - GW; Labette - LB; Montgomery - MG; Neosho- NO; Wilson - WL; Woodson - WO. Nomenclature follows Stotler and Crandall-Stotler (1977) and Schuster (1969, 1974, 1980, 1992).

Musci (mosses)

The most comprehensive published studies for the mosses of Kansas have been that of Churchill (1985). Since this time, Merill (1989, 1991a, 1991b) has published a number of additional reports. In addition, Nonnenmacher (1992) conducted a study of Neosho County, adding a number of new records for the county, as well as southeast Kansas.

The total number of known moss taxa for Kansas is 162. There are 106 taxa reported for southeast Kansas, which represent 65% of the total taxa of mosses for the state. Below is a list of moss taxa for southeast Kansas. The format in Table 10-3 follows that for hornworts and liverworts. Nomenclature follows Anderson, Crum and Buck (1990).

Table 10-1. Anthocerotae (hornworts) of Southeast Kansas.

	AL	BB	CK	CR	CQ	EK	GW	LB	MG	NO	WL	WO
Anthoceros laevis subsp. carolinianus (L.) Schuster	X	X	X	X					X		X	X
Aspiromitus punctatus (L.) Schijakov					X	X	X	X	X		X	X
Notothylas orbicularis (Schwein.) Sull			X								X	

Table 10-2. Hepaticae (liverworts) of Southeast Kansas.

	AL	BB	CK	CR	CQ	EK	GW	LB	MG	NO	WL	WO
Aneura												
pinguis (L.) Dum.									X			
Asterella												
tenella (L.) P. Beauv.			X		X			X	X	X	X	X
Calypogeia												
muelleriana (Schiffn.) K. Mull.			X								X	X
trichomanis (L.) Corda												X
Cephalozia												
bicuspidata (L.) Dum.												X
catenulata (Hub.) Lindb.												X
lunulifolia (Dum.) Dum.												X
Cephaloziella												
divaricata (Sm.) Schiffn.									X			
hampeana (Nees) Schiffn.					X							
rubella (Nees) Warnst.									X			X
Chiloscyphus												
pallescens (Ehrh. ex Hoffm.) Dum.			X									
Cololejeunea												
biddlecomiae (Aust.) Evans	X											X
Conocephalum												
conicum (L.) Lindb.					X				X		X	X
Diplophyllum												
apiculatum (Evans) Steph.				X							X	
Fossombronia												
brasiliensis Steph.					X				X		X	X
foveolata Lindb.			X		X							X
Frullania												
brittoniae Evans			X									X
eboracensis Gott.			X		X			X		X	X	X
inflata Gott.	X	X	X	X	X			X	X		X	X
kunzei Lehm. et Lindenb.			X									
riparia	X	X		X	X				X		X	
squarrosa (Reinw. et al.) Dum.											X	
Geocalyx												
graveolens (Schrad.) Nees			X									
Jamesoniella												
autumnalis (DC.) Steph.												X

Table 10-2. Hepaticae (liverworts) of Southeast Kansas - continued.

	AL	BB	CK	CR	CQ	EK	GW	LB	MG	NO	WL	WO
Jungermannia												
crenuliformis Aust.												X
fossombronioides Aust.					X							X
hyalina Lyell					X				X			X
Lophocolea												
bidentata (L.) Dum.			X						X		X	X
heterophylla (Schrad.) Dum.				X	X				X	X	X	X
minor Nees				X								
Lophozia												
bicrenata (Schmid. ex Hoffm.) Dum.												X
Mannia												
fragrans (Balbis) Frye et Clark				X	X	X		X	X		X	X
Marchantia												
domingensis Lehm. et Lindenb.											X	
polymorpha											X	X
Nowellia												
curvifolia (Dicks.) Mitt.									X	X		
Oxymitra												
paleacea Bisch.					X				X		X	X
Pellia												
epiphylla (L.) Corda			X									
Plagiochasma												
rupestre (Forst.) Steph.												X
Plagiochila												
asplenioformis Schust.			X									
Porella												
pinnata L.				X	X				X			
platyphylla (L.) Pfeiff.	X	X							X		X	
platyphylloidea (Schwein.) Lindb.		X	X		X				X			
Reboulia												
hemisphaerica (L.) Raddi			X	X	X			X	X	X	X	X
Ricca												
beyichiana Hampe ex Lehm.	X	X	X	X	X	X	X	X	X		X	X
bifurca Hoffm.			X									
campbelliana M. A. Howe			X		X			X	X	X	X	X
dictyospora M. A. Howe	X	X	X		X		X		X	X	X	X
frostii Aust.								X			X	X
hirta (Aust.) Underw.	X		X		X	X	X	X	X	X	X	X
lamellosa Raddi			X		X	X	X		X	X	X	X
fluitans L.			X									
sorocarpa Bisch.			X	X	X				X	X		
trichocarpa M. A. Howe					X		X		X		X	X

Table 10-2. Hepaticae (liverworts) of Southeast Kansas - continued.

	AL	BB	CK	CR	CQ	EK	GW	LB	MG	NO	WL	WO
Scapania												
nemorosa (L.) Dum.											X	
undulata (L.) Dum.											X	
Sphaerocarpos												
michelii Bell				X		X	X		X		X	X
texanus Aust.				X		X	X	X	X	X	X	X

Table 10-3. Musci (mosses) of Southeast Kansas.

	AL	BB	CK	CR	CQ	EK	GW	LB	MG	NO	WL	WO
Amblystegium												
varium (Hedw.) Lindb.		X						X		X		
serpens (Hedw.) Schimp. in B.S.G.				X						X		
Anomodon												
attenuatus (Hedw.) Hub.				X					X			
minor (Hedw.) Furnr.	X	X			X					X		X
rostratus (Hedw.) Schimp.	X	X		X	X					X	X	
Anomobryum												
filiforme (Dicks.) Solms in Rabenh.												X
Astomum												
muehlenbergianum (Sw.) Grout				X						X		
Atrichum												
angustatum (Brid.) Bruch & Schimp.	X	X	X	X	X	X	X	X	X	X	X	X
Aulacomnium												
heterostichum (Hedw.) Bruch & Schimp.				X	X					X	X	X
palustre (Hedw.) Schwaegr.			X									
Barbula												
indica (Hook.) Spreng. in Steud.					X					X		
unguiculata Hedw.	X	X	X						X	X		X
Bartramia												
pomiformis Hedw.			X		X							
Brachythecium												
acuminatum (Hedw.) Aust.	X	X	X							X	X	
oxycladon (Brid.) Jaeg.		X	X	X	X	X		X	X	X	X	
Bruchia												
texana Aust.												X
Bryhnia												
graminicolor (Brid.) Grout												X
Bryoandersonia												
illecebra (Hedw.) Robins.									X			
Bryohaplocladium												
microphyllum (Hedw.) Wat. & Iwats.				X						X		
virginianum (Brid.) Wat. & Iwats.								X				

Table 10-3. Musci (mosses) of Southeast Kansas.

	AL	BB	CK	CR	CQ	EK	GW	LB	MG	NO	WL	WO
Bryum												
argenteum Hedw.				X				X	X	X	X	X
caespiticium Hedw.				X		X				X		
capillare Hedw.												X
lisae De Not. var. cuspidatum (Bruch & Schimp in B.S.G.) Marg.									X			X
pseudotriquetrum (Hedw.) Gaertn. et al.			X	X					X	X	X	X
Campylium												
chrysophyllum (Brid.) J. Lange					X	X	X	X	X	X	X	X
hispidulum (Brid.) Mitt.			X	X	X		X			X	X	
Ceratodon												
purpureus (Hedw.) Brid.				X	X		X					X
Climacium												
americanum Brid.					X	X	X					X
Desmatodon												
obtusifolius (Schwaegr.) Schimp.	X	X			X	X	X		X	X	X	X
plinthobium Sull. & Lesq. in Sull.				X						X	X	
porteri James in Aust.						X	X			X		
Dicranella												
heteromalla (Hedw.) Schimp.				X	X	X	X		X		X	X
varia (Hedw.) Schimp.	X	X	X						X			
Dicranum												
condensatum Hedw.												X
scoparium Hedw.			X		X	X	X	X				
Diphyscium												
foliosum (Hedw.) Mohr												X
Ditrichum												
pallidum (Hedw.) Hampe			X	X	X	X	X	X	X	X	X	X
Drummondia												
prorepens (Hedw.) Britt.		X	X			X						X
Entodon												
cladorrhizans (Hedw.) C. Mull.										X		
compressus (Hedw.) C. Mull.										X		
seductrix (Hedw.) C. Mull.	X	X	X	X	X	X	X	X	X	X	X	X
Eucladium												
virticillatum (Brid.) Bruch & Schimp			X									

Table 10-3. Musci (mosses) of Southeast Kansas.

	AL	BB	CK	CR	CQ	EK	GW	LB	MG	NO	WL	WO
Eurhynchium												
hians (Hedw.) Sande Lac.			X						X	X		X
pulchellum (Hedw.) Jenn.									X			
Fabronia												
ciliaris (Brid.) Brid.				X	X			X		X	X	
Fissidens												
bryoides Hedw.			X	X						X	X	X
dubius P. Beauv.			X	X	X	X	X					
fontanus (B. Ply.) Steud.			X	X						X	X	X
microcladus Thwaites & Mitt in Mitt.												X
obtusifolius Wils.									X	X		X
subbasilaris Hedw.											X	
taxifolius Hedw.			X	X		X			X	X	X	
Fontinalis												
missourica Card.			X	X	X					X		
Funaria												
americana Lindb. in Sull.				X								
flavicans Michx.				X	X	X	X		X		X	X
hygrometrica Hedw.		X	X	X				X		X		X
Grimmia												
laevigata (Brid.) Brid.					X	X	X		X		X	X
pulvinata (Hedw.) Sm.	X							X	X		X	X
Hedwigia												
ciliata (Hedw.) P. Beauv.	X				X	X	X		X		X	X
Homomallium												
adnatum (Hedw.) Broth.	X	X	X	X	X	X	X	X	X	X	X	X
Hygroamblystegium												
tenax (Hedw.) Jenn.	X	X	X	X		X		X	X	X	X	
Hypnum												
curvifolium Hedw.												X
lindbergii Mitt.			X									
Leptodictyum												
humile (P. Beauv.) Ochyra										X		
riparium (Hedw.) Warnst.										X		
Leskea												
gracilescens Hedw.	X	X	X	X	X	X	X	X	X	X	X	X
Leucobryum												
albidum (Brid. ex P. Beauv.) Lindb.				X						X	X	
glaucum (Hedw.) Angstr. in Fries			X	X	X	X	X		X			X
Leucodon												
julaceus (Hedw.) Sull.	X	X	X	X	X	X	X	X	X	X	X	X
Lindbergia												
brachyptera (Mitt.) Kindb.									X	X		X

Table 10-3. Musci (mosses) of Southeast Kansas.

	AL	BB	CK	CR	CQ	EK	GW	LB	MG	NO	WL	WO
Orthotrichum												
diaphanum Brid.										X		
pumilum Sw.		X	X	X			X				X	
pusillum Mitt.	X		X	X	X	X	X	X	X	X	X	X
strangulatum P. Beauv.		X	X								X	
Phascum												
cuspidatum Hedw.										X		
Philonotis												
longiseta (Michx.) Britt.									X			X
marchica (Hedw.) Brid.			X	X	X							X
Physcomitrium												
pyriforme (Hedw.) Hampe			X	X	X			X	X	X	X	X
Plagiomnium												
ciliare (C. Mull.) T. Kop.							X			X	X	
cuspidatum (Hedw.) T. Kop.	X		X	X	X	X	X	X	X	X	X	X
Platygyrium												
repens (Brid.) Schimp. in B.S.G.		X	X					X				X
Pogonatum												
brachyphyllum (Michx.) P. Beauv.					X				X	X	X	X
Polytrichum												
commune Hedw.						X	X					X
juniperinum Hedw.			X		X	X	X			X	X	X
ohioense Ren. & Card.			X									
Ptychomitrium												
incurvum (Schwaegr.) Spruce					X	X	X		X	X	X	X
Pylaisiella												
selwynii (Kindb.) Crum et al.					X	X	X			X		X
Pyramidula												
tetragona (Brid.) Brid.									X			
Rhizomnium												
punctatum (Hedw.) T. Kop.										X	X	
Rhodobryum												
ontariense (Kindb.) Par. in Kindb.									X			
Schistidium												
agassizii Sull. & Lesq. in Sull.				X	X	X	X	X	X	X		X
Sematophyllum												
demissum (Wils.) Mitt.									X		X	X
Sphagnum												
capillifolium (Ehrh.) Hedw.												X
cuspidatum Ehrh. ex Hoffm.			X	X								
trinitense C. Mull.				X								

Table 10-3. Musci (mosses) of Southeast Kansas.

	AL	BB	CK	CR	CQ	EK	GW	LB	MG	NO	WL	WO
Steerecleus serrulatus (Hedw.) Robins.		X		X		X	X			X	X	
Taxiphyllum deplanatum (Bruch & Schimp.) Fleisch.		X	X	X				X				
Taxiphyllum taxirameum (Mitt.) Fleisch.		X	X	X				X		X		
Thelia asprella Sull. in Sull. & Lesq.		X	X									
Thelia hirtella (Hedw.) Sull. in Sull. & Lesq.	X								X			
Thelia lescurii Sull. in Sull. & Lesq.					X	X	X		X	X	X	X
Thuidium delicatulum (Hedw.) Schimp. in B.S.G.			X		X	X	X					X
Thuidium recognitum (Hedw.) Lindb.			X	X								
Tortella humilis (Hedw.) Jenn.			X		X	X	X			X		X
Tortula pagorum (Milde) De Not.				X	X		X			X		X
Weissia controversa Hedw.		X	X	X	X	X	X		X	X	X	X

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Chapter 11

HERPETOFAUNA OF SOUTHEAST KANSAS

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Of the 90 species of herps listed by Joseph T. Collins in his 1981 edition of Amphibians and Reptiles in Kansas, only 15 species are not found in the 9 county area of extreme Southeastern Kansas. although only one reptile (cottonmouth) is restricted to the area, six species of Amphibians are found only in Cherokee and Crawford counties. These species result from the unique contribution of the Ozark Plateau which extends into the very southeast tip of the state. The great diversity of habitat, prairies, woods, bluffs and hills, provides ample explanation for the large herpetofauna in the region.

Table 11-1. List of amphibians of southeast Kansas. (E = endangered species, T = threatened species)

AMBYSTOMATIDAE - Mole Salamanders

Ambystoma texanum - Smallmouth Salamander
A. tigrinum - Tiger Salamander

SALAMANDRIDAE - Newts

Notophthalmus viridescens - Central Newt (T)

PLETHODONTIDAE - Lungless Salamanders

Eurycea longicauda melanopleura - Dark-sided Salamander (T)
E. lucifuga - Cave Salamander (E)
E. multipicata griseogaster - Graybelly Salamander (E)
Typhlotriton spelaeus - Grotto Salamander (E)

PROTEIDAE - Mudpuppies

Necturus maculosus - Mudpuppy

BUFONIDAE - Toads

Bufo americanus - American Toad
B. woodhousei - Woodhouse's Toad

HYLIDAE - Treefrogs

Acris crepitans blanchardi - Blanchard's Cricket Frog
Pseudacris clarki - Spotted Chorus Frog
P. triseriata triseriata - Western Chorus Frog
Hyla chrysoscelis - Hyla versicolor - Gray Treefrog Complex
H. crucifer crucifer - Northern Spring Peeper (T)

RANIDAE - Aquatic Frogs

Rana areolata circulosa - Northern Crayfish Frog
R. blairi - Plains Leopard Frog
R. catesbeiana - Bullfrog
R. clamitans melanota - Green Frog (T)
R. palustris - Pickerel Frog
R. utricularia utricularia - Southern Leopard Frog

MICROHYLIDAE - Microhylid Frogs

Gastrophryne carolinensis - Eastern Narrowmouth Toad (T)
G. olivacea - Plains Narrowmouth Toad

Table 11-2. List of reptiles of southeast Kansas. (E = endangered species, T - threatened species)

CHELYDRIDAE - Snapping Turtles

Chelydra serpentina serpentina - Common Snapping Turtle

KINOSTERNIDAE - Musk Turtles

Sternotherus odoratus - Stinkpot
Kinosternon flavescens flavescens - Yellow Mud Turtle

EMYDIDAE - Emydid Turtles

Terrapene carolina triungus - Three-toed Box Turtle
T. ornata ornata - Ornate Box Turtle
Graptemys geographica - Map Turtle (T)
G. kohni - Mississippi Map Turtle
G. pseudogeographica ouachitensis - Ouachita Map Turtle
Chrysemys floridana hoyi - Missouri Cooter
C. picta belli - Western Painted Turtle
C. scripta elegans - Red-eared Slider

TRIONYCHIDAE - Softshell Turtles

Trionyx muticus muticus - Midland Smooth Softshell
T. spiniferus hartwegi - Western Spring Softshell

IGUANIDAE - American Arboreal Lizards

Holbrookia maculata - Lesser Earless Lizard
Crotaphytus collaris collaris - Eastern Collared Lizard
Sceloporus undulatus - Eastern Fence Lizard
Phrynosoma cornutum - Texas Horned Lizard

SCINCIDAE - Skinks

Scincella lateralis - Ground Skink
Eumeces anthracinus pluvialis - Southern Coal Skink
E. faciatus - Five-lined Skink
E. laticeps - Broadhead Skink (T)
E. obsoletus - Great Plains Skink
E. septentrionalis - Prairie Skink

TEIIDAE - Racerunners

Cnemidophorus sexlineatus virdis - Prairielined Racerunner

ANGUIDAE - Anquid Lizards

Ophisaurus attenuatus attenuatus - Western Slender Glass Lizard

Table 11-2. List of reptiles of southeast Kansas - continued.
(E = endangered species, T = threatened species)

COLUBRIDAE - Typical Harmless Snakes

Heterodon platyrhinos - Eastern Hognose Snake
Carphophis amoenus vermis - Western Worm Snake
Diadophis punctatus arnyi - Prairie Ringneck Snake
Tantilla gracilis - Flathead Snake
Opheodrys aestivus - Rough Green Snake
Coluber constrictor flaviventris - Eastern Yellowbelly Racer
Masticophis flagellum - Coachwhip
Elaphe guttata emoryi - Great Plains Rat Snake
E. obsoleta obsoleta - Black Rat Snake
Arizona elegans elegans - Kansas Glossy Snake
Pituophis melanoleucus - Bullsnake
Lampropeltis calligaster calligaster - Prairie Kingsnake
L. getulus - Common Kingsnake
L. triangulum - Milk Snake
Sonora semiannulata - Ground Snake
Thamnophis proximus - Western Ribbon Snake
T. sirtalis parietalis - Red-sided Garter Snake
Tropidoclonion lineatum - Lined Snake
Virginia striatulata - Rough Earth Snake
Storeria dekayi texana - Texas Brown Snake
S. occipitomaculata occipitomaculata - Northern Redbelly (T)
Regina grahami - Graham's Crayfish Snake
Nerodia erythrogaster transversa - Blotched Water Snake
N. rhombifera rhombifera - Diamondback Water Snake
N. sipedon - Northern Water Snake

VIPERIDAE - Pit-vipers

Agkistrodon contortrix - Copperhead
A. piscivorus leucostoma - Western Cottonmouth
Sisturus catenatus - Massasauga
Crotalus horridus - Timber Rattlesnake

Chapter 12

FISHES OF SOUTHEAST KANSAS

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The nine counties comprising southeast Kansas drain into three fairly distinct river systems. Two of these, the Verdigris and the Neosho, are fairly similar in their ichthyofauna in that they both are tributaries of the Arkansas River system (Table 12-1). In contrast, the Marias Des Cygnes basin is a tributary of the Osage system which flows into the Missouri River in central Missouri. One would expect the wide separation of the mouths of the first two from the latter system would lead to greater divergences in their faunas and this is true in some respects. On the other hand, the Neosho system with its great diversity of habitat, draining the plains as well as the Ozarks, is clearly the most diverse in fauna as well.

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Table 12-1. Fish fauna of southeast Kansas. (V = Verdigris, N = Neosho, M = Marais des Cygnes; T = Threatened species)

FAMILY - Common Name
Genus species - Common Name

TAXA	V	N	M
PETROMYZONTIDAE - Lampreys			
Ichthyomyzon castaneus - Chestnut lamprey		X	
POLYODONTIDAE - Paddlefishes			
Polyodon spathula - Paddlefish		X	
LEPISOSTEIDAE - Gars			
Lepisosteous platostomus - Short-nosed Gar		X	X
L. oculatus - Spotted Gar		X	
L. osseus - Long-nosed Gar	X	X	X
ANGUILLIDAE - Eels			
Anguilla rostrata - American Eel	X	X	
CLUPEIDAE - Shads			
Dorosoma cepedianum - Gizzard Shad	X	X	X
HIODONTIDAE - Mooneyes			
Hiodon alosoides - Goldeye			X
SALMONIDAE - Trouts			
Salmo gairdneri - Rainbow Trout		X	
ESOCIDAE - Pikes			
Esox lucius - Northern Pike	X	X	X
CYPRINIDAE - Minnows			
Cyprinus carpio - Carp	X	X	X
Carassius auratus - Goldfish		X	
Notemigonus crysoleucas - Golden Shiner	X	X	X
Semotilus atromaculatus - Creek Chub		X	X
Phoxinus erythrogaster - Southern Redbelly Dace		X	
Nocomis asper - Redspot Chub (T)		X	
N. biguttatus - Hornyhead Chub (T)			X
Erimystax x-punctatus - Gravel Chub		X	
Phenocobius mirabilis - Suckermouth Minnow	X	X	
Notropis rubellus - Rosyface Shiner	X	X	X
N. cardinalis - Cardinal Shiner		X	
N. boops - Bigeye Shiner		X	
N. volucellus - Mimic Shiner	X	X	
N. buchanani - Ghost Shiner	X	X	X
N. stramineus - Sand Shiner		X	X
N. nubilus - Ozark Minnow		X	
Lythrurus umbratilis - Redfin Shiner	X	X	X
Luxilus cardinalis - Cardinal Shiner		X	

Table 12-1. Fish fauna of southeast Kansas - continued. (V = Verdigris, N = Neosho, M = Marais des Cygnes)

TAXA	V	N	M
Cyprinella camura - Bluntface Shiner	X	X	
C. lutrensis - Red Shiner	X	X	X
C. spiloptera - Spotfin Shiner		X	
Pimephales promelas - Fathead Minnow	X	X	X
P. vigilax - Bullhead Minnow	X	X	
P. tenellus - Slim Minnow	X	X	
P. notatus - Bluntnose Minnow	X	X	X
Campostoma anomalum - Stoneroller	X	X	X
CATOSTOMIDAE - Suckers			
Cycleptus elongatus - Blue Sucker		X	
Ictiobus bubalus - Smallmouth Buffalo	X	X	X
I. niger - Black Buffalo	X	X	X
I. cyprinellus - Bigmouth Buffalo	X	X	X
Carpiodes carpio - River Carpsucker	X	X	X
Minytrema melanops - Spotted Sucker	X	X	X
Moxostoma carinatum - River Redhorse	X	X	
M. macrolepidotum - Shorthead Redhorse	X	X	X
M. duquesnei - Black Redhorse		X	
M. erythrurum - Golden Redhorse	X	X	X
Hypentelium nigricans - Northern Hogsucker		X	
Catostomus commersoni - White Sucker			X
ICTALURIDAE - Catfishes			
Ictalurus natalis - Yellow Bullhead	X	X	X
I. melas - Black Bullhead	X	X	X
I. nebulosus - Brown Bullhead			X
I. punctatus - Channel Catfish	X	X	X
Pylodictus olivaris - Flathead	X	X	X
Noturus exilis - Slender Madtom		X	X
N. nocturnus - Freckled Madtom	X	X	X
N. miurus - Brindled Madtom	X	X	
N. placidus - Neosho Madtom		X	
N. flavus - Stonecat	X	X	X
N. gyrinus - Tadpole Madtom			X
CYPRINODONTIDAE - Topminnows			
Fundulus notatus - Blackstripe Topminnow	X	X	X
F. catenatus - Northern Studfish		X	X
POECILIIDAE - Livebears			
Gambusia affinis - Mosquitofish	X	X	
ATHERINIDAE - Silversides			
Labidesthes sicculus - Brook Silversides	X	X	X
COTTIDAE - Sculpins			
Cottus carolinae - Banded Sculpin		X	

Table 12-1. Fish fauna of southeast Kansas - continued. (V = Verdigris, N = Neosho, M = Marais des Cygnes)

TAXA	V	N	M
PERCICHTHYIDAE - Temperate Basses			
Morone chrysops - White Bass	X	X	
CENTRARCHIDAE - Sunfishes			
Micropterus punctulatus - Spotted Bass	X	X	
M. salmoides - Largemouth Bass	X	X	X
M. dolomieu - Smallmouth Bass		X	X
Lepomis gulosus - Warmouth	X	X	X
L. cyanellus - Green Sunfish	X	X	X
L. microlophus - Redear		X	
L. macrochirus - Bluegill	X	X	X
L. humilis - Orangespotted Sunfish	X	X	X
L. megalotis - Longear	X	X	X
Ambloplites rupestris - Rock Bass		X	
Pomoxis annularis - White Crappie	X	X	X
P. nigromaculatus - Black Crappie	X	X	X
PERCIDAE - Perches			
Stizostedion vitreum - Walleye	X	X	X
Percina phoxocephala - Slenderhead Darter	X	X	X
P. caprodes - Logperch	X	X	X
P. shumardi - River Darter		X	
P. copelandi - Channel Darter	X	X	
Etheostoma nigrum - Johnny Darter		X	X
E. chlorosomum - Bluntnose Darter		X	
E. stigmaeum - Speckled Darter		X	
E. zonale - Banded Darter		X	
E. blennioides - Greenside Darter		X	X
E. whipplei - Redfin Darter	X	X	
E. punctulatum - Stippled Darter		X	
E. cragini - Arkansas Darter		X	
E. spectabile - Orangethroat Darter	X	X	X
E. gracile - Slough Darter	X	X	
E. flabellare - Fantail Darter	X	X	
SCIAENIDAE - Drums			
Aplodinotus grunniens - Freshwater Drum	X	X	X
TOTAL (94 Species)	55	89	53

Chapter 13

BIRDS OF SOUTHEAST KANSAS

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An aerial photograph of southeast Kansas shows a rather diverse patchiness of physiographic features. Avian diversity reflects this physiographic diversity. Still, the majority of the countryside is farm and rangeland, so the abundance of species favoring these habitats is high. Red-winged blackbirds, European starlings, eastern meadowlarks, horned larks, and in summer, dickcissels perennially top the list of most abundant species. The woody and brushy vegetation that intersperses the agricultural land is reflected by the fact that on an average Audubon Christmas Bird Count there are about two-thirds as many cardinals reported as eastern meadowlarks. (Two CBCs and two breeding bird surveys for the U. S. Fish and Wildlife Service are conducted annually in the area).

As in the rest of Kansas, bird diversity in the southeast corner is seasonal. Most warblers are transitory. Common yellowthroats do nest in the area as do prothonotaries. Last spring on a survey for the Breeding Bird Atlas in Montgomery County, black and white warblers, painted buntings, yellow-breasted chats, and Swainson's warblers were noted. Parulas are heard commonly in spring migration. Yellow-rumped warblers are seen often in winter.

The strip mining legacy of Crawford and Cherokee Counties initially may be deceiving in regards to quality wildlife habitat. From the air, the miles of rough, corduroy landscape covered by cottonwoods, pin oaks, hackberry, ash, gray dogwood, Japanese honeysuckle, and brambles, and interlaced with hundreds of long, narrow strip pit lakes may look like a wildlife mecca, and indeed it probably <u>is</u> compared to agricultural monoculture. Much of its value, however, may lie not so much in its nutritional attributes, but in the cover and edge it provides to agricultural land. The steep banks of the "pits" keep emergent vegetation suitable for waterfowl to a minimum, and the poor "soil" of the mine dumps no doubt keeps the quality of mast production rather low. A winter birding venture through the heart of old strip mined area is sometimes disappointing. Sometimes one finds a few mallards, shovellers, pied-billed grebes, and great blue herons in the pits, but never in abundance. A longer birding "list" is usually

obtained by keeping to the roads that divide an old mining area and a farm than by following a road dissecting a large tract of mined land.

Old coal mined land possibly holds promise for two species - Canadian geese and wood ducks. A successful captive goose breeding program at the Mined Land Wildlife Area southwest of Pittsburg and goose stocking efforts over the last seven or eight years have seen the abundance of this handsome species rise dramatically in this area. The relative isolation of the pits is attractive to nesting geese. The relative absence in mined areas of large trees with cavities may be a limiting factor for area wood ducks. As the trees age and/or as wood duck boxes are established, the abundance of these birds may increase.

In low-lying areas where mined lands, riparian woodlands, and small croplands and pastures intermix, the wild turkey population has taken off. Fifteen years ago, the sight of a turkey in southeast Kansas was worthy of considerable conversation, but restocking of the eastern race since that time has been a real success story. Currently, it would be a bit surprising to fail to see turkeys on a trip through lowland farmland in late fall.

The streams and rivers of the area and, of course, the marshes in the wildlife properties seem to be generally more attractive to birds than are the strip pits. (The lead and zinc mines of the Galena area hold few birds except an occasional rock dove.) Kingfishers are common as are several woodpeckers. Wood ducks nest along the streams. In the Riverton area of Cherokee County where Shoal Creek enters Spring River, many aquatic species including good numbers of white pelicans, double-crested cormorants, Bonapart's gulls, ring-billed gulls, and a rich diversity of waterfowl are seen in October and November. The Neosho Wildlife Area near St. Paul, the Neosho State Fishing Lake near Parsons, Elm Creek Lake at the Hollister Wildlife Area, and Fort Scott Lake, both near Fort Scott, Lake Parsons and Big Hill Army Corps of Engineers Reservoir near Parsons, and Farlington State Lake north of Parsons are some of the other areas where migratory waterfowl and associated species can be seen.

An exciting addition to protected wildlife habitat has come to pass in Linn County. The Marais des Cygnes State Wildlife Area, about sixty miles north of Pittsburg, annually attracts thousands of ducks and geese to its marshes. Adjacent to the state area is the newly acquired 6,000 acre Marais des Cygnes National Wildlife Refuge. The combined 13,000 acre area includes a 14-mile stretch of the Marais des Cygnes River.

Hunters in these areas take mostly mallards, but green-winged teal and wood ducks are also taken in some numbers, as are occasionally lesser scaup, gadwall, wigeon, shovellers, and others. Blue-winged teal are plentiful, but their early migration precludes their being

taken in large numbers here. Large flocks of snow geese and growing numbers Canadas pass through in migration. Migratory shorebirds are of irregular abundance in some of these areas depending on water levels. Bald eagles and ospreys are frequently spotted in late fall.

Southeast Kansas is noted for its good bobwhite quail hunting. Prairie chicken populations are found in scattered locations in the area - Hollister Wildlife Area, for example - although not in the numbers present further west. Mourning doves are abundant. Woodcocks are taken infrequently. No populations of ring-necked pheasants occur here, although individuals - probably escapees - are seen periodically. Ruffed grouse were released in the Mined Land Wildlife Area in Cherokee County in 1987, and are still seen periodically.

Some species that tend to be seen more often in the southeast part of the state than in others include the rufous-sided towhee, scarlet and summer tanagers and scissor-tailed flycatcher. Our chickadee is the Carolina rather than the black-capped. Bluebirds are quite abundant. On summer nights, one may sometimes hear the calls of three nightjars at the same time: whip-poor-wills, chuck-will's widows, and nighthawks. Yellow-headed blackbirds and western meadowlarks are rare, and while there seems to be adequate habitat for wood thrushes, none have been reported for some time. House finches started appearing at feeders in Parsons and Pittsburg last spring. Fish crows were first reported nesting in 1991, along the Spring River north of Galena.

Hawks are seen perching in great abundance along roadsides in late fall and winter. A drive from Pittsburg to Joplin or Kansas City often yields three or four red-tailed hawks per mile, sometimes more.

On a final note, in 1990, Governor Mike Hayden travelled to Parsons to designate the city the "Purple Martin Capital of Kansas." To date, Bill Brewer has garnered sponsorship of fifty martin houses (at about $125 per) which he has erected along the main thoroughfares of town, all of which host nesting martins. Fledglings are banded annually.

Chapter 14

MAMMALS OF SOUTHEAST KANSAS

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Probably the most notable mammal species in southeast Kansas is the federally endangered gray myotis, a nursery colony of which occurs in the storm sewer at Pittsburg. The population there fluctuates, but averages about 3,000 individuals. Evidently the temperature, humidity, and texture of the roof in the old sewer are sufficient for the specific requirements of this bat. It emerges at dusk to forage for insects along the riparian corridors of Cow Creek and its tributaries. A few have been found over strip pit lakes. The colony will begin to thin out after the first frosts of October, moving to hibernating caves in Missouri. They will return in mid to late March. A study is currently underway to develop a method to assess their numbers accurately without being intrusive.

Big brown bats are frequently found in attics throughout the area. A few eastern pipistrelles have been taken. Although it seems likely that the federally endangered Indiana bat occurs here, it has not yet been taken. Efforts by the U.S. Fish and Wildlife Service to determine its presence in Kansas may be forthcoming this summer.

Red bats are found in the spring after thunderstorms have knocked them out of the trees. Usually they are females with young attached, which makes them too heavy to fly from the ground. Two red bats have tested positive for rabies, one in June, 1988, and one in August, 1992. Two others have tested negative.

The abundance of armadillos seems to be on the rise. More and more of these "Texas speed bumps" are being seen on the roads as compared to seven or eight years ago. A prolonged cold winter may reduce their numbers in Kansas. The extent of competition with Virginia opossums - if any - is not known, but it seems that in many areas one finds both dead on the road, but seldom in equal abundance.

People mentioned seeing black-tailed jackrabbits in southeast Kansas twenty or thirty years ago, but none have been reported in many years. Swamp rabbits have been reported from a marshy area around the confluence of Shoal Creek and Spring River in the Riverton area of Cherokee County. It seems possible some may occur

at the Neosho Wildlife Area near St. Paul.

Chipmunks were released at the Big Hill Army Corps of Engineer Reservoir near Cherryvale about five years ago in an attempt to re-establish them there, but none have been seen in recent years. Fox squirrels are by far the most common tree squirrel in this part of the state, but local populations of gray and flying squirrels do occur.

The soil is too tight for pocket gophers here, but moles abound. Woodchucks are occasionally seen, but could not be said to be abundant. Badgers, though likewise not plentiful, are being reported with increasing regularity.

Beavers have grown in abundance in southeast Kansas to the point of being a nuisance. Whether a decline in trapping pressure or other population regulation agents are at work (or rather not at work) is open to question, but beaver activity in this area has increased dramatically in recent years. Many trees, large and small and of several species, are being cut along streams and lakes. (Many strip pit lakes are devoid of large trees for forty or fifty feet up their steep banks). In given areas, milo and even giant ragweed patches the size of a single-car garage are cut. Only sycamores, Osage orange, and honey locust trees seem to be immune to these interesting, but destructive mammals.

Coyotes, red and gray foxes, and bobcats are fairly common. Three years ago, a new city ordinance in Pittsburg prohibited the keeping of black bears in the city limits. Consequently, one or more bears were released into the countryside and were seen periodically for a year or so. To my knowledge, none have been seen in the area in 1992.

Although not confirmed by track or photograph, it seems possible that cougars occasionally pass through southeast Kansas. Too many knowledgeable people have reported seeing them to discount their presence entirely. Certainly there are plenty of white-tailed deer for a prey base.

Considerable evidence (tracks and slides) for the existence of river otters in the bone Creek area of northern Crawford County has recently been found. Striped skunks are numerous, but the once common spotted skunk has not been seen in southeast Kansas for many years.

White-tailed deer are quite abundant, and are the source of some complaint from soybean farmers (although one observer noted how deer depredation of soybeans along hedge rows seems to decline after the use of a root plow). The writer plants several hundred tree seedlings yearly, most of which eventually suffer deer damage. Highway collisions with deer, of course, continues to pose a threat to motorists at night. Four years ago, Dr. Ralph Kelting,

Professor Emeritus of Botany, was driving to Pittsburg with his wife and struck two deer simultaneously - a buck and a doe that was pregnant with two fawns. The car was damaged extensively and the Keltings escaped serious injury only by virtue of having worn safety harnesses.

Southeast Kansas is blessed with a relatively diverse landscape. Our physiographic diversity continues to host an interesting and, to some extent, a changing community of mammals.

Chapter 15

WATER IN SOUTHEAST KANSAS

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Introduction

In Kansas, water is considered to be most limiting in the western part of the state. But, in spite of southeast Kansas's 36-40 inches of rainfall per year, the area is drought-prone and flood-prone because of clay-packed soils and lack of substantial alluvial aquifers or other shallow ground-water resources.

Surface Water

The streams and rivers of southeast Kansas (Fig. 15-1, Table 15.1) are found in portions of three major river basins: the Verdigris, Neosho, and Marais des Cygnes. The major river in southeast Kansas is certainly the Neosho River. Dividing the area diagonally from north to south, the Neosho is home to fewer species of mussels than once existed and the now federally-listed Neosho madtom. Reservoirs, diversion dams, and other uses have modified this river and several wastewater outfalls create unknown problems for its fauna.

The tributaries of the Neosho River are less well studied than the parent river, which has receive far less attention than its importance would dictate. These tributaries may be important refuges for fauna from the main river. Owl, Rock, Canville, Flatrock, Walnut, Lightning, and Labette are in smaller watersheds with fewer impacts than the main river. The loss and degradation of habitat continues to be a problem throughout the area.

The Verdigris River to the west and its two main tributaries - the Elk River and Fall River - drain the Flint Hills, Cherokee Lowlands, and Chautauqua Hills physiographic regions. Water quality in these rivers is probably better than in the Neosho due to more favorable land uses and smaller population size.

The Spring River system, in the extreme southeast, is probably the most impacted system in southeast Kansas. Water quality impacts in Cow Creek, Brush Creek, Shawnee Creek, Willow Creek, Short Creek, and other Spring River tributaries result from abandoned mines, agriculture, and municipal wastewater discharges. Spring River tributaries from Missouri (Center Creek, Turkey Creek, Shoal

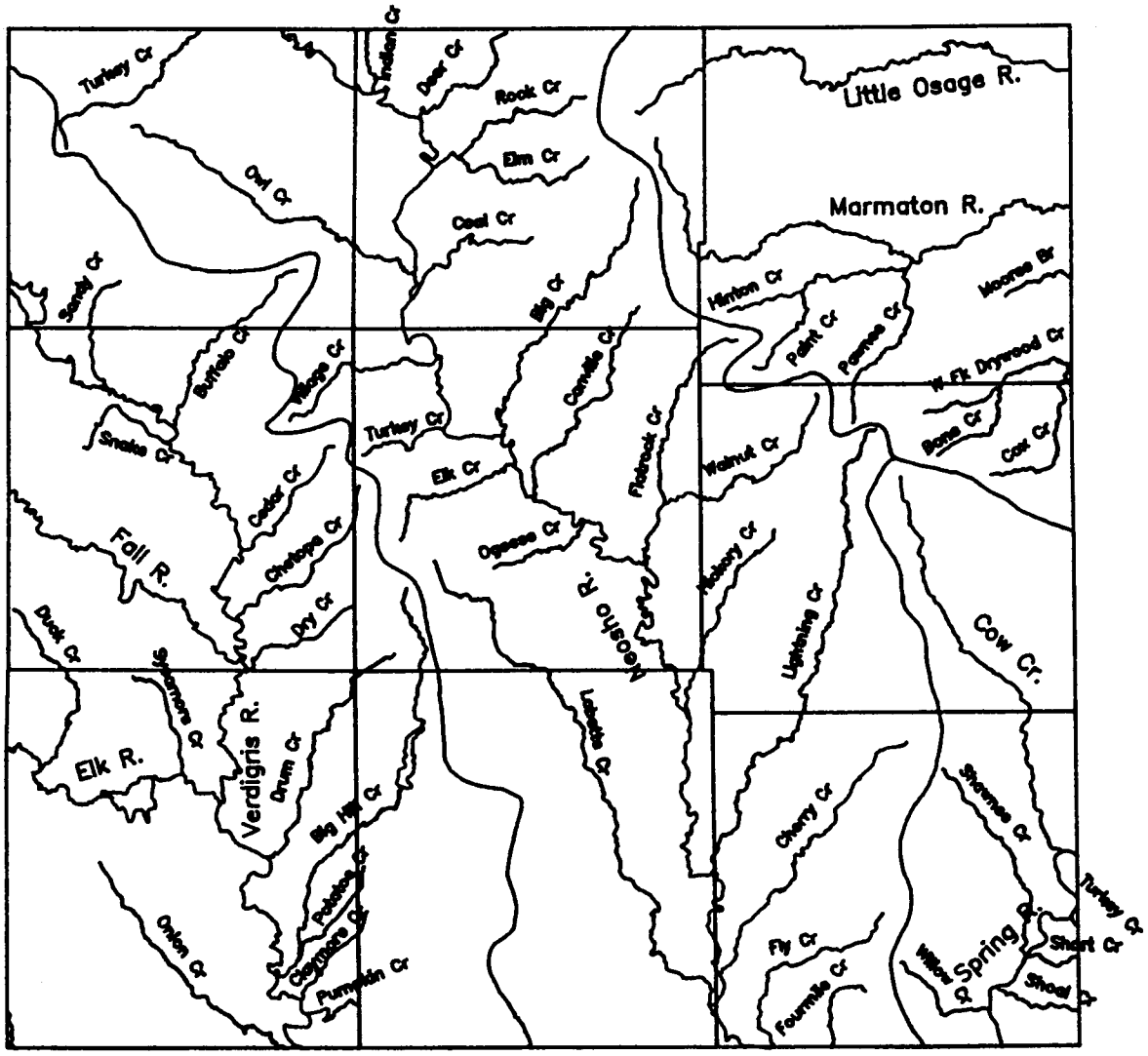

Fig. 15-1. Major rivers and streams of southeast Kansas.

Table 15-1. Principal rivers and streams of southeast Kansas.

River Basin	Waterbody
Verdigris	Verdigris R
	Sandy Cr
	Snake Cr
	Buffalo Cr
	Cedar Cr
	Chetopa Cr
	Fall R
	Dry Cr
	Elk R
	Sycamore Cr
	Duck Cr
	Drum Cr
	Big Hill Cr
	Potatoe Cr
	Claymore Cr
	Pumpkin Cr
	Onion Cr
	L. Caney Cr
Marais des Cygnes	Little Osage R
	Marmaton R
	Moores Br
	Pawnee Cr
	Paint Cr
	Hinton Cr
	W Fk Drywood
	Bone Cr
	Cox Cr
Neosho	Neosho R
	Indian Cr
	Deer Cr
	Rock Cr
	Elm Cr
	Coal Cr
	Owl Cr
	Village Cr
	Turkey Cr
	Big Cr
	Canville Cr
	Elk Cr
	Ogeese Cr
	Flatrock Cr
	Walnut Cr
	Hickory Cr
	Lightning Cr
	herry Cr
	Labette Cr
	Fly Cr
	Fourmile Cr
Spring	Spring R
	Cow Cr
	Center Cr
	Turkey Cr
	Shawnee Cr
	Short Cr
	Shoal Cr
	Willow Cr

Creek) also contribute poor water quality due to wastewater and mine drainage from the Joplin-Webb City Area.

However, the lower Neosho is not without difficulties. In places, Cherry and Little Cherry Creeks consist of coal-fines and only the most acid-tolerant organisms survive.

Several of the area's rivers have been sampled as part of the Kansas Department of Health and Environment's (KDHE) Ambient Water Quality network. Both chemical and biological (macroinvertebrate) data are collected and special investigations are also conducted. The ambient monitoring data characterize long-term trends in water quality, but are less useful for more intensive watershed assessments needed for nonpoint source pollution control.

In order to begin to characterize water quality in smaller watersheds for NPS planning, 25 smaller watersheds in Crawford County were identified (Fig. 15-2, Table 15-2). Three samples were collected over a three month period from the furthest downstream bridge in 23 of these watersheds (the other 2 ran dry). These data are considered to integrate upstream water quality effects, understanding that this is a simplification. Still, this is probably the most intensive look at county-wide water quality in Kansas and serves to prioritize watersheds for further study and management purposes.

The results from two groups of three parameters each are presented: mineral water quality (pH, conductivity, and sulfates) and nutrient water quality (nitrate-N, total ammonia-N, and dissolved phosphorus). For summary purposes, the actual data were classified into one of three categories (good, moderate, or poor) and aggregated into separate overall mineral and nutrient ratings using the same categories.

The results show clear differences in water quality among the watersheds. Mineral water quality was poorest in two locations: the northeast corner in the Marais des Cygnes drainage and Brush Creek in the southeast (Fig. 15-3). These watersheds have been among the most heavily mined in the county and the stream water quality data reflect off-site impacts.

Nutrient water quality also varied across the county (Fig. 15-4). The poorest streams were in the Cow Creek drainage, where population density is greatest and where pasture conditions are not the best.

Overall, the western part of the county in the Verdigris and Neosho River basins contains the best water quality in terms of nutrients and minerals, while the Marais des Cygnes and Spring River basins in the east contain the poorest. This preliminary exercise demonstrates the utility of water quality testing on a more localized basis and suggests the value of more routine and

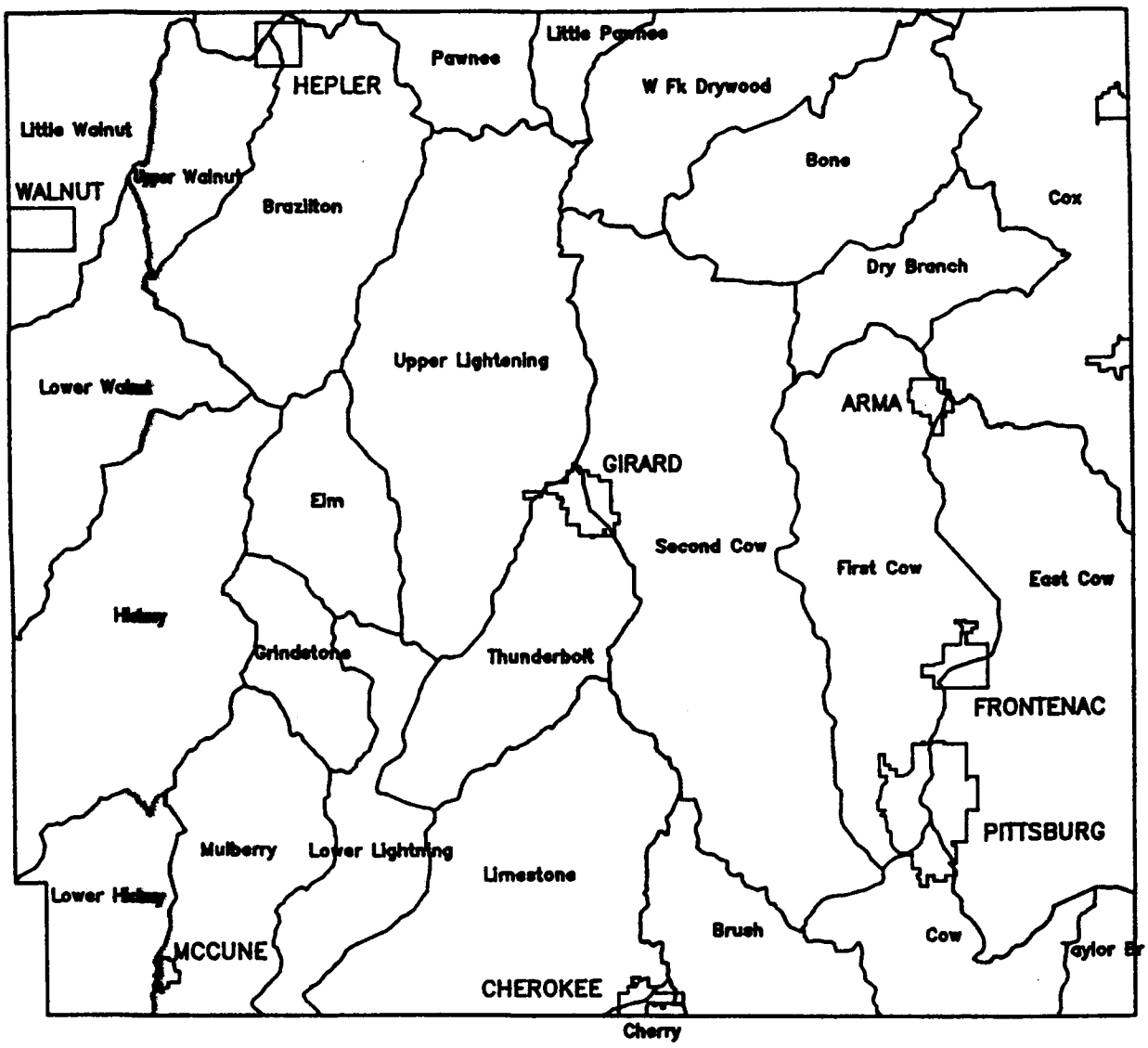

Fig. 15-2. Watersheds sampled in Crawford County.

Table 15-2. Watersheds sampled in Crawford County.

Watersheds	Subwatersheds
Cow	Brush Cr.
	Clear Cr.
	East Cow Cr.
	First Cow Cr.
	Second Cow Cr.
	Cow Cr.
	Taylor Branch
Lightening	Elm Cr.
	Grindstone Cr.
	Limestone Cr.
	Lightening Cr. (lower)
	Mulberry Cr.
	Thunderbolt Cr.
	Lightening Cr. (upper)
Drywood/Cox	Bone Cr.
	Cox Cr.
	Dry Branch
	West Fk Drywood Cr.
Hickory	Hickory Cr.
	South Hickory Cr.
Walnut	Little Walnut Cr.
	Brazilton
	Walnut Cr. (upper)
	Walnut Cr. (lower)
Pawnee	Pawnee Cr.

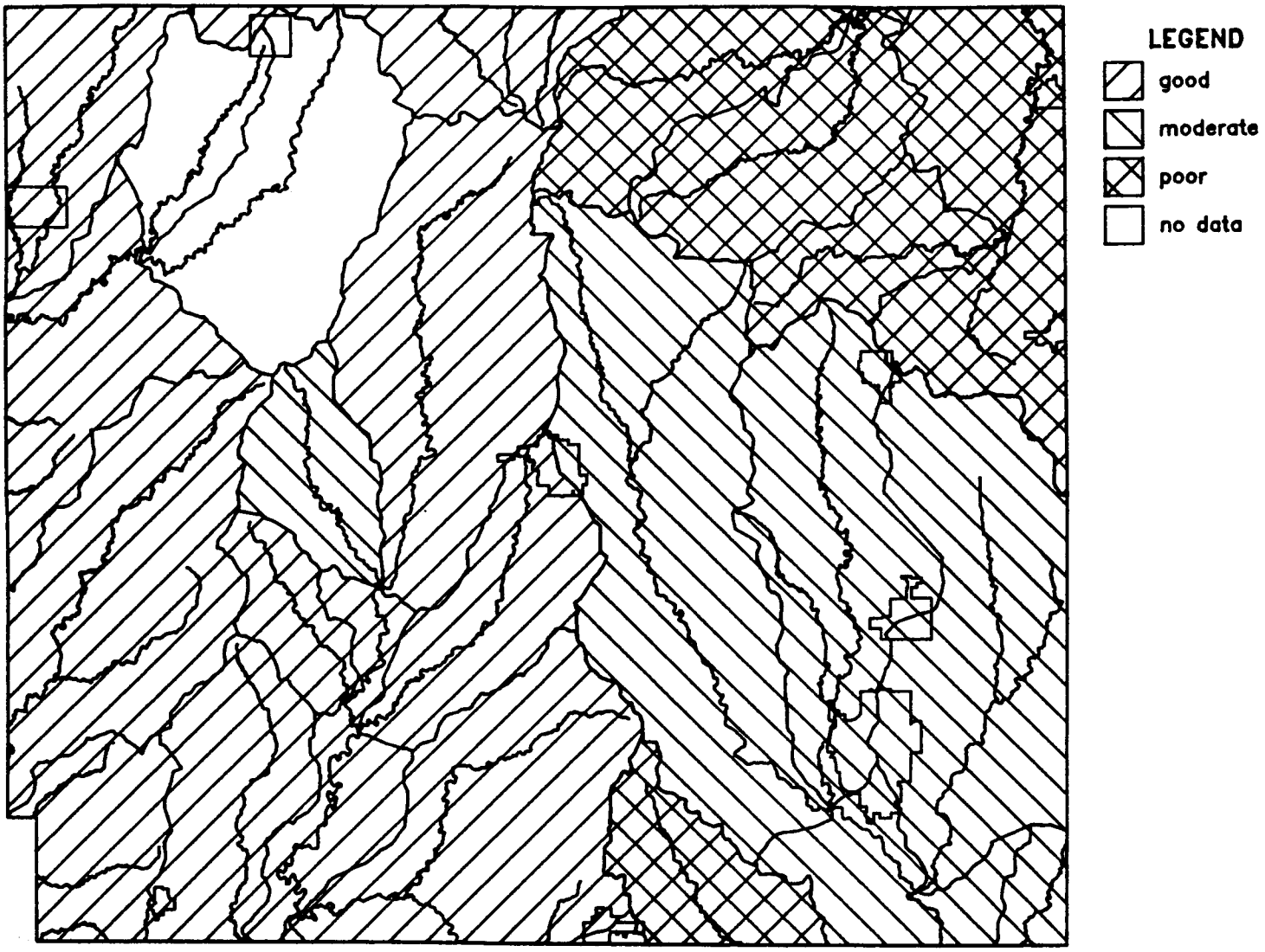

Fig. 15-3. Mineral water quality attributes of watersheds in Crawford County.

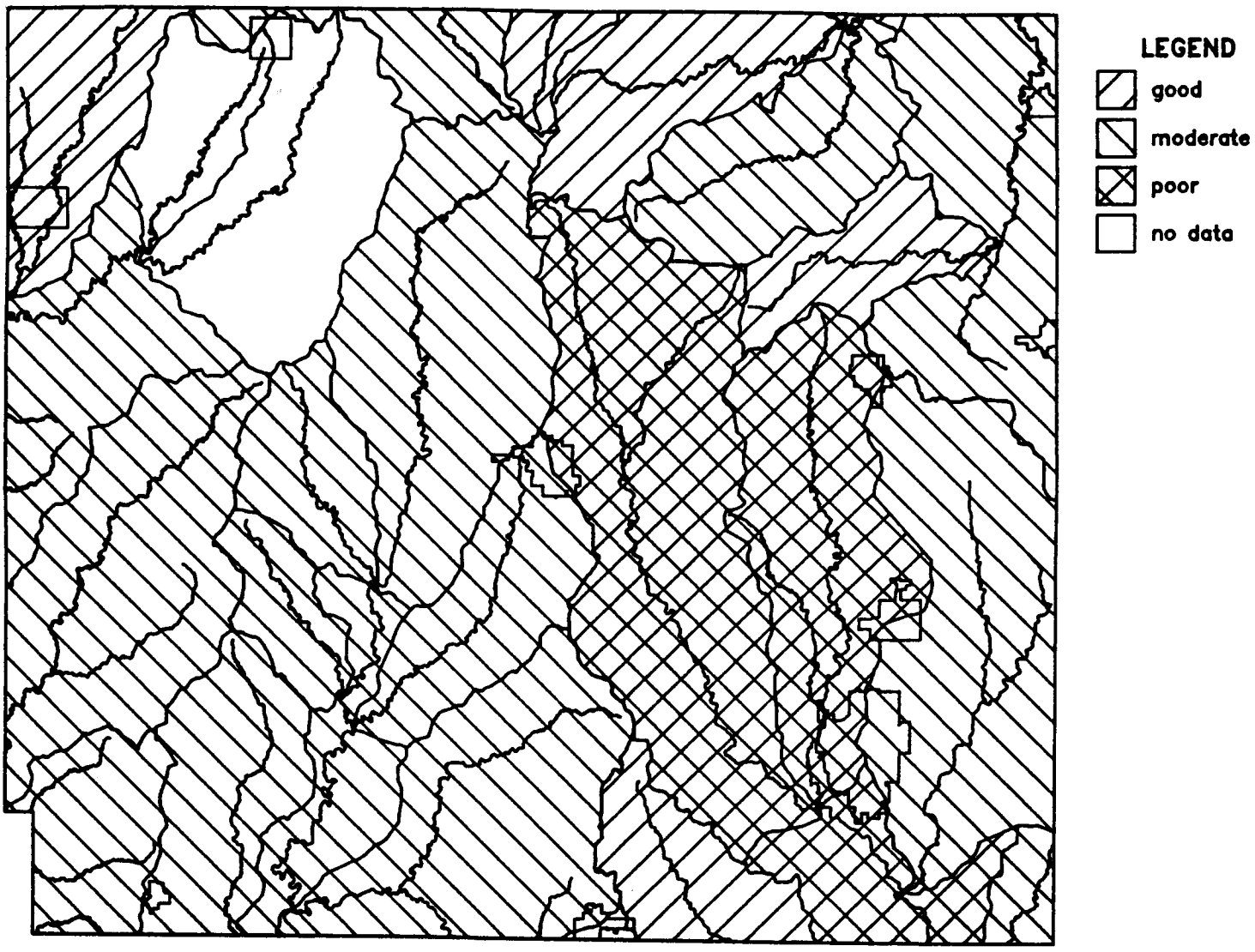

Fig. 15-4. Nutrient water quality attributes of watersheds in Crawford County.

intensive testing to allow the development of a data base for nonpoint source control planning.

Ground Water

Hansen (1991) states that alluvial aquifers and the Ozark Aquifer are two of the five principal aquifers in Kansas and the only ones in southeast Kansas (Fig. 15-5, Table 15-3). Alluvial aquifers are found along Cow Creek and other tributaries of the Spring River in Crawford and Cherokee counties, the Neosho River and some tributaries in Woodson, Allen, Neosho, Labette, and Cherokee counties, and the Verdigris River and tributaries in Woodson, Wilson, and Montgomery counties.

The Ozark Aquifer occurs in extreme southern Bourbon and Crawford and Cherokee counties (Hansen 1991, Fig. 15-5). The aquifer consists of weathered and sandy dolomite and limestone (Ordovician and Cambrian age) and the Arbuckle Group (Hansen 1991). The aquifer is confined in Kansas and western Missouri in the Springfield Plateau area, but is unconfined to the east in its recharge zone.

The Ozark typically yields 30-150 gallons per minute, but may exceed 1,000 gallons per minute (Hansen 1991). The greatest yields of the Ozark are found in both Crawford and Cherokee counties and the southern and southeast border of Bourbon County (Hansen 1992).

The quality of the water from the aquifer allows reasonable treatment. Hansen (1991) reports that water from this aquifer will usually have < 500 mg/L dissolved solids, with occurrences of hydrogen sulfide gas, iron, or gross-alpha radioactivity.

Of the 590,000,000 acre-feet of fresh water (< 1,000 mg/L dissolved solids) storage, only 4.4% percent, or 26,100,00 acre-feet, is found in the Ozark Aquifer (Hansen 1991). Of the 3,990,000 acre-feet per year of potential natural recharge statewide, there is no direct natural recharge to the Ozark Aquifer in Kansas. Thus, in the absence of surface water sources for public water supply, the groundwater supplies on which we depend, are recharged in another legal jurisdiction (Missouri).

This precarious situation, combined with the contamination of existing wells, shallow aquifers and surface waters with acid-mine drainage, may result in greater pressures to develop new impoundments.

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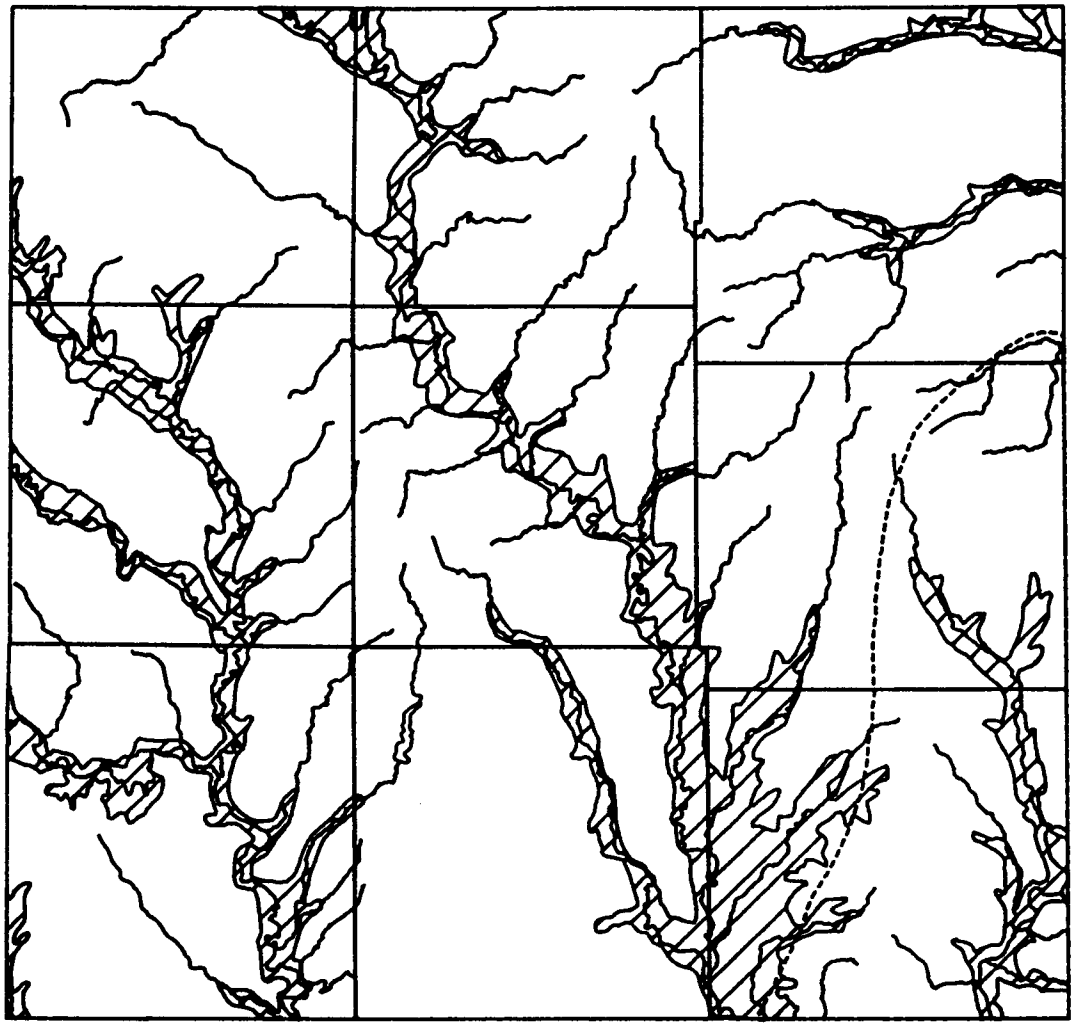

Fig. 15-4. Principal aquifers of southeast Kansas. Alluvial aquifers are hatched and the Ozark Aquifer is bordered by the dashed area in the extreme southeast.

Table 15-3. Estimated volume of freshwater storage and recharge (acre-feet) in principal aquifers in southeast Kansas (from Hansen 1991).

		Storage		Recharge	
County	Aquifer	Volume	Totals	Volume	Totals
Allen	alluvial	39,300	39,300	14,000	14,000
Bourbon	alluvial	26,800		15,600	
	Ozark	41,200	68,000	0	15,600
Cherokee	alluvial	172,000		74,400	
	Ozark	15,200,000	15,372,000	0	74,400
Crawford	alluvial	30,400		13,300	
	Ozark	8,220,000	8,250,400	0	13,300
Labette	alluvial	80,900	80,900	31,180	31,180
Montgomery	alluvial	100,000	100,000	31,700	31,700
Neosho	alluvial	91,400	91,400	33,600	33,600
Wilson	alluvial	90,800	90,800	30,500	30,500
Woodson	alluvial	25,400	25,400	8,300	8,300
Totals	alluvial	657,000		252,580	
	Ozark	23,420,000	24,077,000	0	252,580