

General Description

The [Neosho River basin](#) covers approximately 6,300 square miles and encompasses all or parts of 18 counties in southeastern and east central Kansas. The area is drained by the Neosho River and its tributaries which also drain parts of Missouri, Arkansas, and Oklahoma. The Neosho Basin includes [HUCs](#) 11070201 through 11070207 in Kansas.

The major streams in the basin are the Neosho River and two major tributaries: the Cottonwood River and the Spring River. The Neosho River rises in Morris County and flows southeast to join the Arkansas River near Muskogee, Oklahoma. The Cottonwood River rises in Marion County and joins the Neosho River in Lyon County east of Emporia. The Spring River in the southeast part of the state originates in Missouri and drains about 500 square miles in Kansas. It enters Cherokee County in the east, flows across the southeastern corner of that county,

and joins the Neosho River in Oklahoma a short distance below the Kansas state line.

The larger tributaries of the Cottonwood River are South Cottonwood River, Mud Creek, Clear Creek, Doyle Creek, Cedar Creek, Middle Creek, Diamond Creek, and South Fork Cottonwood River. Tributaries to the Neosho with drainage areas greater than 70 square miles are Rock and Allen Creeks above Emporia, and Eagle Creek, Long Creek, Big Creek, Turkey Creek, Deer Creek, Elm Creek, Owl Creek, another Big Creek, Flat Rock Creek, Lightning Creek, Cherry Creek, and Labette Creek below Emporia.

Elevations in the basin range from 1,320 feet in Marion County at the top of the basin to 826 feet in Cherokee County at the bottom of the basin in Kansas.

There are three major federal reservoirs in the river system: [Marion Reservoir](#) is on the Cottonwood River and [Council Grove](#) and [John Redmond Reservoirs](#) are on the mainstem of the Neosho River. Ground water is found in alluvial deposits along major streams.

Population and Economy⁽⁸⁾

Major cities in the basin include, proceeding generally from northwest to southeast, Hillsboro, Marion, Council Grove, Strong City, Emporia, Burlington, Iola, Chanute, Parsons, Oswego, Pittsburg, Galena and Baxter Springs.



Downtown Council Grove.
Photo courtesy Kansas Geological Survey

There were an estimated 174,000 residents in the basin in the year 2000. The [population](#) of 13 of the counties that have significant land area in the basin was 204,349 in 2000 and is projected to decline to 189,127 by the year 2040. No counties in the basin are expected to gain population during this time but the more rural counties are projected to lose proportionally more population than the counties having regional urban centers. For example, the population of Chase County is projected to have a 15% decrease, while the population of Crawford County is projected to have only a 2 percent decrease by the year 2040.⁽⁹⁾

The local economy is based primarily on agriculture, general manufacturing, and retail trades. The major [crops](#) grown in the basin include wheat, grain sorghum and soybeans. The value of crop production in 2006 was estimated to be \$372,524,860. The production of beef cattle is another important part of the area's agricultural economy. The value of [live-](#)

[stock](#) production in 2006 was estimated to be \$261,789,300.⁽⁵⁾

The Neosho basin has a greater variety of minerals than any other area in Kansas. The production of oil and gas is a relatively small but important component of the economy. A significant amount of coal, lead and zinc mining occurred historically in the southeastern portion of the basin. Strip mining of coal is the only one of these mining activities which continues today. Lead and zinc mining peaked in 1926 and by 1958, mining of these minerals had all but ceased. Legacy heavy metal pollution⁽¹¹⁾ and dangerous underground mine shafts still plague southeast Kansas.

Natural resources of economic importance to area economies are oil, gas, cement, ceramic materials, coal, lead, zinc, stone, and sand and gravel. An additional component of the local economy is the only nuclear powered generating plant in Kansas, located near Burlington. The Wolf Creek Nuclear Power Plant is the largest single water user in the basin. A large biodiesel plant is under construction (November 2007) in Emporia.



Wolf Creek Nuclear Power Plant. Photo courtesy KGS

Water based recreation is important to the economy of the basin with three federal reservoirs, a State Fishing Lake in every county, and nine community lakes attracting boaters, anglers, hunters and campers. State Parks and commercial marinas are located on and around the federal reservoirs in the basin.

Located on the broad, flat flood plain below the junction of Flat Rock Creek and the Neosho River, the Mined Land Wildlife Area is a man-made marsh developed by the Kansas Department of Wildlife and Parks (KDWP) in 1960.

The area covers 3,246 acres. The five largest pools on the area represent 1,675 acres of the 1,787 of intensively managed wetlands. There are 16 independently managed wetlands throughout the area. The area was primarily designed, and is managed to, furnish a resting and feeding place for migratory waterfowl.

Emporia State University and Pittsburg State University provide opportunities for higher education as well as numerous community colleges including Ft. Scott, Labette County and Neosho County community colleges.

Physical Characteristics

Geology and Soils

The Neosho Basin lies chiefly in the Osage Cuestas section of the Central Lowlands Ecoregion.⁽²⁾ However, all three subdivisions of that ecoregion occur in the Neosho Basin: The Flint Hills Upland, the Osage Cuestas, and the Cherokee Lowlands. The Flint Hills, in the western part of the basin, are an area of outcrop of flint-bearing Permian rocks. The Osage Cuestas division occupies over one half of the basin and is characterized by many east-facing escarpments which trend irregularly from north-northeast to south-southwest across the basin. Southeast of the Osage Cuestas section of the basin is the Cherokee Lowlands area. This is an erosional plain which slopes to the west at about 10 feet per mile.

Most of the consolidated surface rocks in the basin are of Pennsylvanian and Permian age. These rocks consist of alternating thin beds of limestone and shale. Coal is present in some areas. Mississippian age rocks are exposed in a small area in the extreme southeast corner of Cherokee County. Mostly composed of limestones and cherty limestones, these areas contain lead and zinc ores. Small areas of Cretaceous and Tertiary rocks are exposed in Marion and McPherson counties. The flood plains and terraces associated with the streams consist of deposits of clay, silt, sand, and gravel, which are mostly of more recent Quaternary age.

There are nine major soil groups in the basin. Soil types include fine textured low permeability types, silt loams, sand silt loams, dense claypans, and alluvial and terrace soils. More detailed soil information can be found on county soil maps.⁽¹²⁾



Clements stone arch bridge over Cottonwood River
Photo courtesy Kansas Geological Survey.

Land Use/Land Cover

The predominant features in the basin are the grasslands of the Flint Hills in the northwestern part of the basin, crop land in the Neosho River and other flood plains, in the Marion Reservoir watershed, and in the Cherokee County area, and the urbanized areas described previously.

Plant communities in the study area include Oak-Hickory Forest, Floodplain Forest, Cross Timbers, Cedar Glades, Bluestem Prairie, and Bluestem-Grama Prairie. Grassland (56%), and row crops, (38%) are the most widespread land cover classes covering about 3,738,540 acres of the basin.

In 2006, there were 8,530 farms covering 4,708,000 acres in the thirteen counties with significant area in the basin. The average farm size was 551 acres.⁽³⁾

The basin contains many important highway and rail transportation arteries. The [basin map](#) shows locations and coverage.

According to the 2003 Assessment of Riparian Areas Inventory by the Kansas Geological Survey (KGS), of the 37,257 bank miles of riparian area, within a 100 ft corridor along each bank in the basin, the dominant riparian cover is pasture/grassland (31%).

The second most common cover is forest land (25%), and third most common cover is a mixture of pasture and trees (20%)

The remaining riparian cover types, in descending order of dominance, are crop land, crop land/tree mix, shrub land, urban, urban/tree mix, and barren land. Overall land use/land cover in the basin mirrors riparian land use/cover with grassland covering 56% of the area, crop land covering 32%, and woodlands covering about 7 percent. The balance is made up of urban uses and water.⁽⁶⁾

Climate

The climate of the Neosho basin is humid in the southeastern half and sub-humid in the northwestern half. The annual [precipitation](#) in the basin varies from approximately 30 inches in the western-most part of the basin to almost 42 inches in the southeast. Approximately 70% of this precipitation falls between April and September. Ten to 18 inches of snow falls in an average winter. Table 1 illustrates variation in annual average precipitation and temperature, and freeze dates from areas in the northern, middle, and southern parts of the basin.

Location	Average Annual ¹		Freeze Dates (32 F.) ²		
	Precipitation (inches)	Temperature (deg. F.)	Last in Spring	First in Fall	Frost Free Days
Cottonwood Falls	35.91	54.3	Apr. 19	Oct. 14	179
Iola	41.84	55.8	Apr. 11	Oct. 23	195
Columbus	44.47	56.2	Apr. 13	Oct. 22	192

¹ Source: National Climatic Data Center (1971-2000 data)

² Source: KSU Weather Data Library (1961-1990 data)

Wildlife and Habitat

The Tallgrass Prairie National Preserve in the Flint Hills, covering 1,895 acres, was established in 1997. The preserve protects a nationally significant

example of the once vast tallgrass ecosystem. Of the 400,000 acres once covered in the North American Continent, less than 4 percent remains, primarily in the Flint Hills of Kansas. The Flint Hills National Wildlife Refuge above John Redmond Reservoir is one of a system of over 500 refuges administered by the U.S. Fish and Wildlife Service (USFWS) dedicated to the preservation and conservation of wildlife. Named for the Flint Hills Region just to the west, the refuge consists of 18,500 acres located on the upstream portion of John Redmond Reservoir on land owned by the U.S. Army Corps of Engineers (Corps).

Established in 1966, the refuge is managed primarily for migratory waterfowl. Intensive use by ducks and geese occurs during the spring and fall migration. Surrounding farmlands are managed on a share basis with area farmers with the refuge share providing food for migrating waterfowl and resident wildlife. Numerous ponds and a system of shallow marshes provide additional waterfowl habitat. Waterfowl and bald eagle management requires that portions of the refuge be closed and that public access be restricted during periods of intensive waterfowl use.



Schermerhorn Cave, South of Galena.
Photo courtesy Kansas Geological Survey.

Schermerhorn Park, just south of Galena in the southeast corner of the basin, contains a small part of the Ozark oak-hickory forest ecosystem. Many of the threatened and endangered (T & E) species live in the "Kansas Ozarks". The area is characterized by sinkholes, caves, swift streams, and steep cliffs.

Much of the original Ozark oak-hickory forestlands still remain in this region. Spring River and Shoal Creek are in this area and provide unique aquatic habitat for many species.

There are 36 T&E species in the Neosho basin. Of these, one is an insect, three are mammals, 10 are mussels, seven are birds, and four are fish. For additional information on critical habitat for these species, please see the KDWP⁽¹³⁾ website in the references.

Because the basin covers a large geographic area with many ecosystem types and diverse land uses, the potential for habitat alteration is widespread resulting in pressures on populations of important species.

Water Resources

There are three federal reservoirs in the basin: [Marion](#), [Council Grove](#), and [John Redmond](#). Coffey County State Fishing Lake provides cooling water for the Wolf Creek Nuclear Power Plant. All counties have state fishing lakes. Council Grove City Lake serves as a water supply for the city of Council Grove. Other localized resources that provide vari-



Lake Kahola spillway
Photo courtesy Kansas Geological Survey.

ous services including water supply, recreation and habitat, include Jones Park Pond, Olpe City Lake, Gridley City Lake, Altamont City Lake, Bartlett City Lake, Lake Kahola, Mined Land Resources Area and Lake, Parsons Lake, Pittsburg College Lake, Marion County Lake, New Strawn City Lake, and Playter's Lake.

Eighty percent of the streams in the basin are intermittent and 20% are perennial streams, for a total of 16,696 miles. Average stream density is 2.7 stream miles/square mile of area, the second highest density of all 12 basins in the state.

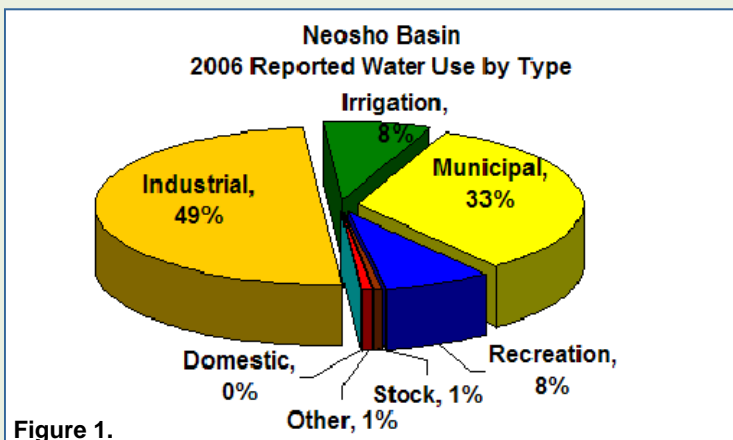


Figure 1.

The Ozark Plateau [aquifer](#) system and Spring River are water resources shared by Arkansas, Kansas, Missouri, and Oklahoma. Demand for water in the region is growing rapidly and concerns about water level declines and potential water quality degradation have prompted long-term management actions. See the [Ozark Aquifer Priority Issue](#) in this section for more information.

Nearly 77% of [water used](#) in the basin is from [surface sources](#) (2006 water use). About 49% of water used is for industrial use, (54% of this from surface water and 45% from ground water), making it the highest use type in the basin, followed by 33% for municipal use, about 8 percent for recreational use and 8 percent for irrigation use (Figure 1).⁽⁷⁾

Water Management

Significant water management entities include conservation districts throughout the basin, the See-Kan, Flint Hills and Lake Region Resource Conservation and Development Councils RC&Ds and 15 active [watershed districts](#). By virtue of its responsibility for three major reservoirs, the Corps is another important water manager in the basin.

Watershed Restoration and Protection Strategy (WRAPS) groups are an emerging water management entity in the basin. These are coordinated by various entities including the See-Kan and Flint Hills RC&Ds, and local conservation districts.

Voluntary watershed management plans are developed by local stakeholders. The plans include management goals intended to improve the overall condition of land and water in the watershed. WRAPS groups have been formed above all three federal reservoirs, along Eagle Creek, the Spring River, and the area below John Redmond Reservoir.

The cities of Parson, Pittsburg, and Emporia are permitted under the KDHE Phase II Stormwater Permit Program. These municipalities are responsible for developing stormwater management programs to address both the quality and quantity of stormwater runoff within their boundaries.

Resources

1. KS Water Plan 2003—Neosho Basin Section.
2. Geology and Soils – Kansas Water Resources Board Preliminary Assessment reports; Ecoregion descriptions.
3. United States Geological Survey 2000. K. E. Juracek. Report No. 00-4177 “Estimation and Comparison of Potential Runoff Contributing Areas in Kansas Using Topographic, Soil, and Land Use Information.
4. Kansas Water Office [Reservoir Fact Sheets](#).
5. USDA, Kansas 2006-2007 County Farm Facts, Agricultural Statistics and Ranking.
6. Wilson, Brownie, Assessment of Riparian Areas Inventory, State of Kansas, 2003. http://hercules.kgs.ku.edu/geohydro/ofr/2003_55/riparian/ofr_2003_55e.htm.
7. WRIS database, Division of Water Resources, December 13, 2007.
8. US Census Data—2000.
9. County Population Estimates. KS Division of Budget. 2007.
10. Verdigris Unit Report—Kansas Water Resources Board Water Plan Studies.
11. Residual effects of lead and zinc mining on freshwater mussels in the Spring River Basin (Kansas, Missouri, and Oklahoma, USA. Robert t. Angelo, M. Steve Cringan, Diana L. Chamberlain, Anthony J. Stahl, Stephen G. Haslouer, Clint A. Goodrich. Kansas Department of Health and Environment, may 2007.
12. http://www.ks.nrcs.gov/news/annual_rpt02/soil.html
13. <http://www.kdwp.state.ks.us/news/other-services/Threatened-and-Endangered-species>

Impacts of Historic Mining Activities

Galena is a rural community located in southeast Kansas, within the Tri-State Mining District EPA Superfund Site in Cherokee County. For over a century, lead and zinc were mined in the region and resulted in production of nearly 3,000 abandoned mine shafts in Cherokee County. Even though lead and zinc mining activities subsided in the latter half of the 20th century, numerous environmental problems and other hazards remain.

Waste mine tailings, also known as chat, which are byproducts of the mining and milling processes for lead and zinc ore, cover 4,000 acres in southeastern Cherokee County according to the KGS. Chat hazards were not limited to just the tailings piles because the wind blew fine metal-bearing dust from tailings piles, spreading the contamination. In addition, leaching from the waste mine tailings has contaminated wells and ground water, with runoff moving contaminants into nearby streams and rivers.

Another by-product of mining operations was highly acidic mine drainage (acidic water, containing metals that can contaminate streams). When the lead and zinc mines were abandoned, they filled with water, and began contaminating local aquifers and surface waters.



Mining waste at Galena. Photo courtesy Kansas Geological Survey.