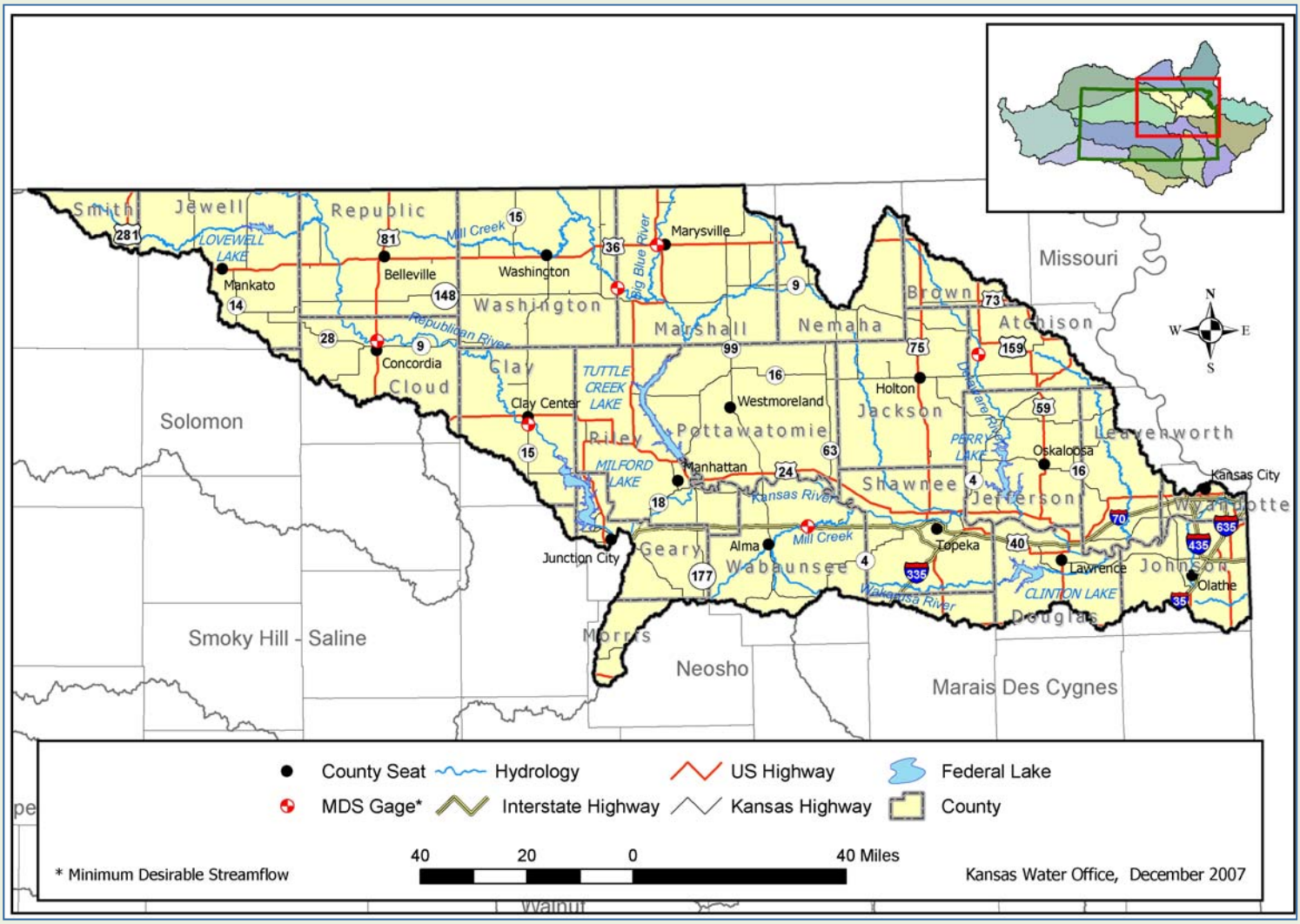
Kansas-Lower Republican River Basin



General Description

The Kansas-Lower Republican basin covers nearly 10,500 square miles of northeast Kansas and includes that portion of the state drained by the Republican River downstream of Harlan County Dam in Nebraska and the Kansas River which originates at the junction of the Republican and Smoky Hill rivers. For planning purposes, the portion of the Blue River drainage in Johnson County which joins the Missouri River in Jackson County, Missouri is also included in this basin. The basin includes all or part of 25 counties.

Major rivers and streams within the basin are: the Upper Kansas, including Vermillion, Mill and Soldier Creeks; Lower Republican; Blue, including the Little Blue River; Delaware; and Lower Kansas, including the Wakarusa River and Stranger Creek. Subbasins include Hydrologic Unit Codes (HUC): 10250016, 10250017, 10270101, 10270102, 10270103 10270104, 10270205 and 10270207. Major reservoirs in the basin are Lovewell, Milford, Tuttle Creek, Perry and Clinton. Ground water sources available in the basin include alluvial and glacial deposits and the Dakota aquifer.

The Kansas-Lower Republican basin slopes gently from west to east, dropping about 1,300 feet in elevation from its highest point in Smith County at approximately 2,050 feet above sea level to the confluence of the Kansas and Missouri rivers in Wyandotte County at approximately 730 feet. The basin covers portions of the High Plains, Smoky Hills, Flint Hills, Glaciated Region and Osage Cuestas physiographic regions.

The basin contains the major cities of Junction City, Manhattan, Topeka, Lawrence and Kansas City, Kansas along with many smaller cities and towns. The U.S. Army installation, Fort Riley is located north of Junction City. Tribal lands of the Prairie Band Potawatomi and Kickapoo nations are located in the basin.

Population and Economy

The basin has the largest population of all the twelve major river basins and had an estimated 1,025,644 residents in the year 2000. The 2000 U.S. Census recorded 1,235,516 residents in the 25 counties contained either wholly or partially within the basin.[2]

This population is projected to grow to nearly 1,583,584 in the year 2040. This basin illustrates major demographic changes which are taking place in Kansas. In the past 40 years, two trends have dominated the state and the basin. Rural counties have lost population, sometimes more than 10% every decade. Urban counties, particularly Johnson and Douglas, are gaining population at an even greater rate. Two examples demonstrate the polarity of these trends. Johnson County, with a population of 143,792 in 1960, had a population of 453,964 in 2000. Washington County, with a population of 10,734 in 1960, had a population of 6,465 in 2000.

Economic drivers in the basin range from agriculture in the upper portion becoming progressively more commercial and industrial in the lower basin. Most of the bottomland and about 50% of the uplands are planted to crops. The primary crops grown include wheat, corn, soybeans and grain sorghum. The value of crops in the 25 counties either partly or wholly in the basin was more than $1 billion in 2006.(3) Livestock are a significant part of the economy, particularly beef production in the Flint Hills. The value of livestock and dairy production exceeded $390 million in 2006. The most important mineral resources in the basin are oil, natural gas, coal, building stone and aggregate materials.

Flint Hill Pastures. Photo courtesy Kansas Geological Survey

Water-based recreation is important to the economy of the basin with five federal reservoirs, ten state fishing lakes and 43 community lakes attracting boaters, anglers, hunters and campers. State parks and commercial marinas are located on the federal reservoirs in the basin.

Physical Characteristics

Geology and Soils

The surface geology of the Kansas-Lower Republican basin is characterized by the exposure of sedimentary rock units which become progressively younger moving from east to west. These rock units are composed mainly of beds of limestone and shale with some major sandstone beds (Dakota Formation and Douglas Group). The area east of the Blue River and north of the Kansas River was glaciated and unconsolidated glacial deposits are widespread. Other unconsolidated deposits include alluvium in river flood plains and wind deposited loess, particularly in the Lower Republican subbasin.

Dakota Sandstone Hoodoo. Photo courtesy KGS.

There are 65 soil associations occurring in the Kansas-Lower Republican basin. In general, the more coarsely textured soils occur in the floodplains of the larger rivers. Finer soils are found in the uplands, particularly in the Glaciated Region and Flint Hills uplands physiographic regions. The soils within most watersheds in the Kansas-Lower Republican basin have a moderate to high slope-erodibility hazard. Only portions of the Upper Kansas, Delaware and Blue River watersheds have a low erodibility hazard.

Land Use/Land Cover

The predominant features in the basin are the grasslands in the Flint Hills, crop land in the Kansas River floodplain and urbanized areas of Junction City, Manhattan, Topeka, Lawrence and Kansas City. Grassland (46%) and cropland (35%) are the most widespread land cover classes covering more than three-quarters of the basin. In 2006, there were 18,740 farms comprising about 8.5 million acres in the 25 counties either wholly or partially within the basin. The average farm size is 454 acres.

Aerial of Topeka, from the east. Photo courtesy KGS.

The basin contains many important highway and rail transportation arteries. Interstate 70 and U.S. Highways 24, 40 and 36 traverse the basin east to west. Short sections of Interstates 35 and 335 along with U.S. Highways 69, 73, 59, 75, 77, 81, 159 and 281 cross from north to south. Burlington Northern/Santa Fe and Union Pacific rail lines follow the Kansas River with numerous spur lines across the basin.

The Kansas-Lower Republican basin has the most streambank miles, 60,604, of the 12 major river basins in Kansas. Within a 100-foot corridor along each bank, about 29% of the land is forested followed by pasture and grassland (21%), tree and pasture mix (18%) and crop land (16%). While comprising only two percent of the bank miles, the Kansas-Lower Republican basin has the largest amount of urban and tree/urban streambank area of the twelve Kansas basins.(4)

Climate

The climate of the Kansas-Lower Republican basin is classified as humid continental with cold winters and hot summers. Normal mean temperature generally increases from northwest to southeast across the basin. Temperatures and rainfall are highly variable. The average annual temperature of the basin is 53° F. Most of the precipitation falls in the summer and spring. June is typically the wettest month. The basin-wide average annual precipitation is 55 inches. Flood events, such as in July 1993 and the drought experienced from 1952-1956, illustrate the variability in precipitation.

	Average Annual[1]		Freeze Dates (32 F.)[2]		
Location	Precipitation (inches)	Temperature (deg. F.)	Last in Spring	First in Fall	Frost Free Days
Concordia	28.4	53.5	Apr. 21	Oct. 19	181
Manhattan	34.8	54.9	Apr. 18	Oct. 15	179
Lawrence	39.8	56.4	Apr. 10	Oct. 27	202

[1] Source: National Climatic Data Center (1971-2000 data)
[2] Source: KSU Weather Data Library (1961-1990 data)

Wildlife and Habitat

A total of 26 species of birds, fish and reptiles are listed as threatened or endangered in the Kansas-Lower Republican basin including single species of snake, snail and beetle.

The basin contains a wide variety of grassland, woodland and riparian habitats. Habitat loss due to urban development is an issue particularly in the Lower Kansas River basin.

In October 2007, zebra mussels were discovered in Perry Lake. This invasive species is expected to impact recreational use of the lake and move downstream with water releases to the lower Kansas River where water intakes and infrastructure could be affected.

Water Resources

The Kansas-Lower Republican basin contains 22,237 miles of intermittent and 5,392 miles of perennial streams for a total of 27,629 stream miles. The density of 2.7 stream miles per square mile places the basin fourth among the 12 major Kansas basins. By contrast, the Cimarron basin has a density of one stream mile per square mile.

There are five major federal reservoirs in the basin. Clinton, Perry, Tuttle Creek and Milford Lakes are operated by the U.S. Army Corps of Engineers (Corps) primarily for flood control. Lovewell Reservoir is operated by the U.S. Bureau of Reclamation (Bureau) and impounds White Rock Creek, but also receives water from the Republican River in Nebraska through the Courtland Canal.

Ground water is available, to a varying extent, throughout the Kansas-Lower Republican basin and is mainly located in three aquifers: the Dakota, Glacial Drift and Alluvial. The alluvial aquifers occupy the valleys of the Kansas, Republican, Blue Rivers and some tributaries. The Glacial Drift aquifer occupies the area roughly north of the Kansas River and east of the Big Blue River. The Dakota is found in Washington and Clay counties and westward.

Water Management

The Corps manages pool elevations in their four reservoirs in the basin according to specific operating rules. Flood flows are stored until downstream conditions allow their release. A conservation pool is maintained in accordance with the lake level management plans to optimize conditions for fish and wildlife benefits and recreational use.

Each lake contains storage to maintain downstream water quality. Milford, Perry and Tuttle Creek lakes contain storage for the state Water Marketing Program. Water supply storage in Clinton Lake is contracted directly with the cities of Lawrence and Baldwin and rural water districts (RWDs) in Douglas County.

Of the approximately 190 public water suppliers in the basin, most use ground water as a source. From the perspective of population served however, most residents in the basin get water from surface water (streams and reservoirs). There is an active Kansas River Water Assurance District in the basin. The Corps reservoirs are operated to meet eligible water right holder needs during periods of low flow through arrangements with the Water Assurance District and the Kansas Water Office (KWO).

There are minimum desirable streamflow (MDS) gages located on the Republican River at Concordia and Clay Center, the Big Blue River at Marysville, Little Blue River at Barnes, Delaware River at Muscotah and Mill Creek at Paxico. The mean annual flow of the Kansas River at De Soto is 4,860 cubic feet per second (cfs). The estimated 100-year flood discharge at this location is 240,000 cfs.

Irrigation is the largest water use in the basin at 45%, followed by municipal at 39%. Industrial uses account for more than 8 percent of water used. While there is some irrigation from the Kansas River alluvial aquifer, most irrigation is in the Lower Republican portion of the basin. Municipal and industrial water use is predominant in the lower basin associated with population centers along the Kansas River corridor. Surface water accounts for about 53% of the water used in the basin.[5]

Milford Dam - Corps of Engineers photo

Watershed Restoration and Protection Strategies (WRAPS) are stakeholder-driven watershed management programs designed to address multiple water resource issues. WRAPS projects have been established above the four federal reservoirs which provide public water supply as well as other watersheds in the basin. There are 17 watershed districts in the basin primarily engaged in flood control. Each county also has a conservation district dedicated to controlling soil erosion, water quality, range and pasture management, fish and wildlife habitat and other natural resource management issues.[6]

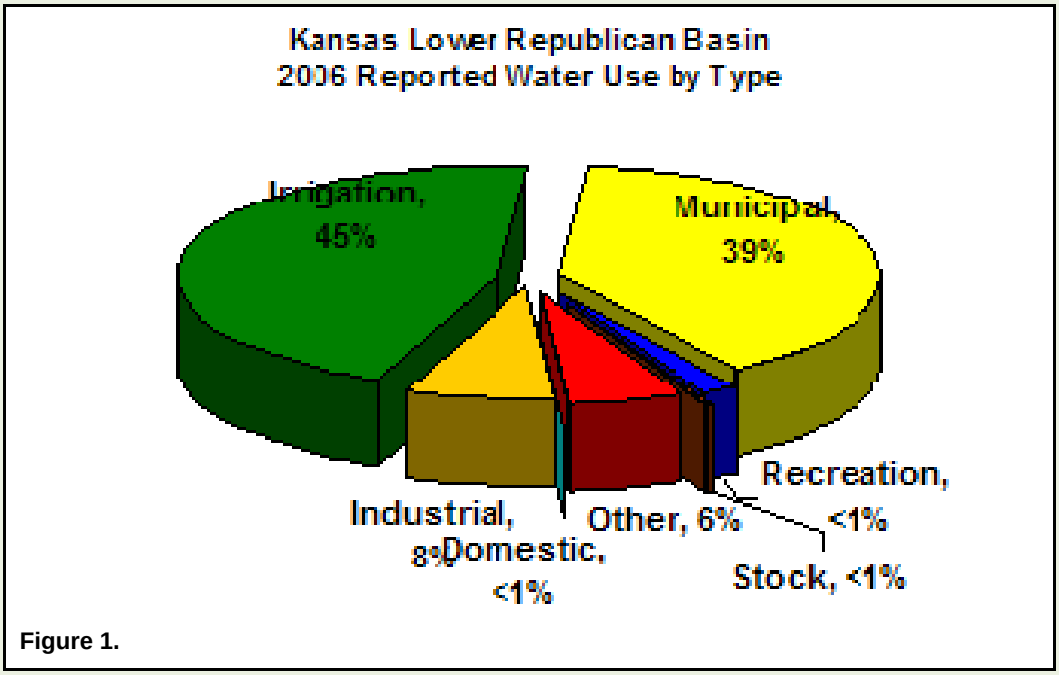


Figure 1.

Our national bird, the bald eagle, had once been reduced to 487 breeding pairs in the lower 48 states. The bald eagle was officially listed as an endangered species in 1967 in 43 states, including Kansas, in a law that preceded the Endangered Species Act. Eagle populations have rebounded strongly since the 1972 ban of several chlorinated hydrocarbon insecticides. The first recorded modern eagle nesting in Kansas occurred at Clinton Lake in 1998. The Kansas and Republican River corridors are listed as critical habitat for bald eagles. Populations have been trending upward in recent years with 250-500 bald eagles typically recorded during statewide winter surveys. In June 2007, the U.S. Department of Interior took the American Bald Eagle off the Endangered Species List. The bald eagle is still protected by the Migratory Bird Treaty and Bald and Golden Eagle Protection Act.

Photo by Bob Gress

Resources

1. Kansas Water Office. 1998. *Kansas-Lower Republican Basin Resource Inventory and Assessment, Volume 4.*

2. U.S. Census Bureau. 2000.

3. USDA. *Kansas 2006-2007 County Farm Facts, Agricultural Statistics and Ranking*.

4. *Wilson, Brownie 2003. Assessment of Riparian Areas Inventory, State of Kansas*.

5. Kansas Department of Agriculture-Division of Water Resources, December 13, 2007. Water Right Information System (WRIS).

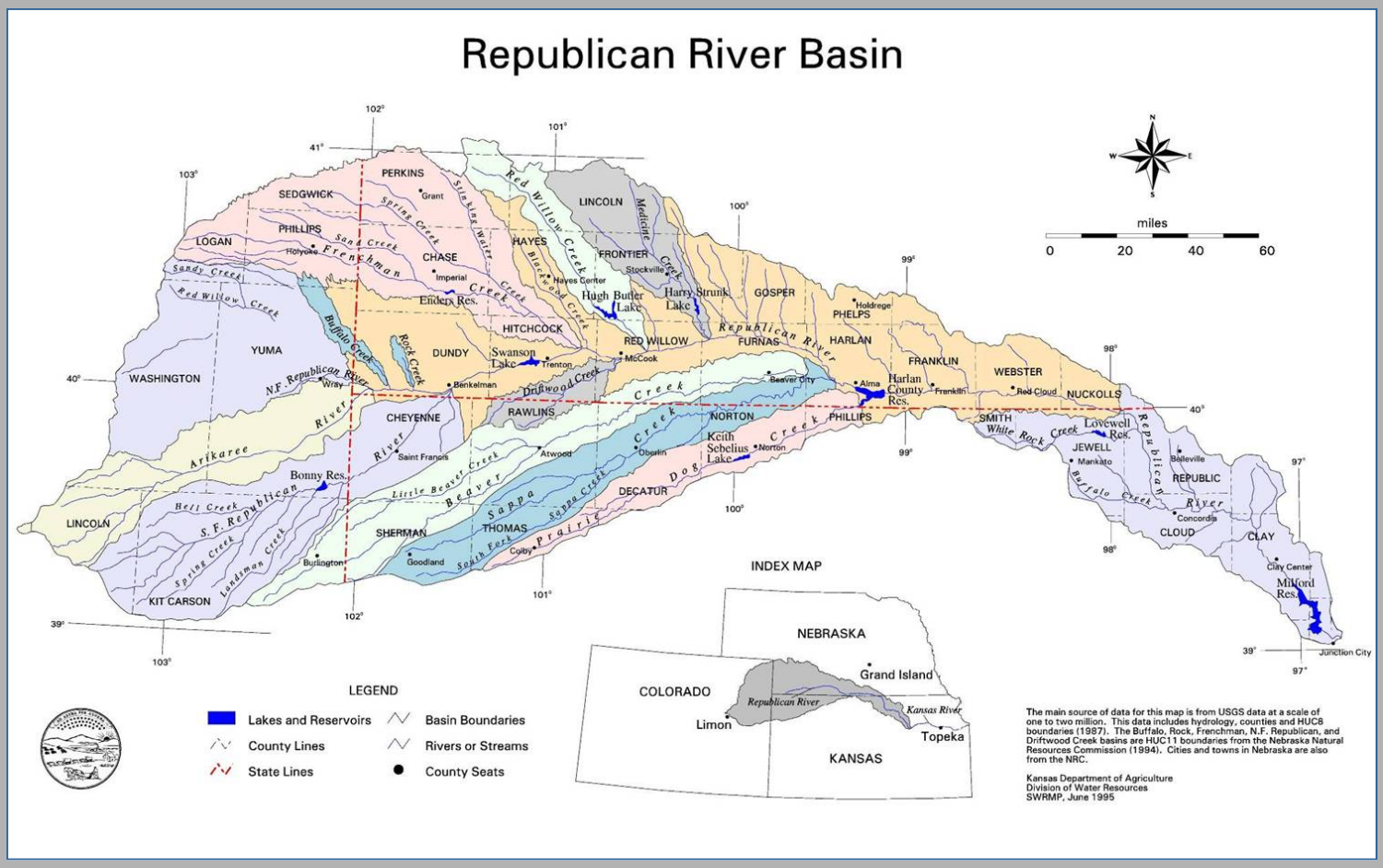
6. Natural Resources and Conservation Service. Accessed January 2009. Resource Conservation and Development Information.

Kansas-Lower Republican River Basin

Republican River Compact and Settlement

The Republican River and its tributaries are important water resources to Kansas. Kansas' interests in the basin include ground water and surface water rights in the Upper Republican River basin and water supply to the Kansas-Bostwick Irrigation District in the Lower Republican basin.

The Republican River Compact was formally signed on December 31, 1942 by the states of Colorado, Kansas and Nebraska. The Compact makes specific allocations to each of the three states in 14 different subbasins and includes provisions related to the ability of the federal government to develop projects within the basin.



In May 1998, Kansas filed a lawsuit before the U.S. Supreme Court for breached terms of the Compact by Nebraska for proliferation and use of groundwater wells connected to the Republican River and its tributaries and by failing to protect the surface flows from other unauthorized appropriations.

As a result, the Republican River Compact Administration ground water model was developed. This tool is used to quantify ground water consumptive use by each state as part of the compact's accounting procedures. The first compliance check for the model's five-year running averages were for the years 2003-2007. The settlement also prescribes more restrictive compliance requirements during water-short conditions, including two-year averaging. The basin currently is water-short. Should the basin remain water-short, the first water-short compliance check would be for the years 2005-2006.