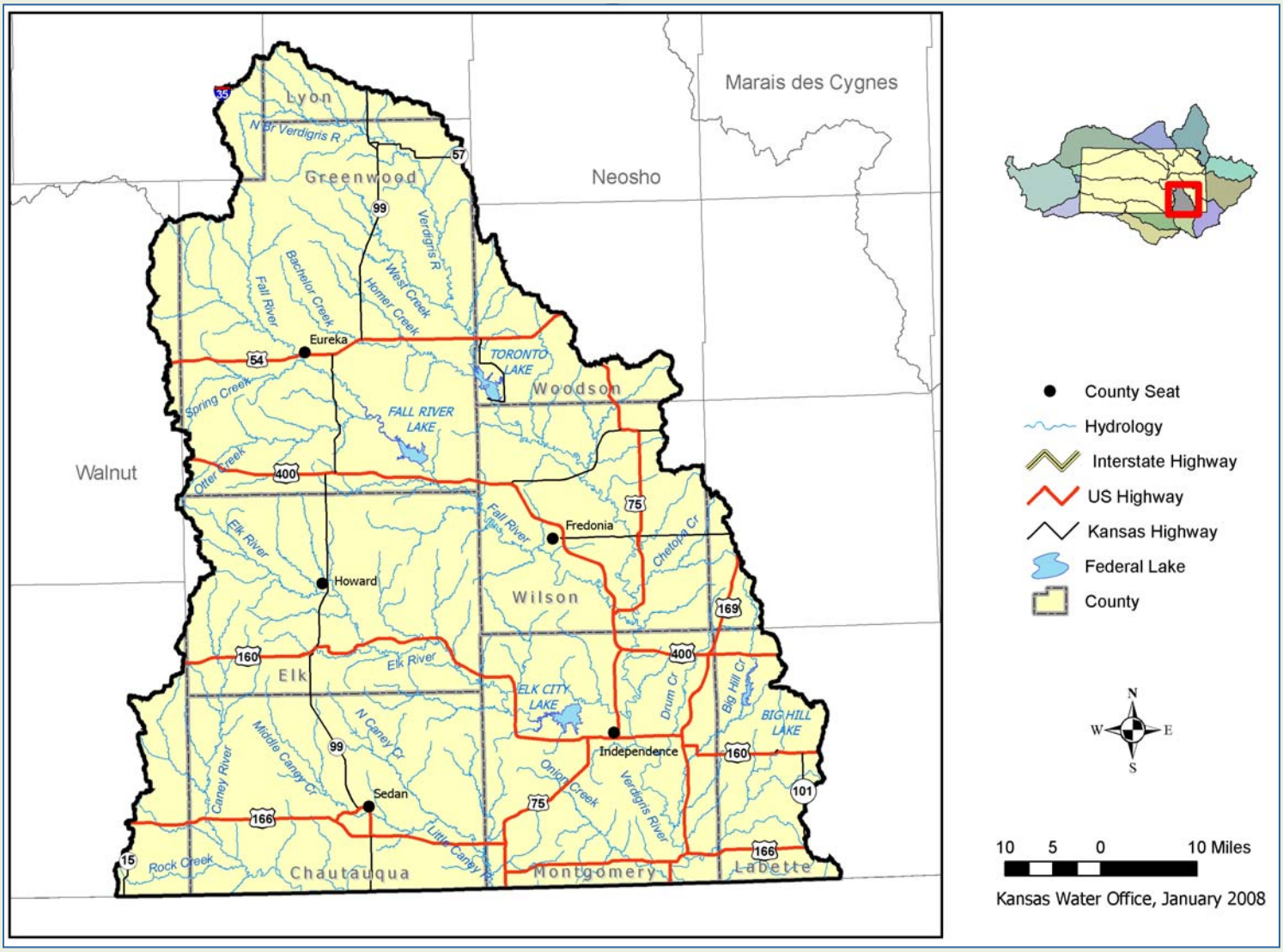
Verdigris River Basin

January 2009



General Description

The Verdigris River is a tributary of the Arkansas River and the basin includes Hydrologic Unit Codes 11070101, 11070102, 11070103, 11070104, and 11070105. The Arkansas River originates in central Colorado, where it flows southeast into and across Kansas before crossing into Oklahoma just south of Arkansas City. The Verdigris River mainstem rises in the southeastern corner of Chase County and flows in a general south-southeasterly direction for about 350 miles to its junction with the Arkansas River near Muskogee, Oklahoma. Elevation ranges from about 1,650 feet at the headwaters to about 680 feet at the state line. The Verdigris basin in Kansas covers approximately 4,440 square miles and encompasses all or parts of 11 counties in the southeastern part of the state. Near the City of Grove Oklahoma, the Verdigris River is dammed to form Oolagah Reservoir, a major drinking water supply storage for the City of Tulsa. Approximately two-thirds of the watershed above this reservoir is in Kansas.

Four federal reservoirs were constructed in the basin between 1949 and 1981; from oldest to youngest they are Fall River, Toronto, Elk City and Big Hill.

Major transportation routes include Highways 54 and 400 which run generally east to west through the basin. Highways 169 and 75 run north and south. See the basin map for locations.

Population and Economy [7]

There were an estimated 103,000 residents in the Kansas portion of the basin in the year 2000 and the population is expected to decrease to around 78,527 by 2040 according to Kansas Water Office (KWO) projections. No counties in the basin are projected to gain population. Major population centers include Independence, Coffeyville, Eureka, Neodesha and Fredonia.

Outside of major population centers, the population is generally rural with small agricultural communities.

The local economy is based primarily on agriculture with some manufacturing and light industrial activity including the Cobalt boat production facility in Neodesha. The major crops grown in the basin are wheat, grain sorghum and soybeans and the production of beef cattle is an important part of the agricultural economy. In 2006 there were an estimated 3,690 farms, with 2,632,000 acres in the five major counties in the basin. The average farm size was 713 acres. Crop value in 2006 was estimated by the Kansas Department of Agriculture at about $113 million. Livestock production value was estimated to be about $119 million.[4]

Toronto Lake Dam. Photo courtesy Kansas Geological Survey.

Education, health and social services, forestry, fishing and hunting, and mining also contribute to the local economy. Another significant contributor is the production of oil and gas. Along with this comes historic contamination from oil and gas production before more stringent regulations were in place to manage brine waste. Thousands of abandoned wells dot the landscape.

Coffeyville and Independence community colleges offer opportunities for higher education.

The four federal reservoirs in the basin offer water based recreation, hunting and other opportunities for experiencing natural environments. A 980 acre park at Fall River Reservoir features forested floodplains, blackjack oak savannahs and tallgrass prairie. Toronto Reservoir has a 4,700 acre park with riparian timber areas, grassland, and wetland communities. Native prairie and timbered areas can be enjoyed on 1,320 acres at Big Hill Reservoir, and Elk City Reservoir has 857 acres of native prairie, limestone bluffs, and deciduous forest. All parks offer camping, swimming, boating, water skiing, hiking, picnicking, bird watching, and photographic opportunities. Public wildlife areas are managed for both game and non-game species. The recreational resources these reservoirs provide are important to the local economy as visitors purchase amenities while in the area.

Physical Characteristics

Geology and Soils

The area is generally characterized as being in the Osage Cuestas Ecoregion with a physiography of cuestas and gentle undulating plains dissected by perennial and intermittent streams. Silty and clayey residuum and colluvium with alternating layers of Pennsylvanian sandstone, limestone, and shale characterize area geology. Glacial drift is fairly abundant in the extreme northern part of this ecoregion. Soils in the western part of the basin were developed from the underlying limestones and shales and in most parts of the area the soils are relatively shallow, making them best suited for native pastures. In the eastern part of the basin, soils are generally sandy residual soils which are low in fertility and quite erosive. These soils occur on undulating to hilly topography and are relatively shallow. In general, this area is more suitable for grazing than for cultivation.

Land Use/Land Cover

Land cover is a mosaic of grassland (74%), cropland (14%), and woodland (9 percent). All other land cover types represent less than 1 percent of the total land cover except for water which represents about 1.5 percent of the land cover. Most of the land use is for agriculture, either grazing and haying or crop production. Most of the crops are grown in the floodplains of the Verdigris River and its tributaries. Natural vegetation transitions from mostly tallgrass prairie in the west to a combination of tallgrass prairie and oak hickory woodland in the east. Upland forests are dominated by shagbark hickory, bitternut hickory, red oak, white oak, and black oak, with Ohio buckeye, American bladderpod, and pawpaw common understory trees. A remnant of the Cross Timbers Forest occurs in the basin.

According to the 2003 Assessment of Riparian Areas Inventory by the Kansas Geological Survey[5] (KGS), of the 25,722 miles of stream bank riparian area in the basin, the dominant riparian cover in a 100 foot zone from the streambank is pasture/grassland (34%).

The second most common cover is forest land (29%), and third most common cover is a mixture of pasture and trees (19%). The remaining riparian cover types, in descending order of dominance, are crop land, crop land/tree mix, shrubland, urban, urban/tree mix, and barren land.

The Natural Resources Conservation Service (NRCS) completed a Rapid Watershed Assessment (RWA) on HUC 11070101 in the basin.(10) The RWA report provides a detailed accounting of land uses and the application and condition of best management practices in this HUC unit. While the information cannot be directly extrapolated as being descriptive of the rest of the basin, it is likely that general trends are comparable.

The Upper Verdigris sub-basin described in the RWA is comprised of 767,225 acres in southeast Kansas including Chase, Lyon, Greenwood, Neosho, Wilson, and Woodson Counties. According to the National Land Cover Data (NLCD), approximately 12% of the sub-basin is in grain and row crop; 78% is in grassland, pasture, and hay; and the rest is in other various land uses. These percentages correspond well with the larger basin.

Resource concerns are numerous in the RWA subbasin. They include, but are not limited to, soil erosion, soil compaction, diminishing surface water quality, deteriorating plant conditions and inadequate water for domestic livestock. Economic issues such as the high capital costs of crop production and farm operation and unreliable profits may delay the acceptance and implementation of conservation practices on agricultural lands in the subbasin.

There are approximately 811 farms and 1,168 operators in the Upper Verdigris subbasin. The estimated average farm size in 2002 was 809 acres, an increase of 15% from the 1987 estimate.

Six NRCS service centers, six county conservation districts, the Upper Verdigris Watershed District and the Flint Hills and See-Kan Resource Conservation and Development (RC&D) councils provide conservation assistance in the sub-basin.

With the exception of Chautauqua County, all counties in the Verdigris basin have adopted and are enforcing environmental codes. Five of the 11 counties have adopted land use zoning regulations.

Climate

Annual precipitation in the basin varies from approximately 34 inches in the west to almost 40 inches in the southeast corner. Approximately 70 percent of this precipitation falls between April and September. Between 11 and 18 inches of snow falls in an average year. The average temperature varies from 34 degrees in the winter to 79 degrees in the summer.

Table 1 summarizes average annual precipitation, temperature and freeze data for years between 1971 and 2000 for the cities of Eureka in the western part of the basin and Independence in the southeast part of the basin.

Table 1.
Climate Summary
Verdigris Basin

	Average Annual[1]		Freeze Dates (32 F.)[2]		
Location	Precipitation (inches)	Temperature (deg. F.)	Last in Spring	First in Fall	Frost Free Days
Eureka	37.78	55.6	Apr. 17	Oct. 16	182
Independence	43.46	57.1	Apr. 10	Oct. 23	198

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

Pasture in Chase County. Photo courtesy Kansas Geological Survey.

Wildlife and Habitat

Numerous threatened and endangered (T&E) species occur in the Verdigris basin. Of these, there is one reptile, one invertebrate, and one mammal. Seven are mussels, seven are birds and three are fish.

The Verdigris River basin provides habitat for several species of T&E mussel species. The presence of mussels generally indicates good water quality since they are not able to move easily from one habitat to another. Mussels provide important filtering functions where they occur, helping to keep the water free of pollutants.

Ouachita Kidneyshell Mussel

Water Resources

Surface water is abundant during rainfall/runoff events and many streams are perennial; however the streams are flashy, characterized by flooding during storm events, followed by low flows during dry weather. There is no assurance that water is present when and where it is needed on a consistent basis. Of the 11,411 stream miles in the basin, 9,724 miles are intermittent, with the remaining 15%, or 1,688 miles, perennial. Stream density of both types is 2.6 stream miles/square mile area, making this basin tied with third place in stream density of the 12 basins in the state.

Due to numerous intermittent streams, surface water is undependable for public water supplies. This, combined with historic flooding, led to construction of four federal reservoirs in the basin, beginning in 1949, with the most recent completed in 1981.

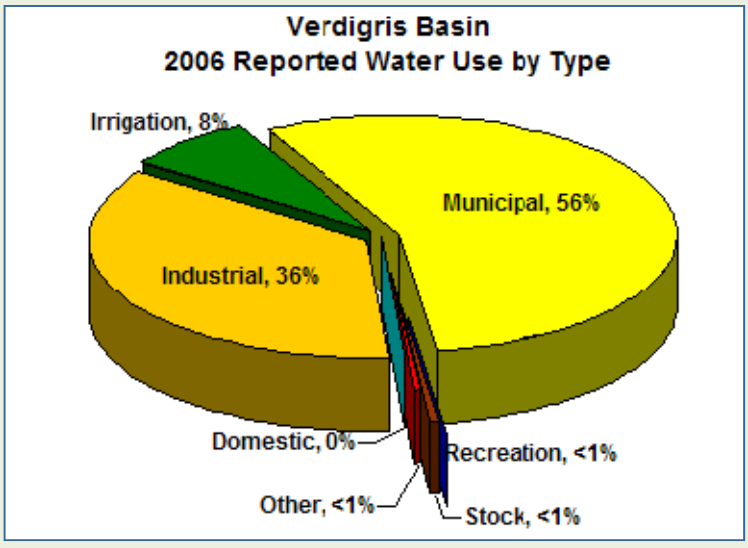
The major streams in the basin are the Verdigris, Elk, Fall, Caney and Little Caney Rivers, and Big Hill and Caney Creeks. Elk and Fall Rivers and Big Hill Creek are tributaries to the Verdigris River in Kansas, while the Caneys join the river in Oklahoma.

In addition to the federal reservoirs in the basin, all counties have state fishing lakes. Other community water resources include the Woodson Wildlife area, Cherryvale City Lake and LaClaire Lake.

Ground water supplies are quite limited in the basin, occurring mostly in alluvial aquifers.

Watershed Districts in the basin have constructed flood control structures to address rural flooding. Most impound water even during non-flood conditions. Several of these are available as back up sources of drinking water. Most are also used for livestock watering.

Surface water is the predominant source of water for beneficial uses in the Verdigris basin, with a very small amount, about one percent overall, derived from alluvial deposits along streams. In the Kansas part of the basin, surface water makes up over 98% of the water used. The majority of water used is for industrial (36%) and municipal (56%) purposes. Recreation (<1 percent), irrigation (8 percent), stockwater (<1 percent) and other uses (<1 percent) make up the remainder of the water used in the basin.[6]



Water Management

Significant water management entities include conservation districts throughout the basin, public water suppliers, the See-Kan Resource Conservation and Development Council (RC&D), and 12 watershed districts. By virtue of its responsibility for the four major reservoirs in the basin, the Corps is an important water management entity.

The City of Coffeyville is permitted under the Kansas Department of Health and Environment (KDHE) Phase II Stormwater Program which gives the city responsibility for managing surface water quality and quantity.

Watershed Restoration and Protection Strategy (WRAPS) groups are an emerging water management entity in the basin. These are coordinated by either the See-Kan RC&D or the Flint Hills RC&D. 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.

Resources

1. KWP-Verdigris Basin Section. November 2003.

2. U.S. Geological Survey 2000. K.E. Juracek. Report No. 00-4177 “Estimation and Comparison of Potential Runoff Contributing Areas in KS Using Topographic, Soil, and Land Use Information.

3. Kansas Water Office Reservoir Fact Sheets.

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

5. 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

6. WRIS database, DWR, December 13, 2007.

7. U.S. Census Data—2000.

8. County Population Estimates. KS Division of Budget 2007.

9. Verdigris Unit Report-Kansas Water Resources Board Water Plan Studies.

10. ftp://ftp-fc.sc.egov.usda.gov/ks/outgoing/web-files/tecchnical-resources

Cross Timbers Forest

Large tracts of ancient deciduous forest still occur on the ridges and rugged escarpments of southeast Kansas, Oklahoma, and central Texas. These woodlands are dominated by centuries-old post oak (Quercus stellata) and are part of the Cross Timbers ecosystem. The Cross Timbers are a complex mosaic of upland forest, savanna and glade which form the broad ecotone between the eastern deciduous forests and the grasslands of the southern Great Plains. The pre-settlement Cross Timbers are believed to have covered some 30,526 square miles extending from central Texas across Oklahoma into southeastern Kansas. The short, stout oaks of the Cross Timbers were not ideal for lumber production, so the original Cross Timbers have often survived on steep terrain that was unsuitable for farming. Literally thousands of ancient post oak can still be found in this region, and there is no doubt that the Cross Timbers is one of the least disturbed forest types left in the eastern United States.

Cross Timbers Forest