

Prepared in cooperation with the
KANSAS WATER OFFICE

WATER USE IN KANSAS, 1990 AND 1995

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This fact sheet illustrates comparative water use from ground and surface sources for 1990 and 1995 for the largest categories of use in Kansas: public supply, irrigation, industrial and mining, livestock, and thermoelectric power generation. Total populations, including those served by public-water suppliers and those using private wells, also are illustrated. These data are organized by major river basin to provide perspective on trends in water use among geographic areas in Kansas. This fact sheet is produced as part of an ongoing cooperative study with the Kansas Water Office and is supported in part by the Kansas State Water Plan Fund.

Introduction

Information on amounts of water used in Kansas is collected and used for many purposes. The Kansas Department of Agriculture-Division of Water Resources (DWR) requires annual reporting of water use by those users with water rights; this information is used to establish and enforce water appropriations. The Kansas Water Office (KWO) requires annual reporting of water use by public-water suppliers who purchase water through the Water Marketing Program. KWO uses water data in its planning and coordination activities, including the Water Marketing Program, Multipurpose Small Lakes Program, regional water-supply planning, basin assessments, and population and water-demand projections. The U.S. Geological Survey (USGS) assists these State agencies with water-use data collection, evaluation, and publication. Together, these three agencies maintain data bases with site-specific information on water use in Kansas.

Since the late 1980's, the State has published annual reports entitled *Kansas Municipal Water Use and Kansas Irrigation Water Use* using the data evaluated for the two largest categories of use. The USGS provides comprehensive data on all categories of water use to the National Water-Use Information Program, which publishes a report every 5 years entitled *Estimated Use of Water in the*

United States. Data for most categories of use documented by USGS are compiled using site-specific information reported to the State. This information is then aggregated by county and hydrologic unit.

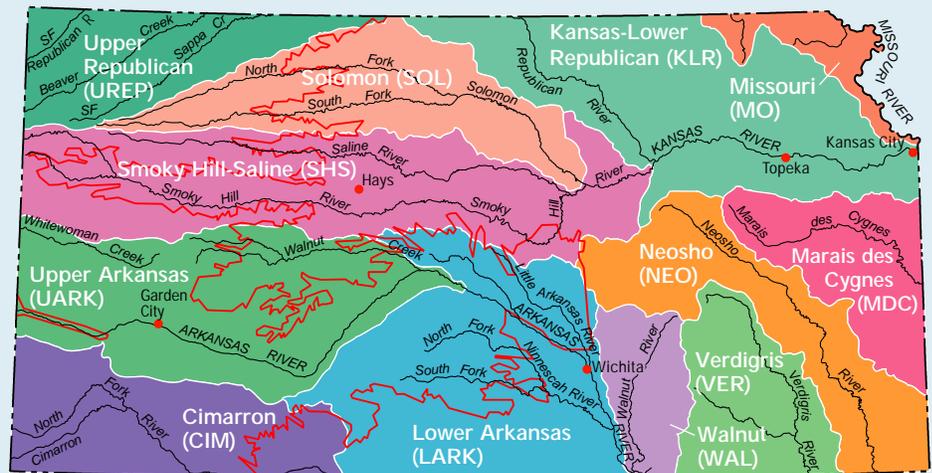
The population and water-use data presented in this fact sheet are from the two most-recent 5-year intervals compiled for the USGS data base. The data were aggregated by the 12 major river basins in Kansas (fig. 1), which coincide with hydrologic-unit boundaries and are the planning units used by the KWO. Population distribution, the availability of ground and surface water, and the degree of urban, industrial, and agricultural activities vary considerably among the basins. Most of the ground-water supplies, irrigated agriculture, and large livestock operations are located in the western part of the State. Large population centers, surface-water supplies, and water uses associated with industry, mining, and power generation are more common in the south-central and eastern parts of the State. Categories of water use discussed in this fact sheet are: public supply, irrigation, industrial and mining, livestock, and thermoelectric power generation. Data presented for these

categories consist of total withdrawals in 1990 and 1995, which include both consumptive and nonconsumptive use. Smaller water-use categories for which data are collected but not illustrated in this report include rural self-supplied domestic, self-supplied commercial, and hydroelectric power generation.

Population

Population served by public-water suppliers and rural population using self-supplied ground water in 1990 and 1995 are shown in figure 2 for the 12 basins. The total population of Kansas increased by about 3.5 percent between 1990 and 1995 (U.S. Bureau of Census, 1991, 1996). During that period, population served by public-water supply systems increased from 2,228,000 to 2,323,000, whereas the self-supplied rural population decreased from 250,000 to 242,000.

Total population using ground water is approximately equal to the total population using surface water in Kansas. However, most basins have a predominant source of public-supply water. All of the population in the Upper Arkansas and Cimarron Basins and the majority of the



EXPLANATION

- (LARK) Basin abbreviation used in figures 2-6
- Approximate eastern extent of High Plains aquifer

Figure 1. Major river basins in Kansas.

population in the Upper Republican, Solomon, Smoky Hill-Saline, and Lower Arkansas Basins use ground water; much of that water is obtained from the areally extensive High Plains aquifer (fig. 1). Most of the population in the Walnut, Verdigris, Neosho, Marais des Cygnes, and Kansas-Lower Republican Basins uses surface water. In the Missouri Basin, approximately equal numbers of people use surface and ground water.

The largest number of people served by public-water suppliers is in the Kansas-Lower Republican Basin. The population served by surface water in that basin increased by nearly 8 percent between 1990 and 1995, primarily due to growth in urban areas using water supplies from the Kansas River and Federal reservoirs. Small decreases in population served by public-water suppliers occurred in the Upper Republican, Solomon, and Verdigris River Basins during that period.

The largest rural self-supplied populations are those in the Lower Arkansas, Walnut, Kansas-Lower Republican, Upper Arkansas, and Smoky Hill-Saline Basins. In the Upper Republican and Walnut Basins, the rural self-supplied population represents at least 25 percent of the total population.

Public Supply

Public supply represents about 9 percent of total annual nonpower-related water withdrawals in Kansas. This category includes water supplied by public or private utilities for residential, commercial, industrial, and public use, in addition to system losses. Public-water suppliers include cities, towns, rural water districts, mobile home parks, and housing subdivisions. The majority of the data used to document public-water supply use in 1990 and 1995 was derived from annual reports submitted to DWR or KWO.

Amounts of water withdrawn in 1990 and 1995 by public-water suppliers in Kansas are illustrated in figure 3. Ground water is the predominant source of supply in the six western basins, whereas surface water is the predominant source of supply in the six eastern basins. The largest volumes of water for public supply, nearly 100 million gallons per day (Mgal/d), were withdrawn in the Kansas-Lower Republican Basin in 1995 and in the Lower Arkansas Basin in 1990.

Total public-supply withdrawals were less in 1995 than in 1990 for each of the western basins except the Cimarron; these differences are attributable to drier weather conditions in 1990. Public-supply

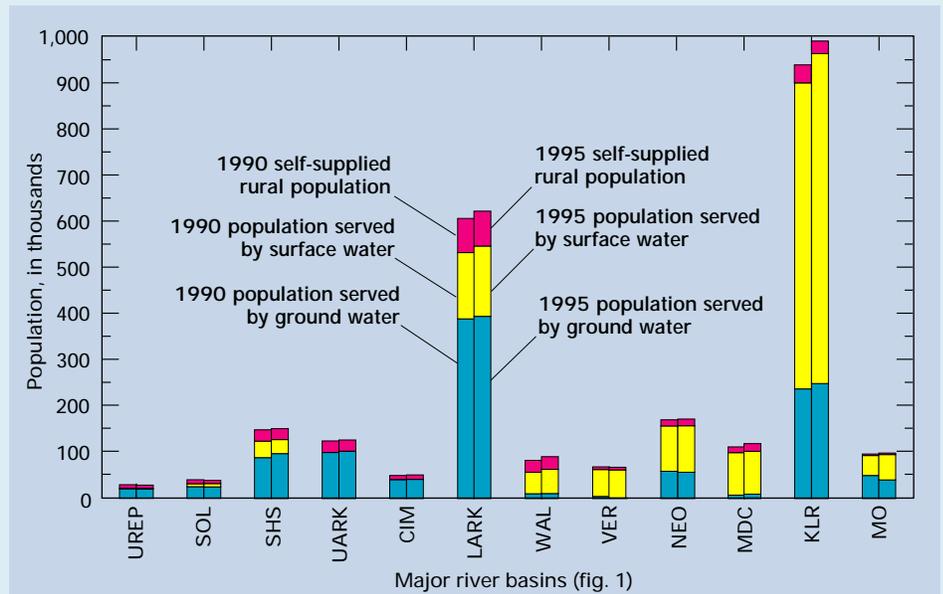


Figure 2. Populations served by surface- and ground-water sources and self-supplied rural populations, 1990 and 1995.

withdrawals in the Lower Arkansas Basin were almost 10 Mgal/d less in 1995 than in 1990 due to a decrease in ground-water pumpage. The city of Wichita alone withdrew 7 Mgal/d less from its well field (north of the city in the *Equus* Beds aquifer) in 1995 than in 1990 due to less overall demand and increased reliance on its surface-water supply in Cheney Reservoir (west of the city).

Total public-supply withdrawals were greater in 1995 than in 1990 in each of the six eastern basins; these differences are attributable to population increases. Surface-water withdrawals in 1995 in the Missouri Basin were 10 Mgal/d larger than in 1990 due to increased withdrawals of water from the Missouri River by Johnson County Water District No. 1.

This utility currently (1999) withdraws about one-half of its supply from the Missouri Basin; however, nearly all of the population served is located in the Kansas-Lower Republican River Basin (near Kansas City).

Irrigation

The irrigation category includes water used for growing crops and represents the largest use of water in Kansas. About 87 percent of total annual nonpower-related water withdrawals are for irrigation. Irrigation water-use data for 1990 and 1995 were derived from information reported to DWR. Irrigation water is withdrawn from approximately 30,000 points of diversion, including

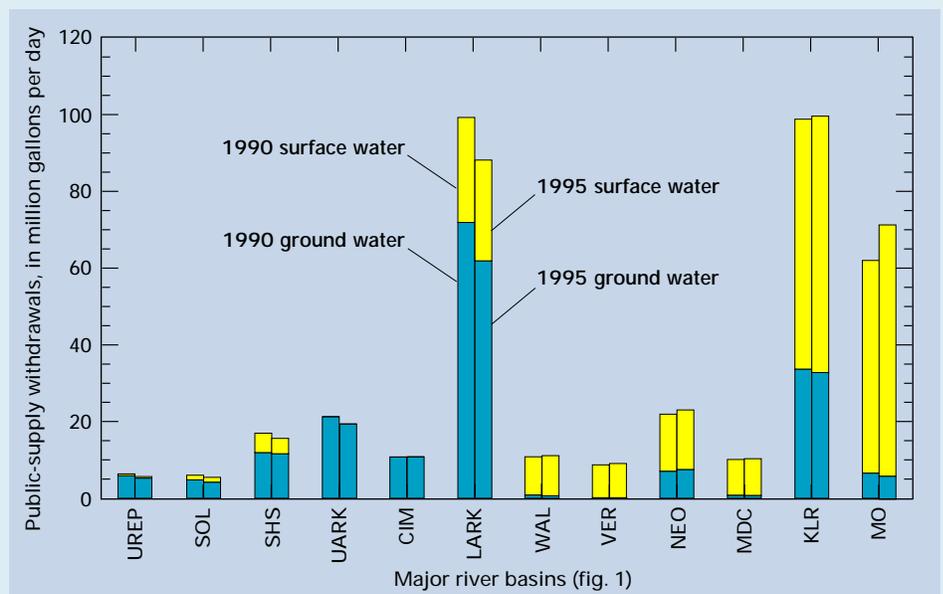


Figure 3. Public-supply withdrawals, 1990 and 1995.

wells, streams, and canals. More than 90 percent of irrigation withdrawals are from ground water.

Irrigation withdrawals from ground and surface sources in 1990 and 1995 are illustrated in figure 4. Most of the ground water available for large-scale irrigation is located in the six western basins, which include areas underlain by the High Plains aquifer. The largest ground-water withdrawals for irrigation are in the Upper Arkansas and Cimarron Basins where the greatest aquifer saturated thickness and numbers of irrigation systems occur. Most of the surface-water use for irrigation in Kansas occurs within irrigation districts that deliver water to farms through canals.

All basins where irrigation is a significant use of water showed less use in 1995 compared to 1990. Statewide, about 21 percent less ground water was used for irrigation in 1995 than was used in 1990 when drier weather conditions prevailed. Statewide, about 15 percent more surface water was used for irrigation in 1995 than in 1990. More water was delivered through irrigation districts in the Upper Arkansas and Solomon Basins in 1995 than in 1990 due to greater availability of water in the rivers and reservoirs supplying those districts. However, less surface water was used from irrigation districts in the Kansas-Lower Republican Basin in 1995 than in 1990.

Industrial and Mining

Combined withdrawals for the industrial and mining categories represent about 2 percent of total annual nonpower-related withdrawals in Kansas. Industrial water use includes water used for manufacturing; production of salt, fertilizer, chemicals, and food; and petroleum refining. Mining water use includes processes associated with coal, oil, and gas production; quarrying; and sand and gravel operations. Industrial and mining water-use data for 1990 and 1995 were derived from information reported to DWR.

Ground- and surface-water withdrawals for industrial and mining use in 1990 and 1995 are shown in figure 5. More than 80 percent of the water used for these categories is ground water. Surface-water withdrawals primarily are related to the production of sand and gravel. Total use is greatest in the Lower Arkansas Basin due to large withdrawals for salt production, sand and gravel operations, and manufacture of aircraft, paperboard, and chemicals. Substantial amounts of water for industrial and mining uses also are withdrawn in the

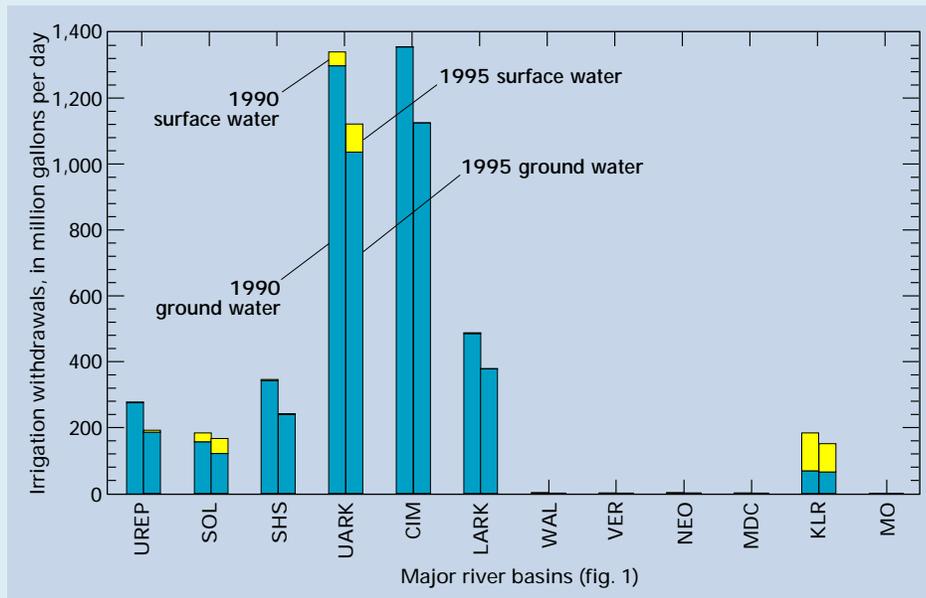


Figure 4. Irrigation withdrawals, 1990 and 1995.

Kansas-Lower Republican Basin, especially for production of construction aggregates.

In most basins, less ground water was reported for the industrial and mining categories in 1995 than in 1990 because several large oil and gas producers were no longer active. In the Upper Arkansas and Cimarron Basins, larger industrial withdrawals in 1995 reflect increased water use for meat-packing plants and ethanol production.

The substantial increase in reported surface water used in 1995, particularly in the Lower Arkansas and Kansas-Lower Republican Basins, is for sand and gravel production. In 1990, dredging operations were not yet required to have water rights. By 1995, rights were mandatory, and

more usage was reported. The withdrawal amounts shown are largely nonconsumptive; only the water evaporated from pits is not returned to the streams.

Livestock

Livestock water use represents about 2 percent of total annual nonpower-related withdrawals in Kansas. Livestock use includes water for raising beef and dairy cattle, sheep, hogs, and poultry, both at large feedlots and on small farms. Usage for these animals was determined from annual livestock statistics published by the Kansas Department of Agriculture and the U.S. Department of Agriculture, along with per-head water-use coefficients used by the State. Livestock use

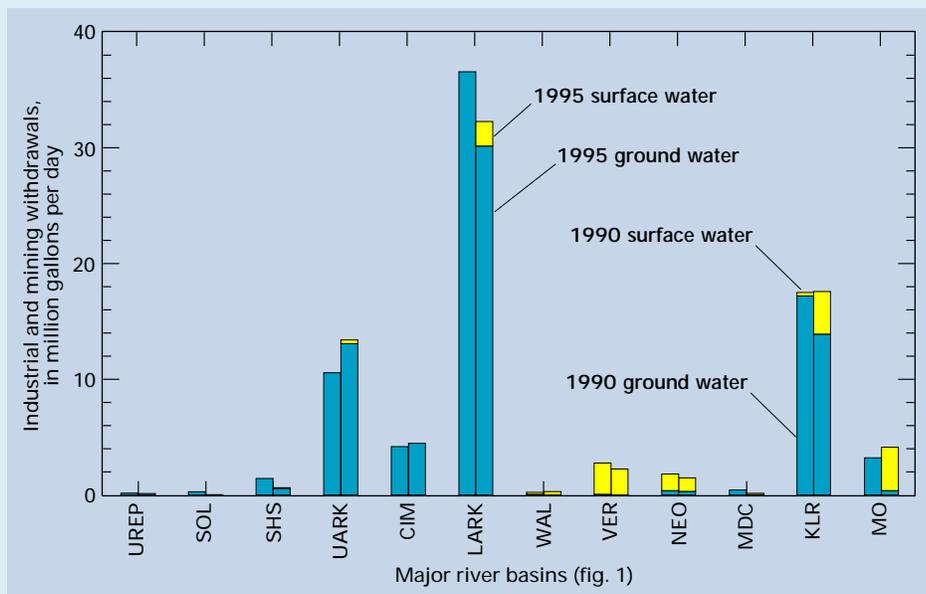


Figure 5. Industrial and mining withdrawals, 1990 and 1995.

includes water use associated with fish farming. Fish-farm water use and sources for 1990 and 1995 were derived from data reported to DWR.

Livestock water withdrawals in 1990 and 1995 are illustrated in figure 6. The largest quantities of water were withdrawn in the basins in southwestern Kansas and in the Kansas-Lower Republican Basin. These are the areas in which confined animal feeding operations are most prevalent. More than 99 percent of the water used at large feedlots throughout Kansas is ground water. Stock ponds are a common source of supply for smaller livestock operations, especially in eastern Kansas.

In 9 of the 12 basins, more water was used for livestock in 1995 than in 1990. Substantial increases in the Upper Arkansas and Cimarron Basins reflect larger numbers of beef cattle, milk cows, and hogs produced in southwestern Kansas in 1995. Statewide, more cattle were produced in 1995 than in 1990, while numbers of other types of livestock decreased.

Water use for fish farms represented about 5 percent of total livestock withdrawals in 1990, but only about 2 percent in 1995. The decline in fish-farm water use is due to several large users in the Lower Arkansas and Kansas-Lower Republican Basins that had either curtailed water use and production by 1995 or were out of business entirely.

Thermoelectric Power Generation

Water withdrawn for thermoelectric power generation represents the second largest category (after irrigation) of use in Kansas. More than 95 percent of the water withdrawn for thermoelectric power generation is nonconsumptively used and is returned to the environment or re-used after cooling. Water use at 25 powerplants with their own source of water is reported annually to DWR. All but one of these powerplants burns fossil fuel; there is one nuclear powerplant in the Neosho Basin.

Because of the uneven distribution of power-generation water use among Kansas basins and the nonconsumptive nature of this category of use, withdrawals for thermoelectric power generation during 1990 and 1995 are not illustrated in this fact sheet. During each of these 2 years, nearly 1,300 Mgal/d were withdrawn for power generation; 99 percent was from surface-water sources in the Neosho, Marais des Cygnes, Kansas-Lower Republican, and Missouri Basins. Minor amounts of ground water were withdrawn for powerplants in the Upper Arkansas,

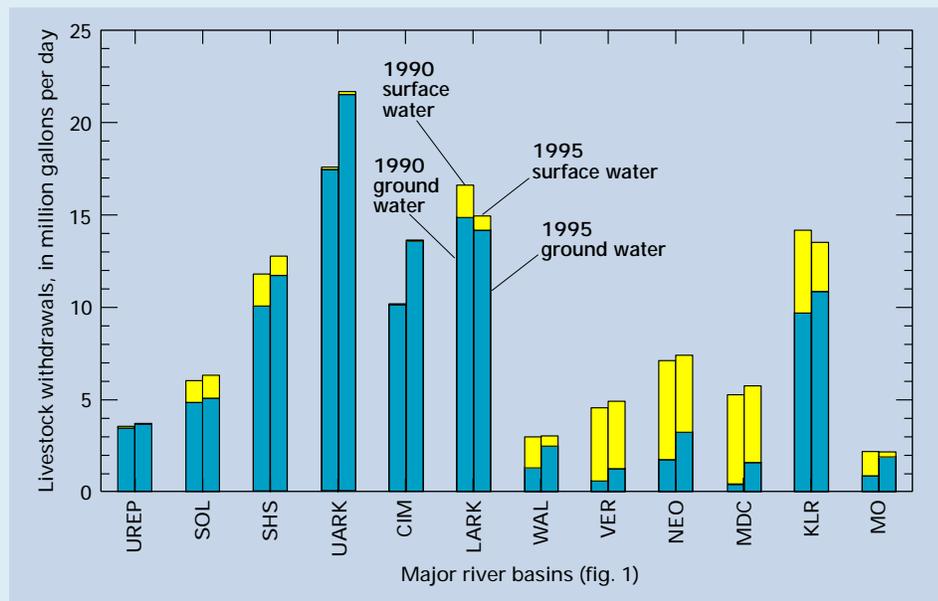


Figure 6. Livestock withdrawals, 1990 and 1995.

Cimarron, Lower Arkansas, and Kansas-Lower Republican Basins.

Summary

Continued collection, analysis, and publication of water-use data for various types of use in Kansas are important in managing water rights and understanding water demands. Presentation of population and water-use data by major river basin for 1990 and 1995 is one way of showing geographic and temporal differences among various types of water use in Kansas. Some of the variation between 1990 and 1995 data is indicative of trends, such as population growth and increased public-water-supply usage in the eastern six basins. Increases in amounts of water used for industrial and livestock uses reflect growth in meat-packing industries and construction of more confined animal feeding operations in the southwestern basins.

Other differences in water use between 1990 and 1995 are related to weather conditions in particular years rather than trends. In the western six basins where population growth was not accompanied by increases in public-supply use in 1995, outdoor water use has a greater effect on yearly amounts used. Lesser amounts of water were used for irrigation in 1995 due to cooler, wetter weather. In the Lower Arkansas and Kansas-Lower Republican Basins, the increase in reported surface-water withdrawals for mining use is related to State water-right regulations. For these categories of water use, long-term trends are best recognized by collecting and evaluating annual data.

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