

FRESHWATER WITHDRAWALS IN MISSISSIPPI, 1990

Penny M. Johnson
U.S. Geological Survey
Jackson, MS

INTRODUCTION

Although Mississippi has large quantities of fresh ground and surface water that are available in nearly all parts of the State (Callahan and Barber 1990b), increased demands for water have created a need for accurate, detailed information on current and historical water use. In recognition of this need, the U.S. Geological Survey (USGS), in cooperation with the Mississippi Department of Environmental Quality, Office of Land and Water Resources (OLWR, formerly the Mississippi State Board of Water Commissioners), began the Mississippi Water-Use Program during 1973. In 1978, the USGS initiated the National Water-Use Information Program to establish a nationwide water-use data base. The National program and the State program have similar goals: to collect, store, and disseminate consistent and accurate water-use information.

The Mississippi Water-Use Program collects information on the following categories of water use: public supply, domestic, commercial, livestock, irrigation, industrial, mining, thermoelectric power generation, sewage treatment, and reservoir evaporation. This information is collected to meet the data needs of hydrologists and water managers at State and local agencies as well as the requirements of the National program. Detailed information on water use by cities, industries, and commercial establishments is stored in a site-specific data base. Every 5 years the site-specific data are aggregated and added to the aggregate water-use data base for the National Water-Use Information Program. Estimates of the amount of water used in each county for saline and fresh ground and surface water for all categories are stored in an aggregate water-use data base, along with the amount of wastewater discharged by sewage treatment plants.

Continuing efforts are made to improve data-collection techniques within the National and State water-use programs. As techniques improve, more reliable water-use data are obtained. As part of the data-collection process for 1990, the OLWR distributed a two-page water-use questionnaire to the 50 largest

public suppliers in the State and a one-page water-use questionnaire to the 50 largest "other users" in the State in May 1991. The "other users" questionnaire was sent to thermoelectric power plants, industries, and some commercial establishments. These 100 users were selected based on total permitted withdrawals for each facility. The questionnaires requested the 1990 monthly withdrawals for all permitted ground-water wells or surface intakes. Other data-collection techniques and sources of data for each water-use category are described in detail with each category.

This report describes freshwater withdrawals from ground- and surface-water sources in Mississippi in 1990 in eight water-use categories: irrigation; aquaculture; thermoelectric power; public supply; industrial and mining; domestic; commercial; and livestock. The categories are discussed in order, beginning with the category with the largest total freshwater withdrawals. Water-use withdrawals are rounded to two significant digits. Percentages are calculated from unrounded numbers.

FRESHWATER WITHDRAWALS IN 1990

During 1990, total freshwater withdrawals from ground- and surface-water sources in Mississippi were about 3,300 Mgal/d (million gallons per day) (Fig. 1). Total freshwater withdrawals increased 17 percent from 1985, although the total population of Mississippi decreased about 2 percent (U.S. Bureau of the Census 1991). Of the total amount, about 80 percent, or 2,700 Mgal/d, was withdrawn from ground-water sources. Total freshwater withdrawals from ground-water sources increased 33 percent from 1985 to 1990. Total freshwater withdrawals from surface-water sources decreased about 22 percent, to about 650 Mgal/d during the 5-year period.

Irrigation

Irrigation water use, the largest water-use category in Mississippi, includes all water artificially applied to farm and horticultural crops, such as rice, cotton, and soybeans. Water-use data for irrigation are obtained

from several sources. Information on the number of acres irrigated, types of irrigation system used, and application rates was obtained from the Mississippi Agricultural Statistics Service (Hugh McWilliams, oral and written commun., 1991), the Mississippi Cooperative Extension Service (Jim Thomas, oral and written commun., 1991), and the Yazoo Mississippi Delta Joint Water Management District (Dean Pennington, oral commun., 1991).

Irrigation withdrawals were estimated to be 1,900 Mgal/d for 1990. Total withdrawals for irrigation increased 34 percent from 1985 to 1990, whereas total irrigated acreage increased 59 percent. Of the total irrigated acreage, 38 percent was irrigated by spray methods (includes center pivot, traveling gun, trickle, and drip systems) and 62 percent was irrigated by flooding, furrow, and ditch methods. About 95 percent of these withdrawals were in the Mississippi River alluvial plain of northwestern Mississippi (commonly referred to as the "Delta"), the darkest shaded area having the highest withdrawals in Figure 2. Irrigation withdrawals accounted for about 57 percent of all water withdrawn in Mississippi and 66 percent of all ground-water withdrawals in the State (Fig. 1).

Rice accounted for about 50 percent of withdrawals for irrigation. About 950 Mgal/d of water were used to irrigate 260,000 acres of rice during 1990. Cotton and soybean irrigation make up most of the remaining irrigation withdrawals.

Aquaculture

Aquaculture (catfish farming) water use, the second largest category of freshwater withdrawals in Mississippi, is defined as water use associated with the production of fish in captivity, excluding fish hatcheries. In Mississippi, catfish are grown predominantly in man-made ponds that lose water through exfiltration, overflow, evaporation, and periodic drainage. About 96 percent of all catfish farming takes place in the Delta, where all the water is supplied from ground-water sources because of its availability, quality, and uniform temperature. In other areas of the State, ground-water withdrawals are about 85 percent of the total withdrawals for catfish farming (Dean Pennington, oral commun., 1991).

Total freshwater withdrawals were estimated by multiplying an application rate by the total pond acreage in a county. Information on pond acreage was obtained from the Mississippi Cooperative Extension Service (M.W. Brunson, oral and written

commun., 1991). The average application rate for 1990 was 4.67 feet per acre per year (Dean Pennington, oral commun., 1991).

During 1990, about 95,000 pond acres were used for catfish production. Total withdrawals for aquaculture were estimated to be 400 Mgal/d for 1990, or about 13 percent of the total withdrawals for 1990 (Fig. 1). Since 1985, catfish-pond acreage in Mississippi increased 29 percent whereas total withdrawals for aquaculture increased 8 percent due to a drop in the application rate.

Thermoelectric Power

The thermoelectric power category includes water used in the generation of electric power with fossil fuel or nuclear energy. Cooling water accounts for most of the water used in this category, with lesser amounts of water used for boiler water, sanitary purposes, and fire protection. Information on freshwater withdrawals was obtained from the OLWR "other users" questionnaire. All 15 power-generation plants operating in Mississippi were included in the questionnaire. Fourteen of these plants are fossil-fueled, and one is nuclear-powered.

During 1990, about 380 Mgal/d of freshwater was withdrawn for thermoelectric power generation, or about 12 percent of the total withdrawals in Mississippi (Fig. 1). Of this amount, surface water accounted for about 89 percent of the withdrawals or 340 Mgal/d. Warren County had the largest surface-water withdrawals for thermoelectric power generation in the State, and Washington County had the second largest (Fig. 2). Thermoelectric power generation accounted for 53 percent of the total surface-water withdrawals in the State (Fig. 1). Water withdrawn for thermoelectric power generation during 1990 decreased by 20 percent from 1985.

Public Supply

Public supply refers to water withdrawn by public and private water suppliers and delivered to multiple users for domestic, commercial, industrial, and thermoelectric power uses. Public supply includes public and private water systems that furnish water to at least 25 people, or that have a minimum of 15 service connections.

Data on public-supply withdrawals were obtained from several sources. Of the public suppliers receiving the OLWR questionnaire, 21 responded with 1990 withdrawal data. Records of the Mississippi State

Department of Health, Division of Water Supply (Bill Wall, oral and written commun., 1991), and 1985 facility and withdrawal information from the USGS site-specific data base were used to complete the estimate of 1990 withdrawals.

Withdrawals are estimated by one of several methods, depending on the information available. Most public suppliers have records of how much water they sell or how many connections they serve. They may have an estimate of the total population that they serve. In cases where the amount of water sold is known, the amount of water withdrawn is estimated by applying a loss factor (assumed to be 30 percent unless other information is available) to the amount sold. The loss factor accounts for water lost during treatment and for leaks in the distribution system. If only the number of connections is known, the number of customers is estimated, after subtracting industrial and commercial connections, by using an estimate of the number of people per household for each county (U.S. Bureau of the Census 1991). The average number of people per household for the State was 2.55 during 1990. If only the number of customers is known, the withdrawal is estimated by multiplying the number of customers by an estimated use of 60 gallons per day per person.

Public-supply withdrawals were estimated to be 320 Mgal/d for 1990, or about 10 percent of the total withdrawals in Mississippi (Fig. 1). Ground water was the source for about 88 percent of these withdrawals for a total of 280 Mgal/d. Three public suppliers withdrew surface water for public-supply use in 1990 (Jackson, Meridian, and Columbus) for a total of about 38 Mgal/d or about 12 percent of the total public-supply withdrawals. The total public-supplied withdrawals in 1990 increased 3 percent from 1985.

Industrial and Mining

Industrial and mining water use includes water for such purposes as processing, washing, and cooling in facilities that manufacture products and water for the extraction of naturally occurring materials, dewatering, milling, and other preparations that are part of mining activities. Major water-using industries and mining operations in Mississippi are producers of chemical and allied products, paper and allied products, petroleum refining, agriculture chemicals and fertilizers, and sand, clay, and gravel mining. Industries can supply their own water, buy it from a public supplier, or both. Industries that withdraw their own water for manufacturing processes often obtain sanitary and drinking water from a public supplier.

Information on self-supplied industries was obtained from the OLWR "other users" questionnaire and from the Mississippi water-use data base. Twenty industries responded to the questionnaire with withdrawal data. Mining withdrawal amounts were estimated from 1990 data and from 1990 estimated State totals for each commodity (Doss White, oral and written commun., U.S. Bureau of Mines 1991).

Industrial and mining users withdrew an estimated 270 Mgal/d, or about 8 percent of the total freshwater withdrawals during 1990. Of this amount, about 54 percent was from ground-water sources, and 46 percent was from surface-water sources. Industrial and mining withdrawals increased 18 percent since 1985. Industrial and mining is the third-largest category of surface-water withdrawals (19 percent) in the State (Fig. 1).

Domestic

Domestic water use includes water for normal household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens. Most water for domestic use is supplied by public suppliers. Self-supplied water for domestic use is usually withdrawn from wells.

Self-supplied domestic users (usually rural homeowners) rarely meter their withdrawals, and withdrawals must be estimated based on the self-supplied population. The self-supplied population for 1990 was estimated by subtracting the estimated population served by public suppliers within the county from the total population of that county. Domestic withdrawals were then calculated by multiplying the total self-supplied population of a county by 50 gallons per day per person.

Domestic withdrawals were estimated to be 33 Mgal/d for 1990. This is an increase of about 106 percent since 1985. The estimated self-supplied population increased from 14 percent of the total population in 1985 to 26 percent in 1990. However, the increase in self-supplied population and domestic withdrawals is due to the different methods used to calculate these figures in 1990. Because domestic and commercial withdrawals are each less than 1 percent of the total withdrawals for the State, they are combined in Figure 1.

Commercial

Commercial water use includes water for motels, hotels, restaurants, office buildings, other commercial facilities, and civilian and military institutions. Most commercial users receive their water from a public supplier. Commercial withdrawal data were obtained from the OLWR "other users" questionnaire and from 1985 data. Withdrawal data from five commercial users that responded to the questionnaire were supplemented with 1985 withdrawal data.

Total self-supplied commercial water use for Mississippi during 1990 was estimated to be 16 Mgal/d. Ground water was the only source of water used for self-supplied commercial use. Self-supplied domestic and commercial withdrawals represent about 1 percent of the total withdrawals in the State (Fig. 1).

Livestock

Livestock water use includes water for livestock, feed lots, dairies, production of poultry and eggs, and other on-farm needs. Water-use estimates for livestock were made by multiplying the number of each type of animal in a county by an estimate of use per animal. Livestock populations were obtained from the Mississippi Department of Agriculture and Commerce (Hugh McWilliams, oral and written commun., 1991), and poultry populations were obtained from Mississippi State University, Poultry Science Department (R.L. Haynes, oral and written commun., 1991). Coefficients for water use per animal were obtained from two sources. Livestock water use per animal was estimated by using the same coefficients used for 1985: dairy cattle, 20 gal/d (gallons per day); other cattle, 10 gal/d; hogs, 3 gal/d. Poultry water use per animal was estimated to be 0.004 gal/d (R.L. Haynes, oral commun., 1991).

Total withdrawals for livestock use were estimated to be 16 Mgal/d for 1990. Ground water was the source for 40 percent of the livestock withdrawals. Total withdrawals for livestock use decreased 4 percent from 1985 to 1990.

SUMMARY

Total freshwater withdrawals in Mississippi during 1990 were estimated to be 3,300 Mgal/d, an increase of 17 percent from 1985, although the total population in the State decreased by about 2 percent during the same period. Ground-water withdrawals accounted for about 80 percent of the total withdrawals in the State, or about 2,700 Mgal/d. This amount is about 33

percent greater than the 1985 total ground-water withdrawals, primarily due to an increase in irrigation. Surface-water withdrawals were estimated to be about 650 Mgal/d, or about 22 percent less than during 1985, primarily due to a decrease in thermoelectric power generation withdrawals.

Total freshwater withdrawals in Mississippi in 1990 for eight categories of use were as follows: irrigation, 1,900 Mgal/d; aquaculture, 400 Mgal/d; thermoelectric power generation, 380 Mgal/d; public supply, 320 Mgal/d; industrial and mining, 270 Mgal/d; domestic, 33 Mgal/d; commercial, 16 Mgal/d; and livestock, 16 Mgal/d.

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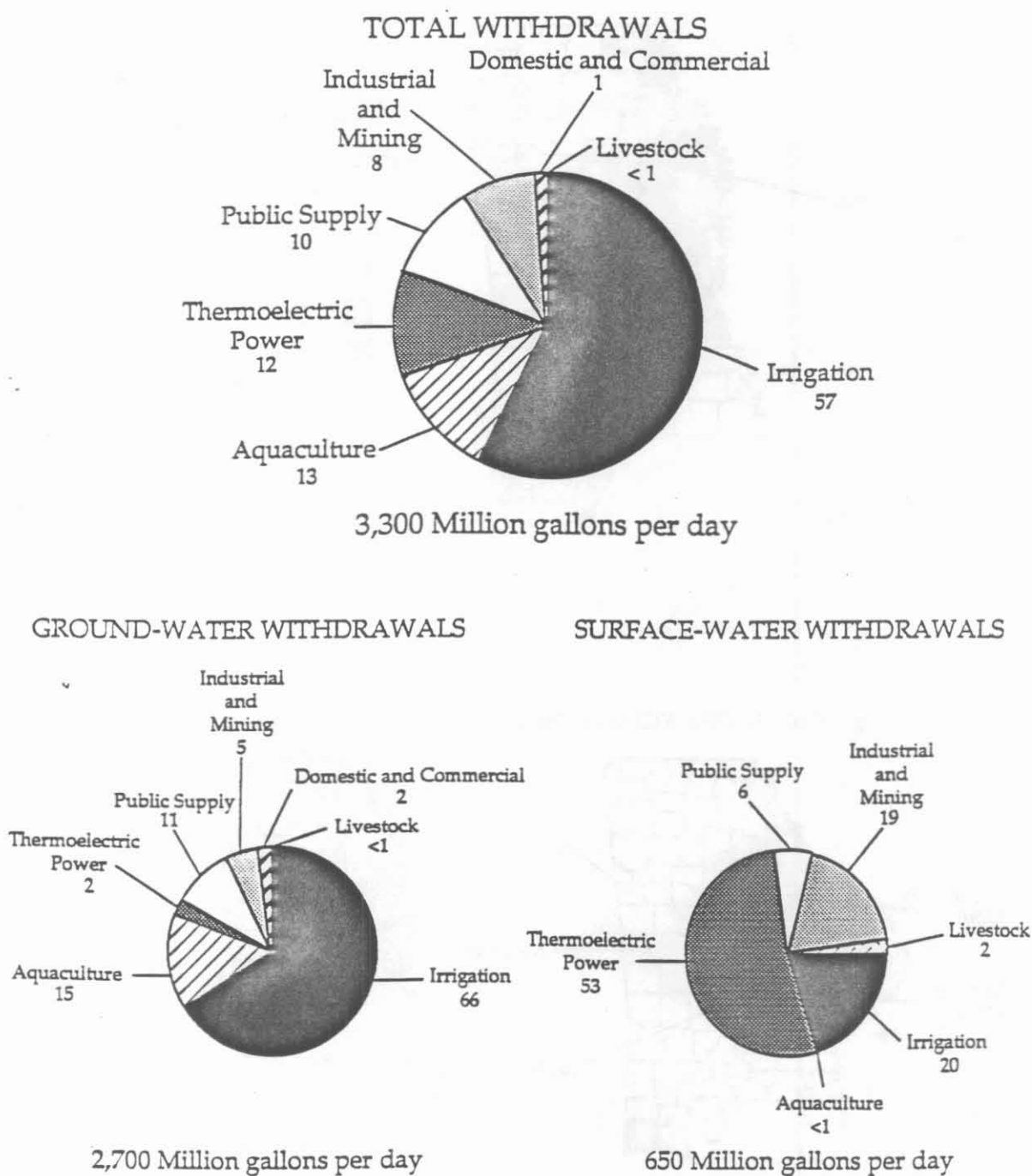
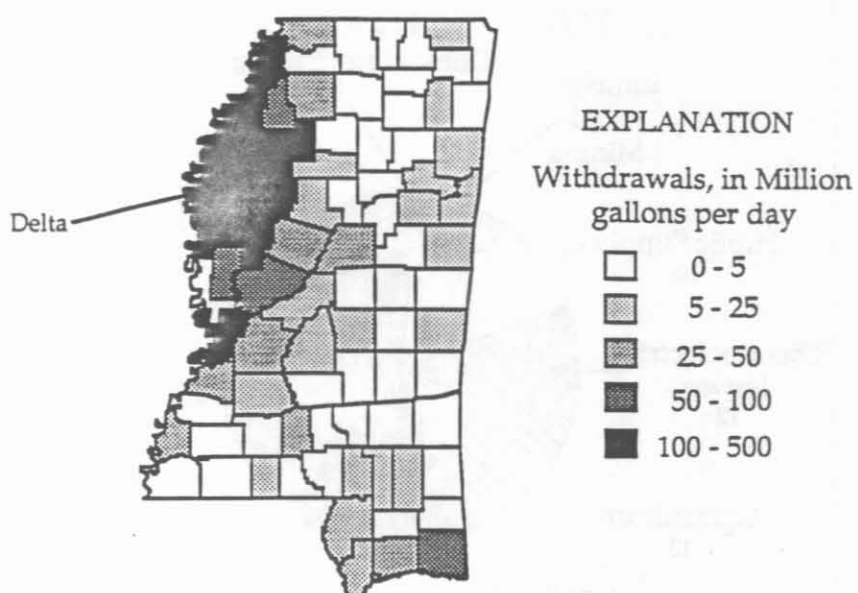


Figure 1.—Total freshwater withdrawals in Mississippi by category of use, 1990.
(Numbers are in percent and may total to more than 100 due to rounding.)

TOTAL WITHDRAWALS



SURFACE-WATER WITHDRAWALS

GROUND-WATER WITHDRAWALS

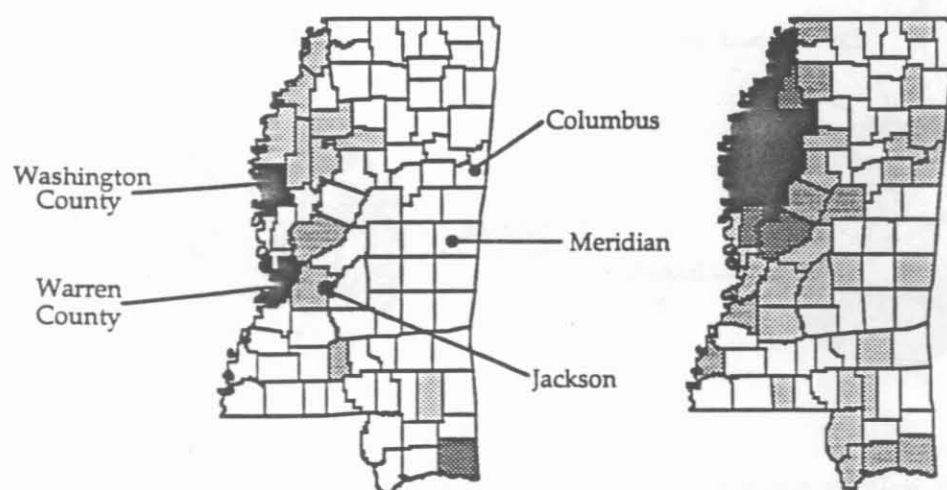


Figure 2.—Total freshwater withdrawals for all offstream water-use categories, by county and source, 1990.