# BENCHMARK FARMS FOR ESTIMATING IRRIGATION WATER USE IN GEORGIA

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## INTRODUCTION

During 1950, there was very little irrigated cropland in Georgia. By 1990, an estimated 441 million gallons per day (Mgal/d) was being withdrawn for the irrigation of 1.2 million acres of cropland (Fanning, 1992). Of the water used, 59 percent was ground water and 41 percent surface water (streams and ponds). During 1990, about 26 percent of all ground water used in Georgia was for irrigation. Currently, there are an estimated 22,000 irrigators in Georgia.

A law was enacted by the Georgia Legislature in 1988 that requires a permit for each irrigation water source exceeding 100,000 gal/d in water use. The Georgia Department of Natural Resources, Environmental Protection Division, Water Resources Management Branch (WRMB) is responsible for the issuance and monitoring of these permits. To date, 19,000 irrigation sources have been permitted.

Although many irrigation sources are permitted, users are not required to meter or report water withdrawn for irrigation, making actual irrigation water-use difficult to estimate. Currently, irrigation water use is estimated by the Georgia Water-Use Program (GWUP), a joint project of the U.S. Geological Survey (USGS) and the Georgia Geologic Survey. Estimates are made by using acres irrigated per crop multiplied by the average volume of water (in inches) applied per crop. Data on irrigated acreage and application rates are provided from a survey conducted by the University of Georgia, Cooperative Extension Service (CES). The current method of estimation does not address crop rotation, types of irrigation systems, locality, seasonality, or varying water-application rates, and is limited by the accuracy of the CES survey results. The USGS in cooperation with WRMB and the University of Georgia Agricultural Experiment Station (AES) is conducting a benchmark farm study to improve agricultural water-use estimating techniques.

## OBJECTIVE

The objective of the USGS, WRMB, and AES benchmark farm study is to establish an irrigation monitoring network in 32 counties in southwestern Georgia (fig. 1) to evaluate and possibly improve currently used methods for estimating irrigation water use. The study will provide project personnel from the three agencies an opportunity to monitor irrigation activities at typical farms having irrigation permits.

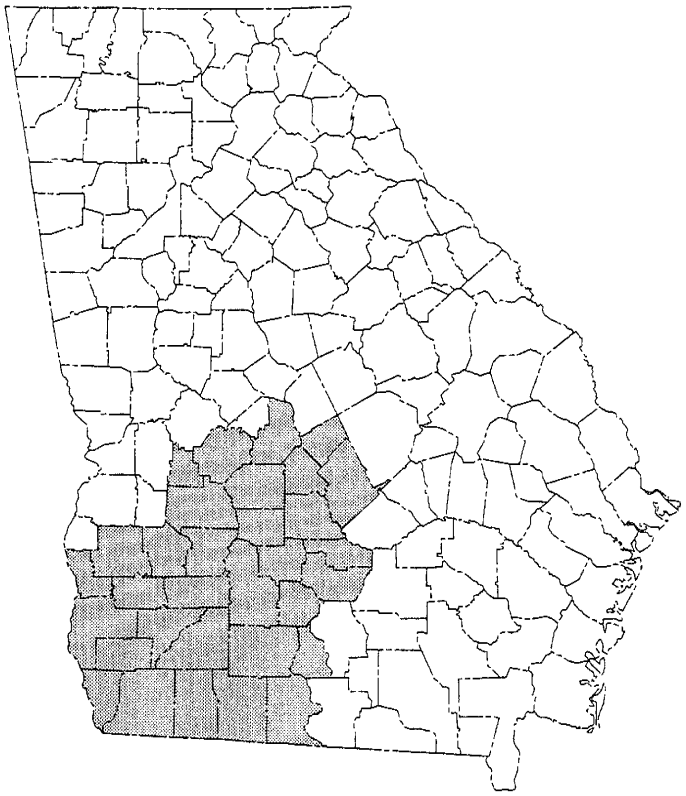

**Figure 1. Benchmark farms study area.**

## APPROACH

An initial survey of a stratified random sampling of 500 permitted irrigators has been conducted by USGS using water source and locality as critical elements. The survey consists of a few easy-to-answer questions: is the farm owner willing to participate in the study (participation is strictly voluntary); how many water-application systems does the pump supply; is the pump diesel or electric; and what crops are irrigated. The farmers were asked to provide information on any changes in their irrigation systems and irrigation practices during the previous five years, particularly whether the system was in use at all. Free efficiency checks of irrigation systems are offered to attract interest. Farmer participation is crucial; thus, a second survey or telephone calls to farmers who did not respond to the first survey may be necessary.

Each site must meet several criteria to be chosen for the benchmark study. Each site must have similar crop type, irrigation system, and pump to other sites in the area; and the discharge pipe must be accessible and suitable for installing a time totalizer and non-invasive flowmeter.

The benchmark network, if fully implemented, would include at least 200 sites, or about 1 percent of the 22,000 irrigation sites in Georgia. A pilot study of 50 selected sites will be conducted during 1995. Irrigation frequency and rate will be monitored using vibration or inductive time totalizers and non-invasive flowmeters at each of the 50 sites. Data will be used to estimate application rates for irrigated crops.

After a site has been selected for the benchmark farm study, it will be visited and assigned a site number. During the initial site visit, the farmer will be interviewed by project personnel and the site will be inspected to determine the pump configuration and confirm the location of the water source and irrigation system. A good location for the flowmeter measurements also will be determined during this visit. Pump data, such as make, horsepower, power source, and capacity, will be recorded. Two vibration or inductive time totalizers will be placed on the pump or irrigation system. Also, for ground-water systems, a static water level in the well will be measured and recorded. Rain gages also may be placed in the field beneath some irrigation systems to measure rainfall and the water applied by the system. Photographs will be taken of the equipment installation to mark the location where the flowmeter measurement is taken.

A second visit to each selected farm will be made during the growing season. A flowmeter will be placed on the pipe and two flow measurements made. During the irrigation season, periodic checks of the time-totalizers will be made by project personnel. During the data-collection period, farmers will record readings from the rain gages and time totalizers onto postcards and mail information to the project office on a weekly and monthly basis, respectively. A final visit to each farm will be made at the conclusion of the data-collection period for an additional flowmeter measurement and the ground-water level will be remeasured.

Flowmeter measurements, rain-gage readings, and time-totalizer readings will be compiled and entered into a computer database. Data analysis will include a comparison of measured versus conventionally estimated irrigation rates. The 500-site random sample will be used to analyze the number of permitted sites in the 32-county area that are not withdrawing water for irrigation purposes. This analysis will provide an upper limit on estimated irrigation withdrawals by providing data on the permitted irrigation pump capacity that is in use, as opposed to the total permitted capacity. The 50-site pilot study does not represent a statistically valid sample for estimating actual irrigation withdrawals, but will establish the core of an irrigation-monitoring network and provide some site-specific irrigation water-use data (which is currently unavailable). This study also will determine the costs, manpower needs, and feasibility of the use of time-totalizers and non-invasive flowmeters in Georgia. Each participating farmer will receive a written account of all data collected at their farm or farms.

## SUMMARY

State and local officials need accurate data to quantify irrigation withdrawals. A pilot study of 50 selected benchmark farms will be made to test and improve current methods of estimating irrigation water use. If the pilot study is successful, the study may be expanded to include a statistically significant network of sites. The study will provide an estimate of water-application rates for various crops and sources at 50 pilot sites and make a statistical determination of the percentage of inactive permits in the 32-county area. These estimates will provide an upper limit on estimated irrigation water withdrawals by providing data on the permitted irrigation pump capacity that is in use, as opposed to the total permitted capacity.

## LITERATURE CITED

Fanning, J.L., Doonan, G.D., and Montgomery, L.T., 1992 Water use in Georgia by county for 1990: Georgia Geologic Survey Information Circular 90, 98p.