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Projected 1992 Groundwater Levels On the Arkansas Grand Prairie

Richard C. Peralta and Aminollah Yazdanian

The Arkansas Grand Prairie has been a major rice producing area for most of this century. The irrigation water required for rice, and at the present time, for soybeans, is primarily obtained from a Quaternary aquifer. This extensive formation underlies much of eastern Arkansas as well as parts of other states. Groundwater enters the Grand Prairie region from extensions of the aquifer lying outside of the area. Prolonged pumping of water from the aquifer at a rate exceeding the recharge rate has significantly reduced Quaternary groundwater levels in the Grand Prairie.

Research was conducted to project the changes in Quaternary groundwater levels from 1982-1992 for a study area encompassing the Arkansas Grand Prairie (Fig. 1) using a computer simulation model. The study area is bounded by the White River on the east, the Arkansas Post Canal on the south and the Bayou Meto on the west. The study area was divided into cells 3 miles by 3 miles in size.

The major users of Quaternary groundwater in the Grand Prairie are agriculture, aquaculture and municipalities. Estimates of water use in each cell were based on historical aquacultural, rice and irrigated soybean acreages; climatological data; and municipal use. A groundwater computer simulation model was validated for the period 1972-1982. Tests verified that it would accurately predict changes in groundwater levels ten years into the future.

Simulations were performed to estimate water levels in 1992 if "current" pumping continues. In this test, 1982 crop acreages, average climatological conditions and historical aquacultural and municipal pumping were used for each year from 1982 to 1991. The predicted change in water levels shown in Figure 2a is based on the rather optimistic assumption that the average groundwater levels which were observed in the boundary cells from 1972 to 1982 would continue to exist between 1982-92. Boundary cell water levels might more realistically be expected to follow the trend established in 1972-1982. In that situation, resulting 1992 water levels (Figure 2b) show an even more dramatic decline. In both figures, 1992 water levels are subtracted from 1982 levels. A negative value represents a drop in the water level in the cell. The drop in water levels is especially marked in the north-central part of the Grand Prairie where declines of up to 26 feet can be expected by 1992.

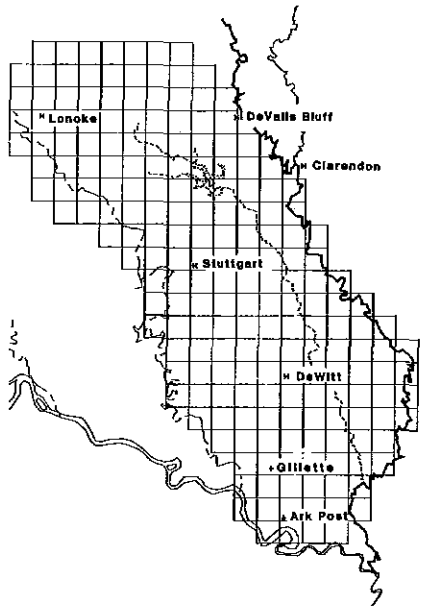

Fig. 1. Grand Prairie study area divided into cells of 3 miles by 3 miles.

Between 1972 and 1982 the volume of groundwater stored in the Quaternary aquifer dropped from 16,640,000 to 15,676,000 acre-feet. This represents a decline of six percent of the 1972 storage. Predicted declines between 1982 and 1992 range from six to nine percent of the 1972 storage volume.

The decline in water table elevation will cause an increase in the cost of raising the water to the ground surface for use. In addition, as saturated thicknesses decline, more users will find it impossible to obtain even the minimum desired discharge from some wells. In 1982 there were about 90 square miles on the Prairie where obtaining a 500gpm yield from the Quaternary aquifer throughout the growing season was doubtful. By 1992, that area will double in size to 180 square miles.

In conclusion, projected declines in Quaternary groundwater levels on parts of the Grand Prairie present a threat to agricultural productivity in those areas beyond 1992. Consequences of the projected declines include higher pumping costs and an increase in the number of unusable wells.

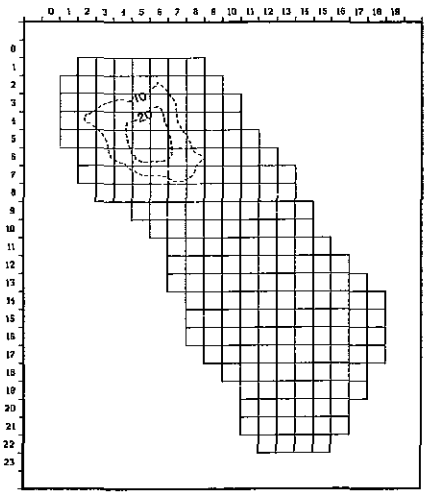

Fig. 2a. Predicted decline in feet in Grand Prairie study area water levels from 1982 to 1992 if boundary cell groundwater elevations are the same as they averaged from 1972-82.

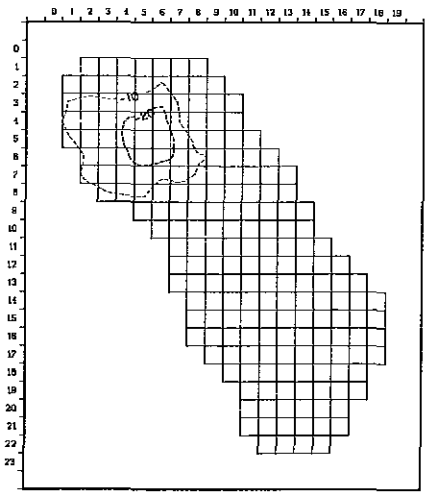

Fig. 2b. Predicted decline in feet in Grand Prairie study area water levels from 1982 to 1992 if boundary cell groundwater elevations continue to decline at the same rate they did between 1972-82.

Dr. Peralta is an assistant professor and Mr. Yazdanian is a graduate assistant in the Department of Agricultural Engineering.