For many years, students living on the Southern High Plains have learned about the Ogallala Aquifer, the region’s main source of irrigation water. When these students learn that the Ogallala is declining in some areas, the first question they ask is undoubtedly, “How long will it last?” Although many generalized estimates have been made, Texas Tech University researchers say the question is difficult to answer because the volume of the underground water source depends upon where one lives.

For the past two years, a research team has been working to map the aquifer and to find an answer to this age-old question. The team is led by Lucia Barbato, senior research associate and associate director of the Center for Geospatial Technology (CGST), Kevin Mulligan, Ph.D., director of the center and associate professor of geography, and Kenneth Rainwater, Ph.D., director of the Water Resources Center.

The research project uses Geographic Information Systems (GIS) to analyze and map the data from thousands of irrigation wells that access the Ogallala.

“Twenty years ago, it would have been very difficult to take on a project like this,” Barbato explains. “Within the last 10 years, however, GIS software has become more mainstream, and we have been able to develop programs to automate the analysis procedures.”

BENEATH THE SURFACE:
Mapping the Ogallala

Lucia Barbato and Kevin Mulligan have investigated the Ogallala Aquifer through mapping data from thousands of irrigation wells.
With the GIS technology, researchers have been working to determine how much water remains in the Ogallala as an 80 foot or more decline over the 15-year study period. The aquifer declines about nine-tenths of a foot each year, but an area where the city of Lubbock has investigated pumping water to irrigate parks in that part of town. On average, the aquifer declines about nine-tenths of a foot each year, but in some areas, the aquifer is going down as much as three feet per year. With their maps, researchers are now able to pinpoint exactly where those declining areas are, Barbato says. “The average saturated thickness of the aquifer in the Texas study area is approximately 103 feet with a range from 28 feet in Oldham County to 282 feet in Roberts County. The total amount of water in storage for the 42 counties in 1990 was 403.5 million acres. In 2004, this amount was 354 million acres. Although the data vary significantly by county, overall the data show a decline of 49.5 million acres or about a 13 percent decline over the 15-year period. That’s slightly less than 1 percent decline per year,” Barbato says. Not only will the team’s research benefit inquiring students, but researchers can use the information to educate farmers about water usage and conservation. For example, Barbato says, “In the southern Ogallala, where the aquifer is thickest, we can start to quantitatively manage the resource.”

The next step in the process was to determine the amount of available water in storage in the aquifer. Not only is water in the aquifer, but the underground water source is mostly gravel and sand with an average saturated thickness of about three feet. The percentage represents the specific yield of the aquifer, Barbato notes. Using the specific yield and saturated thickness information, the team has developed an understanding of the amount of the aquifer that is water.

The team has calculated the saturated thickness, the aquifer volume, and the amount of available water in storage for the entire Texas Ogallala Aquifer and for each of the 42 counties over the 15-year study period. After the research team tackled the well data for Texas, researchers began work on the New Mexico and Oklahoma well data.

“With the GIS technology, researchers have been working to determine how much water remains in the Ogallala as an 80 foot or more decline over the 15-year study period. The aquifer declines about nine-tenths of a foot each year, but in some areas, the aquifer is going down as much as three feet per year. With their maps, researchers are now able to pinpoint exactly where those declining areas are, Barbato says. “The average saturated thickness of the aquifer in the Texas study area is approximately 103 feet with a range from 28 feet in Oldham County to 282 feet in Roberts County. The total amount of water in storage for the 42 counties in 1990 was 403.5 million acres. In 2004, this amount was 354 million acres. Although the data vary significantly by county, overall the data show a decline of 49.5 million acres or about a 13 percent decline over the 15-year period. That’s slightly less than 1 percent decline per year,” Barbato says. Not only will the team’s research benefit inquiring students, but researchers can use the information to educate farmers about water usage and conservation. For example, Barbato says, “In the southern Ogallala, where the aquifer is thickest, we can start to quantitatively manage the resource.”