SITUATED ON THE HIGH LLANO ESTACADO OF WEST TEXAS, Texas Tech University in Lubbock is adjacent to the desert regions of the United States and Mexico, making the region ideal for the study of arid and semiarid lands and water. More than half of Texas, one-third of the United States, and one-third of the Earth is arid or semiarid.

Researchers at Texas Tech have a long legacy of addressing water issues in the region and globally. In 1966, then-Texas Tech President Grover Murray, who had just arrived at the university, established the International Center for Arid and Semiarid Land Studies (ICASALS). The center’s founders hoped to establish the comparative study of arid lands and how people relate to the land from an international perspective.

ICASALS was former President Murray’s brainchild, an inspiration that came to him in the middle of the night during his travels in northern Africa as a consultant for Magnolia Oil. He wanted a program that would set Texas Tech apart and generate wide, perhaps international, recognition for the university. With an array of cross-discipline contributions from the campus, Murray was thinking of solving such problems as how to conserve resources and how to increase the productivity of land in dry climates.

Murray’s early interest in water has continued throughout the university’s research history, and current President Jon Whitmore has declared water to be a major research initiative at Texas Tech. The water initiative involves collaborative teams of faculty and students who represent law, public policy, economics, agriculture, geosciences, engineering, biological sciences, and health sciences, among others, and encompasses all colleges within the university.

ICASALS, with its international partners and in cooperation with other centers and departments across the university, has a huge potential, says Director A.C. Correa, Ph.D. “ICASALS is the only center in Texas and one of only a few in the United States dedicated to the study of all issues related to dry lands. With other centers in Nevada and Arizona, we want to become the third major center in the United States working on dry land research and education projects. Texas Tech has strong research areas in agriculture, geology, remote sensing, water resource management, and wind energy; to mention just a few that define a university niche in dryland-related activities. Another characteristic of ICASALS is its close working relationship with faculty associates in different academic departments and research centers that have well-established connections in all continents. Our present programmatic emphasis is in Latin America, specifically in Mexico, Central and South America, as well as Africa.”

ICASALS is part of the Office of International Affairs, and in 2006, ICASALS celebrated its 40th anniversary with an international conference focusing on water issues in arid and semiarid lands. Speakers at the meeting covered four main areas: water resources, agriculture in arid lands, water law and policy, and natural sciences. The conference was the center’s first in the last 30 years. 

BY KIPPRA D. HOPPER
While the water stress we now are encountering in Texas and globally is serious, in terms of the availability of fresh water, it is nothing compared to what may be in our future.

The Water Law and Policy Center strives to generate relevant and timely information to the public and to local, regional, state and national policymakers, legislators, and political, economic, and social interest groups to enhance water-related decision-making processes.

The collaboration of Texas Tech researchers and their colleagues across the globe encompass studies of reclamation of polluted water and wastewater reuse, to conservation of playa lakes wetland and the preservation of the Ogallala Aquifer, to the economics of water use by farmers on the High Plains, to health problems related to water consumption, and to laws governing water worldwide.

The Water Resources Center researches share resources and try to minimise the impact of detriments to the environment, a theme of the center since it was established. The CASNR Water Center researchers have done work related to water for decades, often in conjunction with College of Engineering faculty.

"Water issues are escalating in the state and in the world," Eckstein says. "The CASNR Water Center focuses on all aspects of water use and conservation in both the urban and rural landscapes through research and outreach. We want to educate our own students, but we also are providing information to the general public and policy makers. We think outreach is an extension of research so that people will be more aware of water issues. Agriculture has a long tradition of educational outreach to the general public."

Eckstein, the George W. McCluskey Professor of Water Law at the Texas Tech University School of Law, focuses on international issues, especially those that involve tranboundary freshwater resources, and he stresses that water is a global concern. Interdisciplinary researchers with the School Law Center for Water Law and Policy are studying, reviewing and offering recommendations for new regulations as well as amendments to existing laws. Eckstein’s water issue research interests cover areas such as Europe, the Middle East and Mexico. He currently is advising the United Nations on developing rules for governing aquifers that straddle two countries or sit on the border, so that issues, such as who controls the aquifer, do not evolve into conflict.

"We have rules that make political sense, but they sometimes make no scientific sense at all. So, we are trying to bridge that gap and establish universal rules understood by all fields. This center is meant to be a place for learning and education, with think-tank capabilities, and operating on all levels from local to international. A lot of work at Texas Tech focuses on irrigation, crop selection, and cultivation practices that affect how much water people take out of the aquifer."

The College of Agricultural Sciences and Natural Resources also is broad, including disciplines such as range and wildlife, and natural and social sciences. The hydrologist housed in the College of Engineering has collaborated with the agricultural science researchers as long as Texas Tech has been doing research. National issues, especially those that involve tranboundary freshwater resources, are an area of study and research.

Agriculture has a long tradition of educational outreach to the general public. Whether they result in conflict or cooperation is yet to be seen."

One of the university’s larger multidisciplinary projects is the Federal Ogallala Initiative in which Texas Tech is the lead institution. The university joined with the Agricultural Research Service of the U.S. Department of Agriculture, Kansas State University, West Texas A&M University, Texas Cooperative Extension, and the Texas Agricultural Experiment Station to collaborate on their efforts on many different aspects of research on the Ogallala Aquifer. The Ogallala is an underground source of water that extends throughout the Great Plains.

The Water Resources Center researchers started realizing that the Ogallala Aquifer was not everlasting, they started studying the processes of hydrology and agriculture and how they work together, Raiman says. People don’t need to feel a sacred connection to it, and they are very different from urban people in terms of their views about agriculture, ranching and water conservation. A lot of work at Texas Tech focuses on irrigation, crop selection, and cultivation practices that affect how much water people take out of the aquifer."

The researchers across the region are coordinating their models of each area of the aquifer. We already know some things about the Ogallala, and we are building on that,” says Ethridge, who continues to work on the agricultural economy. “On the economic side in the southern portion of the aquifer, we already have some results that compare different ways of regulating the pumping from the Ogallala, and how much effect the regulations would have on both water withdrawal and economic impacts. The Ogallala Aquifer’s conditions are so different across the region that it may make sense to sit a task force international to international level, but probably is not. If you try to impose a one-policy scenario on the whole region, it probably is going to be what an economist would call a sub-optimal solution. Then that raises the question of how can policymakers cope with that? We learn more as we go, and that is always the case with research.”

“In most places, water is way too cheap,” Ethridge comments. “We talk about water scarcity, but scarcity is only created by prices being too low. Fundamentally, you create scarcity by anything being underpaid. So, should we charge more for water? Is value judgment. Water issues are extremely complex, and we have to look at water in a social context.”

“We can look at the evolution of the Plains here, just as a microcosm of the world, which is just a tiny speck on the globe. Before Western Europeans came to the United States, only Native Americans occupied the land. In certain localities, water may have been scarce, but in general, there was plenty of water,” Ethridge says. “But thinking about the population that later lived upon the Plains, we see that the numbers of people did not grow very much until the population really expanded when irrigation was introduced after World War II. The greater population and agricultural production now here is using that water. When the water is used up, are we going to import water, or is the population going to go down?”

Heavy irrigation of the region began in the 1950s. Rainwater makes the point that the current United States farm legislation encourages crop irrigation. “We must recognize that in some places, we will not be able to irrigate forever,” Rainwater...
Rainwater’s opinion about how long the region will have sustainable water to continue current agricultural production depends on what “sustainable” means. In the mid-1990s, when the Water Resources Center began its involvement in regional recharge projects, the High Plains of Texas, Rainwater asked irrigation experts to predict how much water per year would be needed to grow cotton and to maximize the yields.

“We were told to plug into our model the figure of 18 inches per year in places where it rains intensively. We found that the pumping rates required for that amount of irrigation would lead to virtually complete depletion of groundwater in 15 or 20 years in some parts of the aquifer,” he says. “Based on the model results, it was apparent that, for the aquifer to still be here, that irrigating farmers have been using significantly less than that high irrigation estimate, and that irrigation from the aquifer has been greater than previously estimated. So, the region’s groundwater is not necessarily going away as fast as people might have predicted.”

Texas Tech researchers Lucia Barbato and C. Mark Eckstein began their Center for Geospatial Technology have made maps of how much depletion the region has each year. The researchers can compare water injection rates with the water people have in current storage on the depths of water tables and the base of aquifers across the region.

“There is a big difference in how much saturated thickness that exists across regions, across parts of the aquifer. Some places do not have much saturated thickness, while other places have a couple of hundred feet of saturated thickness. Sustainability is very different,” Rainwater explains. “How much pumping the water from the ground costs depends on how deep the water is. If we are depleting the aquifer, that distance gets further, and the amount of money it costs to pump the water is directly proportional to that distance.”

The economists in the College of Agricultural Sciences and Natural Resources focus partially on water use efficiency. “Given the quantity of water available, how do you spread it among the competing various uses to create the most income, the greatest economic benefit?” asks Ethridge. “And, how do you allocate the water over time so as to extract the most economic benefit? We are sitting on top of a ground water resource here that we are mining. To not mines it all at the same time we derive no economic benefit from it, so that doesn’t make any sense. But if we have a finite resource that can’t last forever we use it, what’s the optimal time to use it so as to extract the most from it? These are questions of economic efficiency of utilization of the resource.”

Another multidisciplinary project involves researchers along with producers who are looking at improving groundwater management on the South Plains. Texas Tech is working with the Texas Agricultural Experiment Station, the Texas Agricultural Extension Service, the U.S. Department of Agriculture, the High Plains Underground Water Conservation District, and the Natural Resource Conservation Service and involves 26 sites, including Rainwater’s. In this demonstration project, funded with $6 million from the Texas Water Development Board, researchers are collaborating with 26 cooperating farms with the most diverse sites in one locality on the High Plains, Ethridge says. “We have everything from straight cotton production to diverse operations with some cotton and hay and livestock operations,” he says. “I’m impressed with what our researchers have been able to put together to gather massive amounts of data, and therefore, many possibilities. A lot of this type of precise data has not been obtained under field conditions before, so water efficiency up to now has been more hypothetical.”

Researchers are trying to find a balance of the best water conservation technology – the most efficient, economically feasible, water efficient technology - that will sustain agricultural income over a long period of time. One answer may involve the integration of crop operations with livestock operations, he suggests. The 26 farmers involved with the project also are closely observing the research and making their own recommendations. The farmers will make the decisions about what changes to make in their own operations next year, and the team of researchers will track the changes, collecting data again next year. College of Agricultural Sciences and Agricultural researchers are monitoring each of the 26 sites to measure the water amount that goes on each crop.

Another project is examining aquifer recharge from playa lakes. A hydrologist, Rainwater suggests that the measurements taken at the sites likely will indicate how people have underestimated how much water returns to the Ogallala Aquifer as recharge. Water reaches the underground water source through either natural recharge of infiltrating rainfall or by crops can use the water. Researchers from the civil engineering, plant and soil science, and natural resource management departments, in cooperation with the Texas A & M, are placing instrumentation at as many playa sites as possible in hopes that they can see how much of the rain is being left behind and how much is going down and how much seeps into the subsoil. They are comparing in each county is one playa was considered as the poster child for the potential positive and negative. The United States is extremely water rich, although not in the South or Southwest, but Mexico is water poor throughout. Population growths are different, and water needs are different in the two countries. So, how much do we allocate to each country? Do we do it based on need? Well, that means Mexico should get most of it. Do we do it based on geography, where most of the Great Plains, South or Southwest? Mexico should get most of it. Does that mean that the United States should get the remaining water? Should we base allocation on some other principle of law? While there is some international law on this topic, the matter is far from settled.”

Texas Tech is continuing its heritage of exploring issues pertaining to water in the Southwest region, but to the world as well. Early pioneers of the university, like Grover Murray, recognized that water was and always will be a major factor in West Texas. Today’s researchers know that the century may well be the century for dealing with water as our life source.