

# the Playas

Written By Jurad Foster  
Illustrated by Katie Decker

# of the

# Ogallala



*The Ogallala Aquifer, the largest underground water resource for the U. S. Great Plains, has had a front row seat to very unique and drastic environmental changes throughout time. What was once a large expanse of rolling, open prairies inhabited by Native Americans, early western settlers, and abundant American Bison, the Great Plains has been transformed into one of the most intensely agricultural driven environments in the world. One aspect of the Great Plains that has remained is the presence of a unique wetland system dotting the landscape – playas. Throughout the years, these internationally recognized features of the landscape have provided habitat and shelter for wildlife and have played an integral role in shaping the agricultural façade of the Plains. Playas also offer scientists and other researchers a subject of interest that unveils one of the playa's most vital characteristics—they serve as the primary source of water recharge to the Ogallala Aquifer.*

The Ogallala Initiative Playa Research Team was formed at Texas Tech University to further investigate the importance of playas to aquifer recharge and to determine the best playa management techniques for the sustainability of the Ogallala. Several of the university's top water, soils, and conservation researchers work on the team, including Ken Rainwater, Ph.D., P.E., an engineering professor and director of the Water Resources Center, Richard Zartman, Ph.D., professor in plant and soil science, Loren Smith, Ph.D., professor in range, wildlife, and fisheries management, and Wayne Hudnall, Ph.D., professor in plant and soil science. Dennis Gitz, Ph.D., a plant physiologist with the United States Department of Agriculture, is also a key member of the

Researchers estimate that more than 25,000 playas exist

team. With national and international support, as well as funding from the Ogallala Initiative, which is a research support program granted to four universities in 2003, the team will try to uncover some of the more intriguing questions not answered about playas and their ability to contribute greatly to society.

Playas, often referred to as playa lakes, are among the world's most unique ecosystems, and today are one of the least known and underappreciated resources to the High Plains' population. Researchers' definitions of a 'playa' vary regionally, some describing playas as shallow water holes similar to prairie potholes that receive water infrequently over time. Others define playas as fairly large water discharge zones. The origin and development theories of playas are as varied as their definition. In his book, *Playas of the Great Plains*, (University of Texas Press, 2003), author Loren Smith provides specific details concerning playa wetlands, and he compiles various theories of origin and development from other researchers. The book states that some researchers believe the playas are a result of dissolution, the movement of calcium carbonates in an outward fashion forming the roundness of playas, while other researchers believe wind plays a large part in form-

ing the depression-like characteristics of a playa. Still, the belief remains that playas are in part a result of buffalos wallowing in the surface water during the time in which these animals were plentiful and independently roamed the Plains. Regardless of any one specific theory of origin and development, Smith summarizes that playa lakes are created by a combination of these forces, and researchers may never know which component is the most significant in playa formation. Very little literature exists about playas and playa research as a result of limited knowledge about the Great Plains when compared to the remainder of the United States' ecoregions. Because of the large number of playas that exist within private lands, research also has been limited. According to Smith's *Playas of the Great Plains*, researchers estimate that more than 25,000 playas exist, ranging from western Nebraska and Kansas, to eastern Colorado and New Mexico, to the Southern High Plains of Texas. These playas are a feature of the semi-arid to arid landscape of the Great Plains, and they play a vital part in the make up of the ecological environment.

The changes in the prairie over time to a predominantly agricultural setting has greatly affected the way in which playas operate as recharge centers and as habitats for life on

the Plains. The Ogallala Initiative Playa Research Team members at Texas Tech focus much of their efforts on looking at the way water is managed in and near playas and exploring whether the playas offer hope for a quickly depleting water resource below the surface. Two key issues the team is concentrating on are the locations within a playa where water recharges the aquifer, and whether sediment influences how water makes it to the aquifer.

"We need to realize the importance of this topic," Zartman says. "Fifty years from now, irrigation may be displaced due to costs and affordability. We may be on a much more systems approach for water management rather than irrigation." Zartman, who has spent 32 years at Texas Tech studying water management, is a member of the team concentrating on water moving into the soil. "It's a team, and it's like looking at an elephant: you look at its tail, its tusks, its feet, and so on," Zartman explains. "However, all of us are looking at the same thing – how much water gets into the playa and then partitioning that water once it is in the playa."

Zartman's specific study of water infiltration includes equipping a number of playas with infiltrometers, devices that measure how much and how fast water moves through the soil once

water reaches the playa. Each infiltrometer is instrumented with thermo-couples to determine differences in the temperature within the ground. When water is present, the ground temperature differs from when water is not present. Ultimately, this will help the team determine the location of the water in the ground. The research playas contain weather stations as well, where environmental data, such as rainfall, sunlight, wind speed, and wind direction, is collected and downloaded once a week.

Using these instruments allows Zartman the opportunity to determine the effect that sediments have on water infiltration. Zartman explains that row crops, such as cotton and grain sorghum, and the majority of the cultivated land in the area of study have high yields of water and sediment runoff. "This runoff decreases the total volume of water a playa can hold, and the water spreads out. As a result, this allows more evaporation to take place, and our hypothesis will test whether this negatively affects the amount of water that is held in the playas, and in return, is transferred to the Ogallala Aquifer," he says.

Because the Southern High Plains is such an agriculturally rich environment, sedimentation is an issue that requires special attention in this project. Smith, who has continually studied playas and their characteristics since 1984, is applying his expertise to this aspect of playa recharge. "Playas are filling up with sediments mainly from eroded soils from the agricultural fields surrounding them," Smith says. "We know how this affects wildlife – the sediments fill the playas up and there is less room for water. What we do not know, however, is how the sediments are affecting recharge." Smith explains that a number of conservation programs are in place to maintain wildlife habitat around playas, but no program exists for removal of sediments from playas.

Smith, like Zartman, emphasizes the effects sediments have on playas and their ability to hold water and maintain their roles as aquifer recharge centers. Smith explains the increase in surface area is a result of sedimentation amplifying evaporation, and because of evaporation, less water may be available for recharge. Smith concentrates on sediment depths, analyzing and estimating



these depths, as well as looking at the plant communities that potentially affect water transpiration. “We compare playas that have a great deal of sediment in them to those that do not,” Smith says, and explains that less than 5 percent of the 25,000 playas exist in native grassland settings and are unaffected by sedimentation. “Probes are stationed in sedimented and non-sedimented settings, and then recharge rates can be compared, and the effects that sediments have on recharge can be investigated.”

Smith explains that placing instruments near as many playas as possible with probes will help apply any discovered information to the entire region containing playas. “We would like to instrument 30 or 40 playas scattered throughout the High Plains,” Smith says. “One of the problems that we have talked about in the past is not having enough playas under analysis. From an experimental perspective, we are trying to sample as many as possible, so that when we make a statement as to how much recharge there is in a particular playa, for instance, we can say that with a fair amount of confidence.”

Wayne Hudnall, the team’s soil expert, has spent nearly three decades researching environmental problems associated with soils and the complete study of their formation. His particular role within the team lends him the opportunity to study different soils in and on the edge of playas as well as studying how water moves in relation to the soils. In determining the playa soil makeup, Hudnall is able to also determine historic details about the playa’s sediment formation. Carbon structures within the soils have a variety of sources, and by analyzing which carbon isotopes are present in the soils, Hudnall and his smaller team of researchers can determine where the sediments originated. “We have already sampled down to more than 2 meters in the playas,” Hudnall says, explaining his work on the same playas Zartman has instrumented. “We look for those certain isotopes that may hold the key to past history. A large amount of sand and silt comprise the sediment, and that holds true for both pasture and crop as well.”

Hudnall explains that the original surface, or the bottom of the playa, is made up of 35 to 40 percent clay with very little sand in the mixture. According to Hudnall, this poses a problem for water movement. “The clay will stop the water from recharging,” Hudnall states, “and it holds water from seeping and refilling.” Channels in the soils need to be present in order for water to travel past these clay layers. However, several questions still surface when analyzing soil formation and water movement. “Some playas hold water much longer than others, and we try to study this question and provide some answers,” Hudnall says. “Some playas seem to have a higher recharge than others and therefore hold more water for longer

periods of time, and we want to find the answers behind that. Using hydraulic conductivity, we can measure the recharge rate of water, and this may provide some of the answers.”

Solutions, or more properly attributed, conservation practices, that could offer maintenance and additional sustainability to the Ogallala are dependent on the team’s research. The Conservation Reserve Program (CRP), a federal program, gives economic incentive for producers to take land out of production, and has acted as a major player in returning a large amount of the Plains prairies to grassland. However, the types of grasses that have been planted around playas have not helped much because they are exotics impeding water flow relative to natives. Smith explains that characteristics of exotics, such as vegetation height and thickness, could have adverse effects on water movement and recharge.

Other conservation implementations the team proposes range from simply establishing buffer strips of native, hydro-movement friendly grasses around the exterior of the playas, to practices such as actually digging sediment out of the bottom of playas or creating runoff zones from lands of production that direct water flow to playas and reduce the effects of erosion. The bulk of the research taking place by the team will determine which practices will be utilized and also will help to introduce these practices into legislation for policy. “If sediments impact recharge,” Smith states,

“we could propose conservation programs that put these buffer strips around entire playas. Not only will that help the sediment from entering the playa, aiding the playa in holding water longer, but if the playa holds water longer, we hope that will help with recharge.” Smith stresses, though, that propositions such as these are still questions that need to be answered before any major conservation practices are proposed.

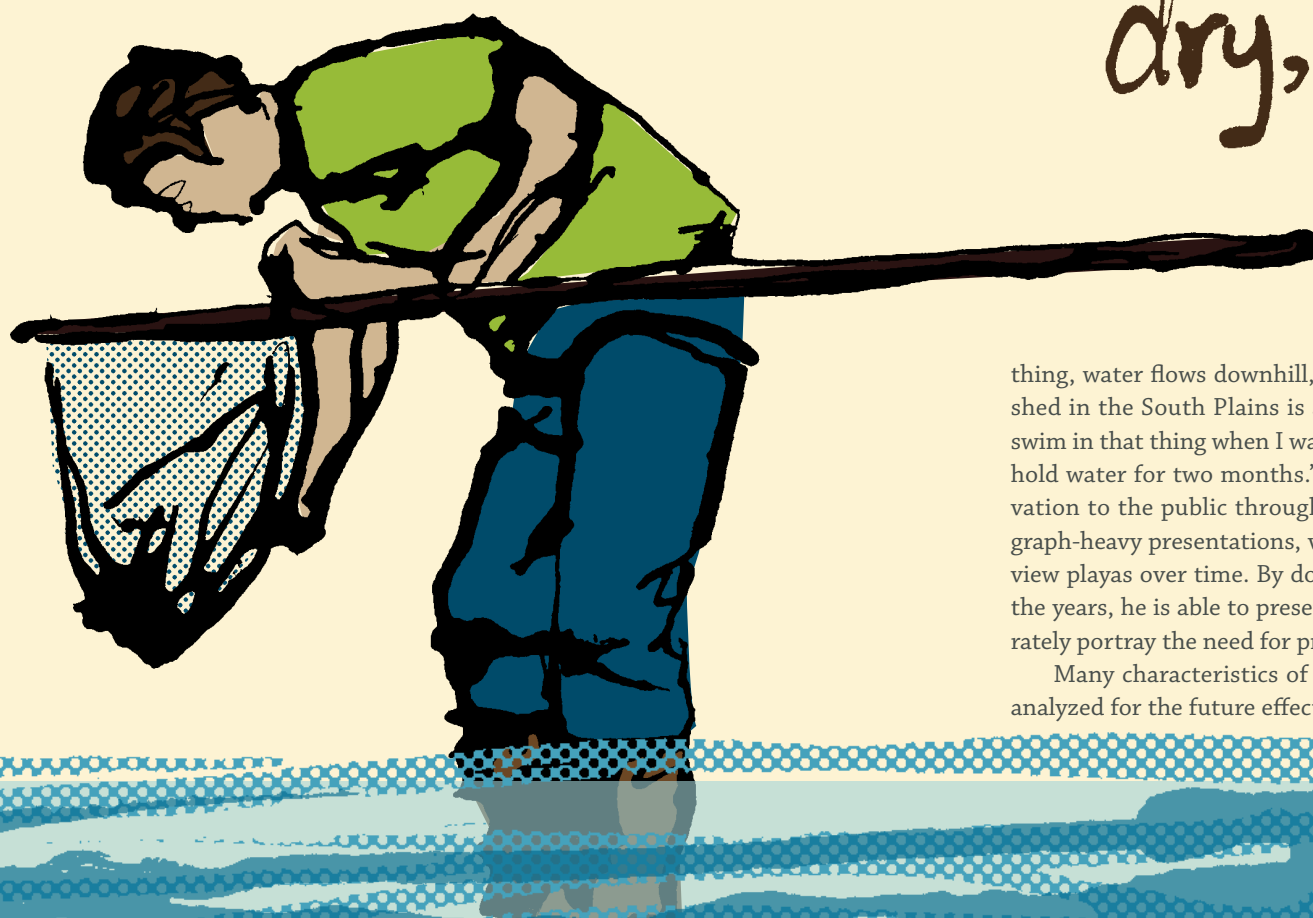
Communicating to the general public about the need for conservation practices for playa wetlands is sometimes a difficult job. “I was talking to a close farmer friend once about playa hydro-periods, or the amount of time a playa will hold water,” Smith says. “We were driving down the road next to his house on the farm he was born on in the late 1920s. He stopped on the road next to a playa, and he said to me, ‘Do you see that? When I used to drive down this road, I’d look down into that playa. Now, it’s level with the road.’ He asked me a rhetorical question, ‘what happened?’ He already knew the answer. It is not an intentional

lala Initiative Playa Research Team. Through all of the currently known information pertaining to playas and the team’s work, one issue looms over all – a warning of what could happen in the near future to the sustainability and use of the Ogallala Aquifer in the High Plains, particularly in the Southern High Plains.

“The study of water management continually has gained momentum and was not previously thought of as necessary because of water’s availability and low cost,” Zartman says. “The effects of this thinking are slowly being pronounced. The efficiency of water used today is much higher than it was 30 years ago, therefore, the proper studies must be done to provide alternatives to these problems.”

While water distribution technology is more efficient, the amount of land under irrigation has multiplied. Aquifer depletion happens at a speed many researchers believe is too fast for recharge and water level retention to occur at current usability rates. The destruction of playa lake systems and their water recharge charac-

“When the well is dry, we will know the worth of water.”  
Benjamin Franklin



teristics play a role in preventing aquifer sustainability. This is an issue that faces everyone inhabiting the nation’s Plains areas and is being tackled by the Ogallala Initiative Playa Research Team. Benjamin Franklin stated in *Poor Richard’s Almanac* that when the well is dry, we will know the worth of water. Researchers at Texas Tech University are taking the precautions now in order to prevent the drying of any wells on the Plains in the future. ■

Many characteristics of playas and playa lake systems will be analyzed for the future effectiveness and productivity by the Ogal-