

Water Abundance and Shortfall in New Mexico from a Statewide Water Budget Perspective



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Alexander "Sam" G. Fernald was appointed director of the New Mexico Water Resources Research Institute (NM WRRI) in July 2013 after having served as interim director since January 2011. As director, he leads the Institute in its mission to develop and disseminate knowledge that will assist the state, region, and nation in solving water resources problems. Dr. Fernald is also the program chair of the Water Science and Management Graduate degree program, where he establishes, initiates, and leads all academic, programmatic, budgetary, administrative, and instructional aspects of the program. Additionally, he is a professor of Watershed Management in the Department of Animal and Range Sciences at New Mexico State University.

Dr. Fernald's earned degrees include a 1987 B.A. in international relations from Stanford University, an M.E.M. in 1993 in water and air resources from Duke University, and a Ph.D. in watershed science from Colorado State University in 1997. He was also a National Research Council Postdoctoral Fellow from 1997-2000 for the U.S. EPA.

New Mexico Water Resources Research Institute collaborated with New Mexico Tech, the New Mexico Bureau of Geology and Mineral Resources, the U.S. Geological Survey, and the New Mexico Office of the State Engineer, to put together the New Mexico Dynamic Statewide Water Budget (NMDSWB) that brings together the main fluxes and storage components of water in New Mexico at four different scales: counties, planning regions, river basins, and the state. The green rectangle in the

middle of Figure 1 corresponds to about 3.7 million acre-feet of water use a year. This information is prepared for the Office of the State Engineer's Water Use by Categories Report. This model compiles about 30 million data points to show the historic period from 1975 to 2018, and estimates some future changes until 2099.

For example, it is really important to understand groundwater storage as illustrated in Figure 2. If you compare Lea County (shown in blue) with Socorro County

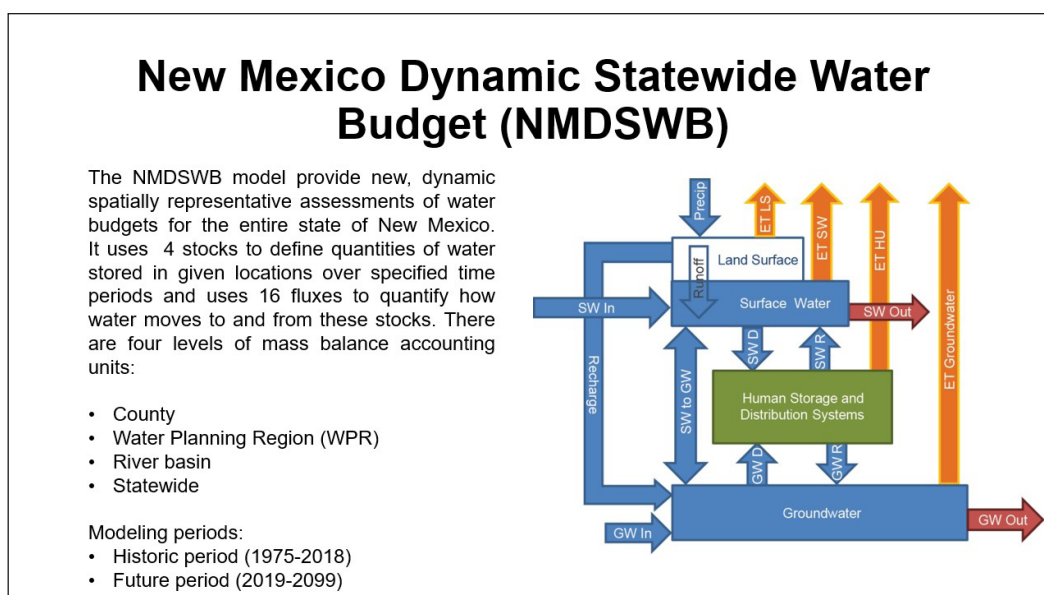


Figure 1. The New Mexico Dynamic Statewide Water Budget (NMDSWB).

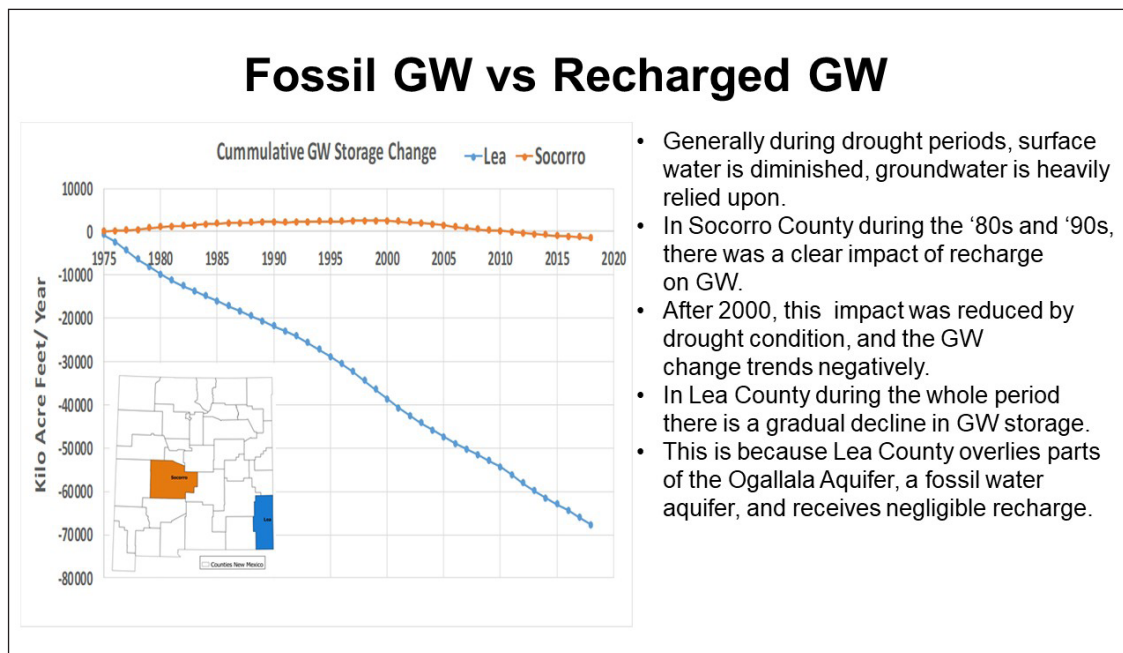


Figure 2. Fossil groundwater versus recharge groundwater in Lea and Socorro Counties.

(shown in orange), you see that Lea County does not have access to a river that recharges groundwater. The aquifer is essentially leftover fossil groundwater, and you will see this continual decline because there is essentially no recharge. On the other hand, if you look at Socorro County, where the Rio Grande is running through the county, we see gradual increases in groundwater storage until the 90s, when that turned around and we saw gradual decreases. Therefore, it is very important to consider recharge when you think about groundwater.

Figure 3 is another picture depicting groundwater depletions in the basin. The Rio Grande is outlined in black, and it fluctuates from year to year. We had more of a declining trend in the 90s, with Rio Arriba County showing little fluctuation and a general long-term equilibrium in groundwater storage. In Bernalillo County, there was depletion until the San Juan–Chama Project diversions began, and then there was less depletion. For the lower Rio Grande in Doña Ana County, we see decreasing groundwater storage and ongoing fluctuations. Different fluctuations occur depending on where you are in the state.

Senator Udall’s comments on the changes in runoff are reflected in Figure 4. In Doña Ana County (shown in orange), we see fewer surface water withdrawals starting in the late 90s and 2000s. Because less surface water is available, there is a concomitant increase in groundwater

withdrawals. Surface water withdrawals in Bernalillo County (shown in blue) increased due to the San Juan–Chama diversion, which led to reduced groundwater withdrawals. Over this same period in Rio Arriba County (shown in green), groundwater withdrawals were unchanged.

Using the NMDSWB, Figure 5 shows that total surface water and groundwater withdrawals for agriculture in Doña Ana County decreased from 1975 to 2018. Return flows, where water goes back to the river through surface water or groundwater, have declined because of changing evapotranspiration and changing irrigation technology. It does not make sense to have as much flood recharge if you are pumping groundwater. Interestingly, depletions (shown in green), that is, the actual water consumed and sent back to the atmosphere, are more or less stable, allowing us to use that information to guide our planning.

Figure 6 shows predicted groundwater storage change. Groundwater diversions (upper right) indicate that high-efficiency agriculture uses less groundwater. By anticipating the future impacts of climate change and variability, we can make a difference with high-efficiency agriculture and reduce our long-term groundwater storage depletion. We can use this research to guide our policy, our technology, and our changes. That concludes my brief tour of the NMDSWB.

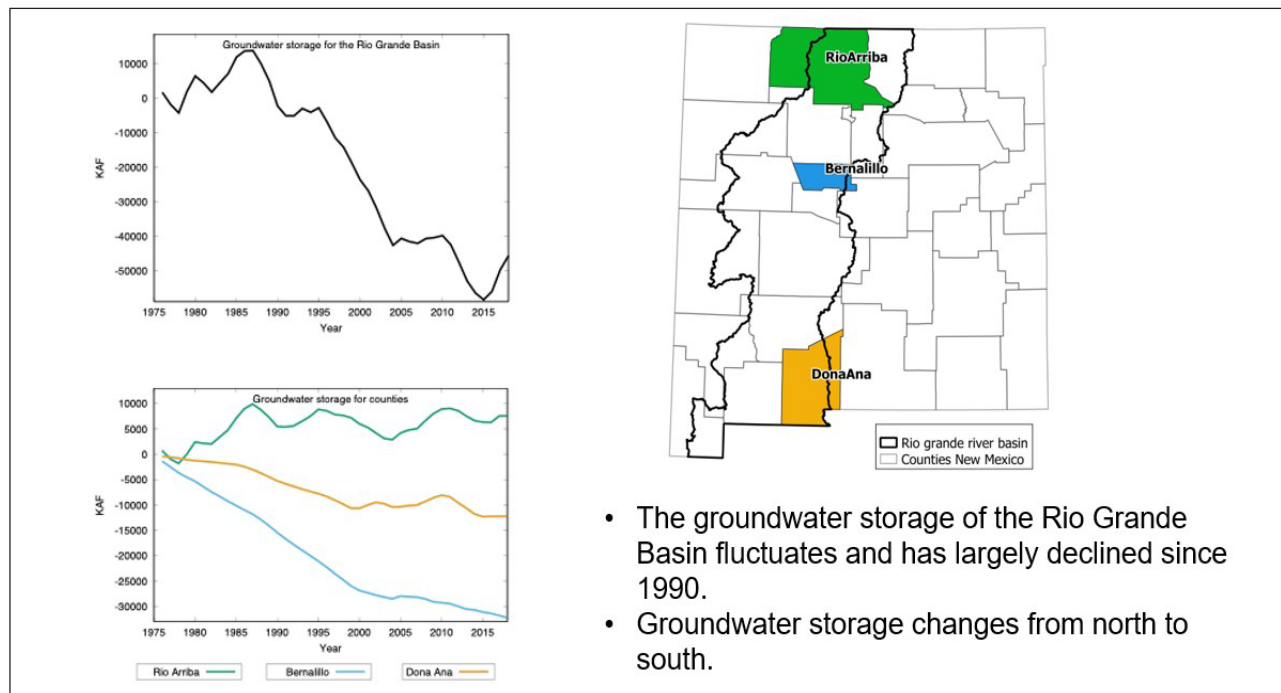


Figure 3. Groundwater depletion in counties.

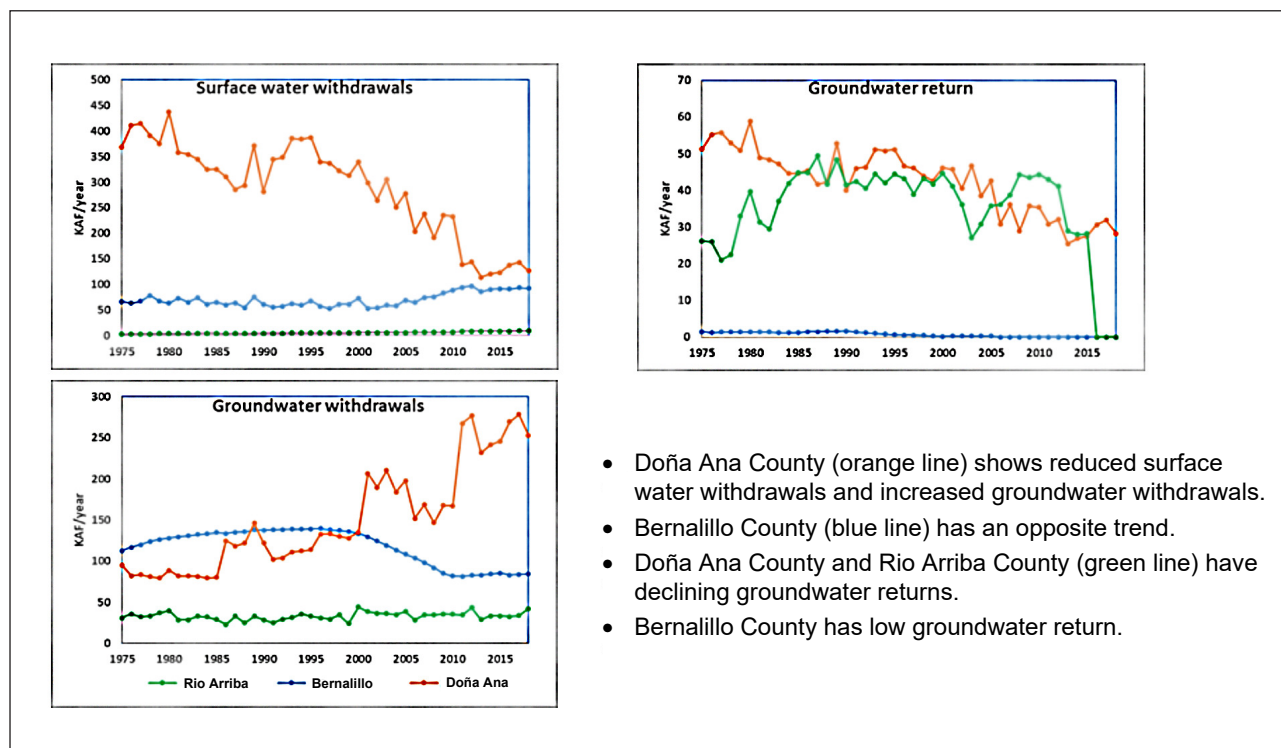


Figure 4. Surface and groundwater withdrawals in Rio Arriba, Bernalillo, and Doña Ana Counties.

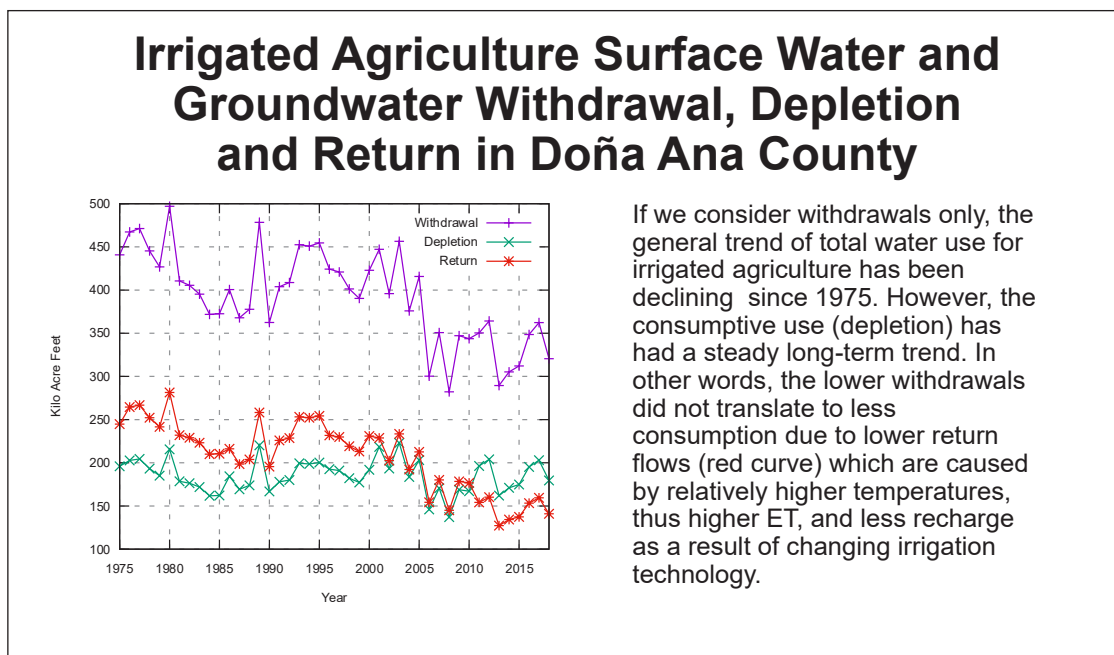


Figure 5. Groundwater withdrawal, depletion, and return in Doña Ana County.

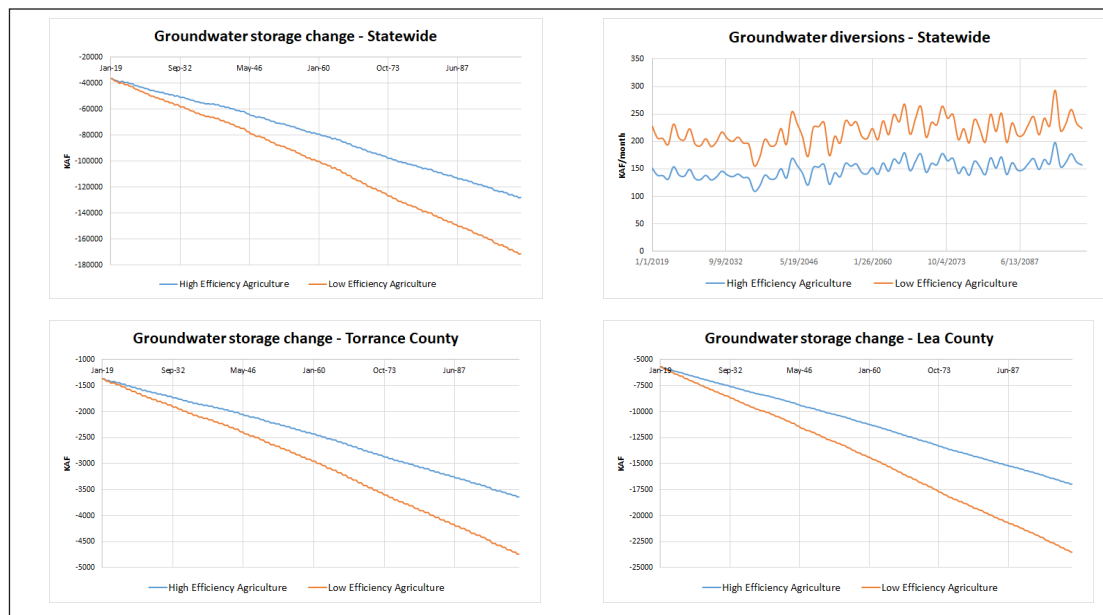


Figure 6. Predicted groundwater storage change (2019–2099).