Coping with Drought on the Rio Grande

By Zack Guido

This article is part one in a series exploring the impacts of the current drought on water management and agriculture in New Mexico's Lower Rio Grande Valley.

Ditch runners—men patrolling irrigation channels—twist open steel gates cut into concrete waterways in New Mexico's Lower Rio Grande River Valley, bathing pecan orchards in water and nurturing vibrant chili plants.

At first sight, all seems a healthy, hydrated green. The upstream reservoirs, however, paint a darker, drier picture—one that water managers believe may be the new normal and will force agriculture to adapt to a diminished water supply.

Water storage in Elephant Butte and Caballo reservoirs, which supply water to about 90,000 acres of farmland in New Mexico and half the population of El Paso, Texas, has plummeted amid a decade-long drought. Stores in both reservoirs stand at less than 10 percent of capacity, and water destined for those pecan trees and chili crops is all but exhausted. Until a string of wet years restocks the reservoirs, agriculture and urban needs will be forced to make up shortfalls using groundwater and other practices.

On the Rio Grande—historically the wellspring for more than five million people in Colorado, New Mexico, Texas, and Mexico—coping with scarcity has become a reality, and water management and use in the region may be a leading example of how to adapt to drier times.

Water Use

The Rio Grande flows about 1,800 miles from the peaks of southern Colorado to the Gulf of Mexico, forming the international border between the U.S. and Mexico. The primary use of water changes with geography. In northern New Mexico, Rio Grande water supplies a substantial portion of urban water needs for Albuquerque, while irrigation draws the most water in the southern part of the state.

Elephant Butte is New Mexico's largest reservoir on the Rio Grande, storing about 2.2 million acre-feet of water. An acre-foot covers one acre of land in one foot of water and satisfies, on average, the annual water needs of about eight Albuquerque residents. The U.S. Bureau of Reclamation jointly manages Elephant Butte with Caballo Reservoir, a smaller structure about 25 miles down river that impounds an additional 350,000 acre-feet. In a good year, these reservoirs release about 790,000 acre-feet; 416,000 is allocated to the Elephant Butte Irrigation district (EBID) in southern New Mexico, and 314,000 and 60,000 acre-feet are passed to Texas and Mexico, respectively.

When flows in the river and storage in Elephant Butte and Caballo reservoirs are sufficient, EBID doles out 36 inches of water per acre of land, which is considered a full irrigation allotment. In some years, EBID has allocated more; recently, the allocation has been less.

"In about 1978, we began a 23-year full-supply of surface water," said Gary Esslinger, director of the Elephant Butte Irrigation District (EBID). "We had plenty of snowpack runoff. The lakes were full. We were just over our heads in surface water."

In 2003, drought set in. It was a wake-up call, Esslinger said.

Dry Times

Low streamflows in the Rio Grande have been, on average, the rule in the past decade. The headwaters above Del Norte, Colorado, where most of the flow in the Rio Grande originates, have been about 83 percent of the historical average since 2002, marking the driest decade since the 1950s and early 1960s. Precipitation in the headwaters has been below average eight of the last 10 years. The low flows have caused storage in Elephant Butte to tank, leaving little water for farmers (*Figure 1*).

"In terms of releasable water, we will be down to zero [by the end of the irrigation

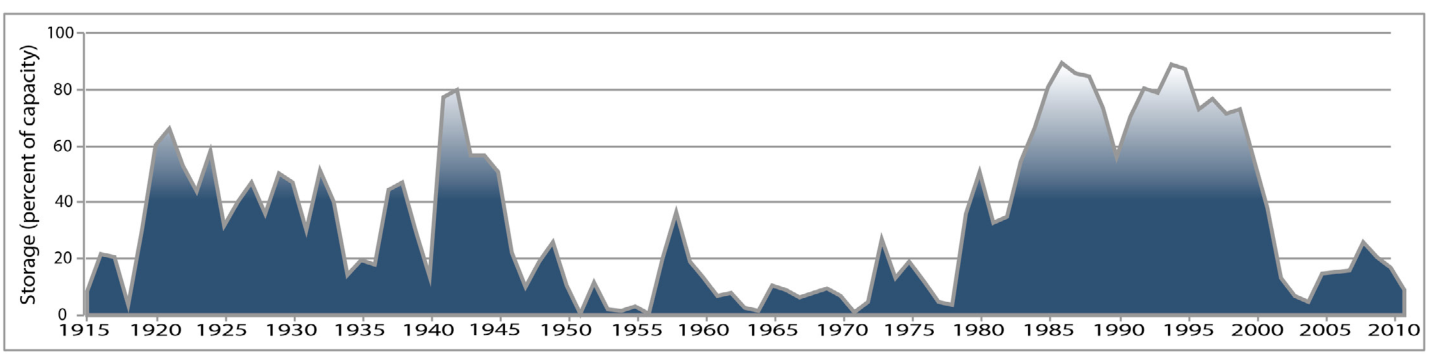

Figure 1. Water stored in Elephant Butte Reservoir (as a percent of its full capacity of 2.195 million acre-feet) at the beginning of the water year on October 1. Source: U.S. Bureau of Reclamation.

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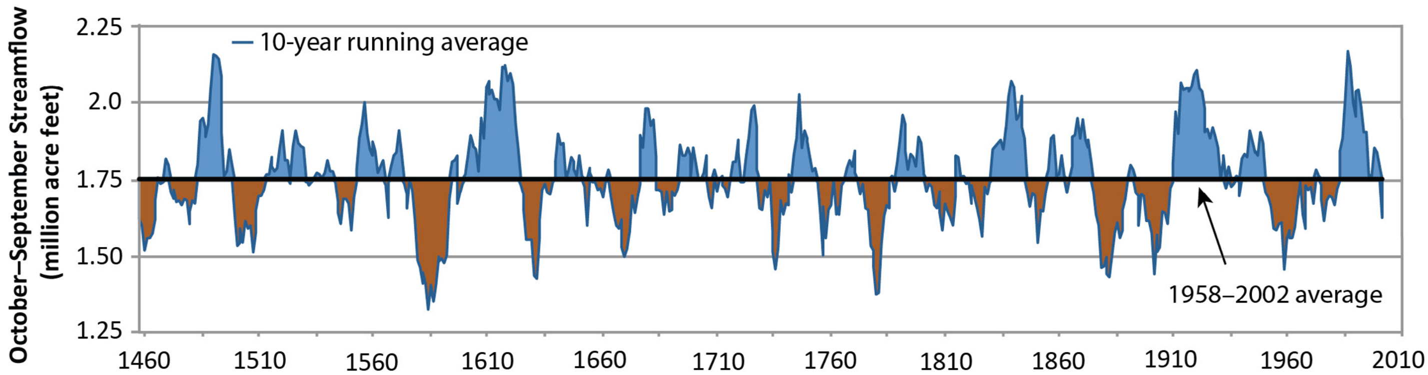

Figure 2. Reconstructed streamflow of the Rio Grande at Otowi Bridge north of Albuquerque. The record was developed using tree rings and published in a peer reviewed article that appeared in *Climate Research* in 2012. Source: www.treeflow.info.

season],” said Phil King, professor of civil engineering at New Mexico State University and an EBID consultant.

The low flows have forced EBID to allocate only 10 inches per acre to irrigators this year; last year it was only 4 inches. Since 2003, EBID has doled out a full allotment only once, in 2008.

The recent dry spell is not unusual. Researchers at the University of Arizona used tree rings to recreate streamflows at Otowi Bridge, about 60 miles north of Albuquerque, for the years 1450–2002. This 552-year record shows five 10-year periods in which flows were less than the lowest values measured by stream gauges (*Figure 2*). The most persistent drought occurred in the late 1800s, when flows measured 73 percent of average during an 11-year period.

The 20th century is not representative of streamflow variability in the Rio Grande, said Connie Woodhouse, professor at the University of Arizona’s School of Geography and Development and co-author of the tree-ring reconstruction of Rio Grande streamflows. “We have longer droughts and more severe [lower] flows reconstructed,” she said.

The record is a warning: the severity, frequency, and duration of droughts in the future may exceed those of recent years, which will create additional challenges for water management and use.

“The greatest uncertainty is the changes that are coming with climate change,” said Filiberto Cortez, manager of the Bureau of Reclamation’s El Paso Field Division. Historical practices are changing, he added.

Adapting to Drought

While best estimates from climate models suggest the future will be drier, recent trends suggest that drier climes already have set in.

“Average [Rio Grande streamflows] seem to be on a long-term decline,” King said, adding that future droughts likely will become more severe.

In many places in the Lower Rio Grande, groundwater has been the saving grace during the last dry 10 years. Farmers and urban water managers have supplemented meager surface water allotments by ramping up pumping, lowering water levels in some areas.

“The groundwater is hydrologically connected to the river. It’s not magically making water; it’s really borrowing it from future water supplies,” King said.

Pumping groundwater is also more costly than river water and saltier, which over time can lower crop yields. For smaller farms or those on tight budgets, pumping groundwater likely is only a short-term coping strategy and not a sustainable policy. This has led EBID to explore new strategies to boost supply, including capturing monsoon torrents by building earthen structures that funnel water spilling from drainages into irrigation canals.

“We’ve been really intense in developing a stormwater management plan to capture the water and use it to recharge our aquifer,” Esslinger said.

Capturing monsoon precipitation, however, cannot completely compensate for reductions in streamflow experienced in the recent decade, King said. Other changes also likely will be needed.

“Farming will adapt,” King said. “I think what you will see is a change in the crop types. Probably, [farmers will] concentrate what little water there is on smaller acreage and grow higher value crops.”

While it easy to see gloom in a drier future, farmers and other water users will respond, perhaps in unexpected ways.

“Farmers here are very progressive, very innovative,” Esslinger said. “Garlic and things that we’ve never thought of may be grown here and may be a new source of agriculture.”

Part Two in this series will be issued in September and will explore how farmers are coping with the current drought.