Basin profile: Brazos River Basin
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Water Scarcity Status

- Over-allocation of water resources for use in agriculture, industry, and municipalities has resulted in unsustainable consumption of surface and groundwater within the basin.
- Degradation of aquatic and riparian ecosystems is evidenced by recent addition of two fish onto the US Endangered Species list.
- Businesses and homeowners in the area have experienced economic losses due to the fact that lowered water levels in water storage reservoirs no longer reach waterfront properties and docks are dry.

Basin Overview

Location: Central Texas, United States of America
Area: 42,800 square miles (110,851 square kilometers)
Climate: Dry (upper basin) to temperate (lower basin).
Basin population: 2,500,000

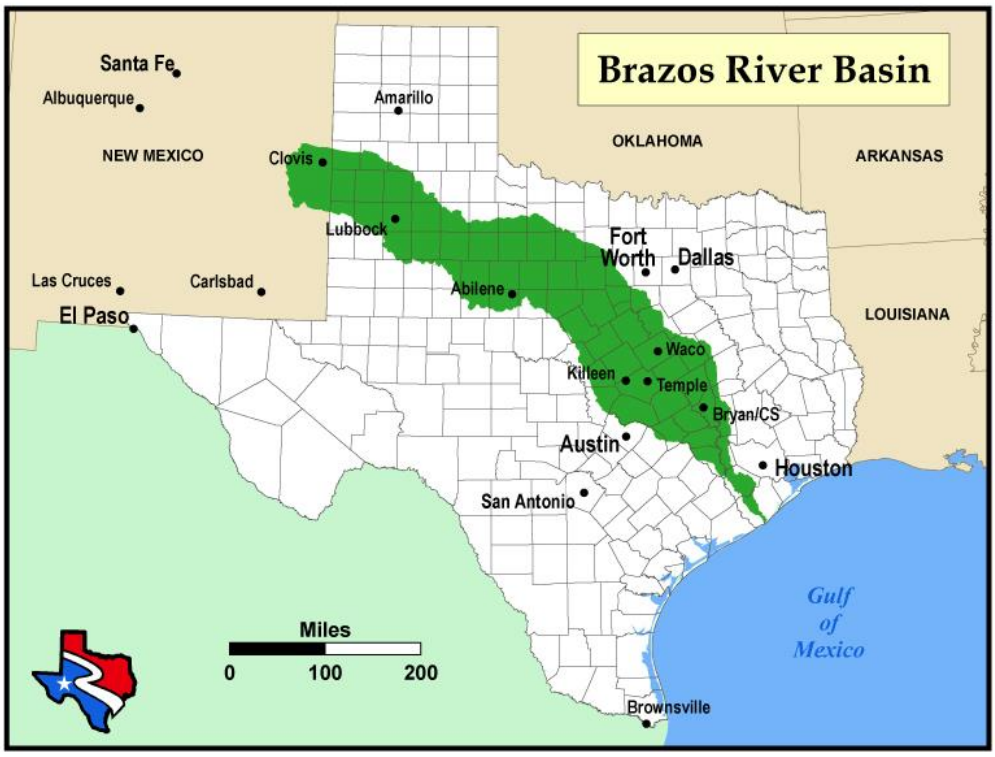

Figure 1: Map of Brazos River Basin (source: Brazos River Authority)

The Brazos River begins with the confluence of the Salt Fork River and the Double Mountain Fork River in central Texas and travels 873 miles (1,405 kilometers) southwest across the state until it drains into the Gulf of Mexico. The overall average annual flow of water within the Brazos River is 11,148,612 acre-feet (13.75 cubic kilometers).

Each year the Brazos receives an average of 29.5 inches (749 mm) of rainfall but this number can be as low as 16 inches (406 mm) in the upper Brazos to as high as 47 inches (1194 mm) in the lower Brazos. Currently 19 dams exist within the Brazos River Basin, and of those 19, 13 are situated on the river itself. Of these, four are managed by the Brazos River Authority and eight are managed by the U.S. Army Corps of Engineers. The basin's first dam was the Possum Kingdom Reservoir, built in 1941. This dam is located close to the middle of the Brazos River and remains one of the largest reservoirs in the basin.

The major cities in the watershed include Waco, Lubbock, Bryan, Richmond, Graham, Calvert, Temple, and Abilene. Lubbock and Waco are the two biggest cities in the basin, with populations of 289,384 and 605,904, respectively. While the Brazos River Basin has a relatively small population overall, the cities of Dallas, Houston, Fort Worth, and Austin all lie very close to the basin. As these metropolitan centers continue to expand it is likely that at least some of their suburban communities will overlap into the basin. Native Americans have inhabited the Brazos River Basin for thousands of years.

The Brazos River Authority holds the most power in administering the water within the basin. Much of the authority's powers and abilities are subject to broader policies and laws enacted by the Texas state government and the Texas Commission on Environmental Quality. The Authority distributes water to stakeholders through the issuing of permits. The access to water amongst all those holding a permit is often referred to a "first in line, first served" system in which those who were first to receive their permit have priority for receiving their allotted amounts. There is little regulation on how much water can be withdrawn from the river and in many tributaries the Authority is capable of withdrawing 100% of the available water. Under the current system, the Authority has little capability of monitoring how much water is being withdrawn and used by each user.

The Brazos River Basin is dominated by agriculture, but with pockets of industry located in the lower portion of the basin, and cities and their service jobs comprising a larger role as time goes on. Typically, in the upper portion of the Basin the major source of income comes from agriculture and ranching. Sorghum, rice, and cotton are the three most popular crops being grown across the basin. During the 1950s and continuing today, industry has begun to play a larger role in the basin's economy, particularly with the establishment of a Dow Chemical Company facility in 1940 in Freeport, Texas. Other chemical companies and fertilizer producers such as Monsanto have based some of their operations near Dow's plant. These chemical plants play a large role in the economy of the lower Brazos River Basin.

Water Budget

In 1997 the amount of water withdrawn from the Brazos River and its surrounding floodplain aquifer was approximately 1,316,836 acre-feet (1.62 cubic kilometers) while the return flow was a meager 113,820 acre-feet (0.14 cubic kilometers). This means the consumptive use of water in 1997 was 91%. This statistic is significant in two ways. First off, it demonstrates that the water withdrawn is very unlikely of returning. Second, the total annual consumptive use appears low when compared to the overall natural flow of water within the Brazos River, which was 11,148,612 acre-feet (13.75 cubic kilometers). However, when the month-by-month rates of consumptive use is compared to the total available water in the river each month, it can be seen that a large proportion of the river is depleted during drier months.

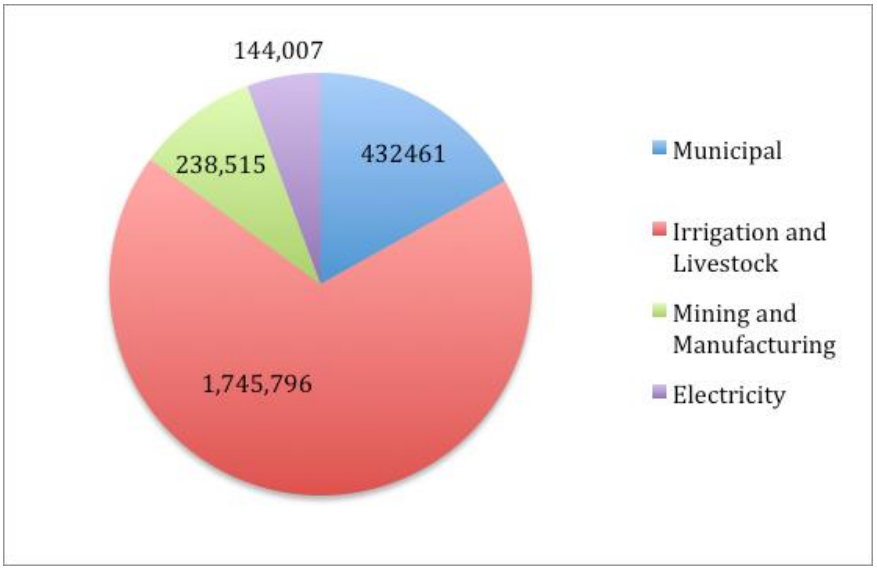

Figure 2. Water withdrawals by sector. Data measured in acre-ft/year (Texas Water Development Board, 2014).

Water Scarcity Impacts

Environmental Impacts

In the past 50 years the basin has experienced considerable ecological damage, particularly in regards to aquatic and riparian ecosystems. The lack of flowing water in many portions of the river or its tributaries has fragmented many reaches of the river, thereby isolating many migratory populations and hindering the downstream movement of sediment and nutrients as well. This issue is exacerbated by dams which restrict the natural flow of water, which can also affect the temperature and dissolved oxygen content of the water released downstream, thereby altering downstream habitats. The Sharpnose shiner and Smalleye shiner have both recently been listed under the US Endangered Species Act. These species are highly vulnerable to extirpation from the river because water withdrawals and dam releases are impacting their spawning activities during the drier months of September to April.

Additionally, vegetation along the banks has become water stressed, resulting in the decline of riparian plants. Water shortages and drought have left local forests and other vegetation exposed to forest fires which have further degraded natural vegetation. The decline in plant life has left the river much more susceptible to erosion, which brings in unwanted sediment that increases the turbidity of the water. Also, the vegetation along the banks serves as a filter to much of the run-off from nearby farms, communities, or businesses. As a result, increased amounts of fertilizers and other pollutants have been found in higher concentrations throughout the basin. The loss of riparian vegetation has also made much of the surrounding countryside more vulnerable to severe flooding. The lack of natural flows and dam construction has severely altered natural flooding patterns, resulting in degradation and diminishment of natural wetlands. Lastly, a more subtle consequence of the loss of vegetation is the warming of areas of the river that were previously shaded by overhanging trees and shrubs.

Economic and Social Impacts

The water shortages that are currently taking place due to overuse of water supplies, in addition to drought, have caused several businesses to lose money, lay off employees, and even go bankrupt. Water shortages and reservoir depletions have also impacted many residents' waterfront properties. In fact, water shortages have meant that many docks no longer even come into contact with water. Such changes to waterfront properties have in many cases negatively impacted their financial value, leaving owners and fellow residents upset.

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