



The Sabine and Neches Rivers and Sabine Lake (pictured) are currently being considered by the Environmental Flows Program. Photo by Earl Nottingham, © Texas Parks and Wildlife Department.

A balancing act

Rivers need varying flows to remain healthy

The Texas Instream Flow and Environmental Flows Programs in place today are products that evolved from diverse perspectives and ever-advancing scientific approaches for examining flows of the state's surface water.

Cindy Loeffler, Texas Parks and Wildlife Department's (TPWD) water resources branch manager, said a long-held common belief was any river water flowing into the Gulf of Mexico was wasted. That water needed to be withdrawn for human and industrial use.

For the most part, that belief has been replaced with the realization that Texas needs a balance between human demands and environmental needs. The state cannot appropriate all the water; its river systems need enough water for wildlife and fish to thrive, and still have enough for recreational and commercial fishing and other uses to continue.

"What we had in the past was the tap was turned on or off," Loeffler said. "There was no in-between. Even if a river was protected, diverters could pump the river flow down to some minimum flow.

"Now what we know is when looking at the health of a river or bay, you have a flow regime that, over a year or several years, will have high flows, low flows, pulses, maybe floods, and all that is important to maintain healthy river ecosystem over time," she said.

This variation in flows provides numerous benefits.

Environmental flows help maintain native and rare animal, fish, and plant species and also help maintain the capacity of streambeds and river channels to carry runoff, scientists and agency staff said. ➔



For example, high flows provide flushing of sediment and nutrient runoff, which helps protect water quality.

Reduced flows can keep rivers from assimilating wastewater discharges, which can lead to higher treatment costs, Loeffler said.

Sufficient flows also contribute to the state's economy.

"We enjoy immense economic benefits from recreation and sport and commercial fishing," Loeffler said, adding that billions of dollars are generated from these activities. "So this is not just an environmental issue."

Along with the environmental interests, however, are the multiplied water demands from increasing population and drought. Texas' population is expected to jump from 21 million in 2000 to 46 million in 2060, according to Texas Water Development Board's (TWDB) State Water Plan. And drought is predicted to become more frequent with climate change.

Recognizing these demands, the need for balance became increasingly apparent to the Texas Legislature, prompting it to pass the instream flow and environmental flows legislation.

"I think the Legislature recognized the need to promote a sound ecological environment in the state ... while balancing the competing needs of the state," said Kellye Rila, Texas Commission on Environmental Quality's (TCEQ) water rights permitting and availability section manager. "We've grown very fast, and the legislature recognized the need to do the best thing we can do to balance all those needs."

The challenge with both programs is to select and/or synthesize the science to determine instream flows or environmental flow regimes.

An example of an instream flow study is geomorphic classification, which describes the landscape and underlying geology of the river, said Dr. Mark Wentzel, hydrologist with TWDB's surface water resources division. These studies describe the variability along the length of the river. For instance, the lower San Antonio River is a different type of stream just below the city of San Antonio than it is on the coastal plain, he said.

Another type of study is determining baseline characterizations of species present in the basins. The program has current studies on the Sabine and Brazos rivers on the habitat requirements for freshwater mussels.

"When we can identify the habitat that the mussels require, then in the future that will allow us to model how the habitat changes with different flow rates, and that will allow us to pick appropriate flows," Wentzel said.

Dr. Kirk Winemiller, Regents Professor of wildlife and fisheries sciences at Texas A&M University, has researched environmental flows relating to lateral connectivity, which is overbank connections to oxbow lakes and other backwater habitats. Oxbow lakes are U-shaped lakes formed when a curve or meander of a river separates from the rest of the river. His research focuses on determining the relative importance of the off-channel habitats in oxbow lakes and how fish respond to flow variation. This research is being used in the instream flow program.

"What we learned," Winemiller said, "is that quite a number of fish species use these lakes as important habitats. Some fish complete their entire life cycle in oxbow lakes. For some, oxbow lakes are a more important habitat than the river channel.

"We have shown convincingly, at least for the Brazos River, that these (oxbow lakes) are an integral part of the river ecosystem, so it is

essential that the river gets periodic high flow pulses that produce connections,” he said. “Without it, we would have a much poorer fish fauna in the river and the abundance of certain species would be significantly lower.”

For the environmental flows recommendations, the Bay and Basin Expert Science Teams (BBESTs) are using the best available, previously conducted, science. The Texas Environmental Flows Science Advisory Committee is compiling available information for efficient use by the basin teams.

Winemiller, who is on the Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Expert Science Team, said work led by The Nature Conservancy to determine a flow regime for Caddo Lake and Big Cypress Creek is providing groundwork for estimating environmental flow requirements for other basins. That effort proposed “building blocks” of instream flow regimes, including frequency, amount, and length of floods, high flow pulses, and low flows needed for variations in annual and seasonal flows that will best protect fish and wildlife populations. An adaptive management approach tests and adjusts the building blocks for a better understanding of how the flows and their values are developed, according to the Caddo Lake Institute’s Web site.

“That Caddo Lake effort was a critical proving ground for our current efforts,” he said.

For more information on the Texas Instream Flows Program studies, visit <http://www.twdb.state.tx.us/instreamflows/studies.html>.

For more information on the Environmental Flows Program science resources, visit http://www.tceq.state.tx.us/permitting/water_supply/water_rights/eflows/resources.html. 💧



Texas Parks and Wildlife Department and Brazos River Authority staff sample fish on the Brazos River. Photo by Earl Nottingham © Texas Parks and Wildlife Department.