



Running the rivers

Scientists say 2011 drought showed importance of environmental flows regulations

Carrying water so precious it has been called liquid gold, the 23 major rivers in Texas flow past pastures and cities, factories and suburbs. These waters have endured the wettest and driest of years, but experts say the rivers' biggest stresses now come from the multitude of demands from industries, municipalities, agriculture, environment and wildlife.

A scorching combination of abnormally low rainfall and abnormally high temperatures made the record-breaking drought of 2011 especially taxing on the state's surface water supplies. Water managers saw some rivers significantly slow, while others dwindled down to puddles.

A decade before, the Texas Legislature set out to improve the regulation of these highly sought-after water supplies and enlisted both the expertise of scientists and the know-how of local stakeholders. Betting on a potentially contentious process that would require consensus, the state officials' goal was to develop new surface water environmental flow regulations that ensured Texas rivers were managed both to meet the needs of the state's residents and to maintain sound ecosystems and habitat for wildlife.

The Texas Instream Flow Program, mandated in 2001 through Senate Bill 2 (SB 2), directed state agencies to conduct scientific studies determining how much water should flow in each river or stream to ensure a healthy environment. The Environmental Flows Program, outlined in Senate Bill 3 (SB 3) and passed in 2007, created a process for the state to establish environmental flow standards using the best available science for its river basin and bay systems.

After years of input from stakeholders and research by scientists, the first phase of the environmental flows process is now nearing completion, which will entail the Texas Commission on Environmental Quality (TCEQ) releasing environmental flow standards for each of the 13 river basins mandated in the program. The state is required to revisit the standards every 10 years and revise them if necessary, taking an adaptive management approach that will take into account new research as it becomes available.

Navigating the Texas "water wars"

Before SB 3, TCEQ already had the authority to protect the environment when new water rights were issued, said Kellye Rila, director of TCEQ's Water Availability Division. ⇨



However, TCEQ could only place special conditions on individual water rights, said Cindy Loeffler, Texas Parks and Wildlife Department (TPWD) Water Resources Branch chief. “This led to a piece-meal approach that wasn’t very protective,” she said. “SB 3 is a comprehensive approach that applies to entire river basins and receiving estuaries.”

“Under Senate Bill 3’s Environmental Flows Program, this is done through a stakeholder process,” Rila said.

Determining and maintaining the balance between ecological and human needs has not been easy, and hundreds of stakeholders and scientists have participated in the process.

“The Instream Flow Program was my entry point into the Texas water wars,” said Dr. Kirk Winemiller, a Regents Professor in the Department of Wildlife and Fisheries Sciences at Texas A&M University.

Winemiller has studied river systems ecology all over the world, but when it comes to collisions of policy and science affecting ecosystems, in Texas he’s an expert.

At a seminar on the Texas A&M campus earlier this year, Winemiller discussed the Instream and Environmental Flows Programs.

“Prior to 1985 (when instream flows first became regulated), environmental needs were not officially considered in Texas water planning, and as a result many streams and rivers in Texas have been over-allocated,” Winemiller said. “Both of these programs are all about future water. The burden of environmental protection falls on future water rights because already-established rights cannot be changed.”

TPWD was also charged with implementing both SB 2 and SB 3, and Loeffler is responsible for the implementation of SB 3.

“Many rivers and streams are fully appropriated—if everyone were to use their water rights, there may not be water left in the river—and SB 3 only applies to new or amended water rights,” Loeffler said. “SB 3 directs stakeholder committees

to identify strategies to make up the difference between environmental flow standards and what is actually in the river, such as voluntary dedication of existing water rights to protect instream flows, increasing conservation or using return flows.”

Winemiller has served on science advisory teams for both programs and observed the complexities involved, not only with competing interests reaching consensus, but also with determining the specific, science-based water allocations that will keep a river healthy.

“The question of how much water does a river or stream need, or what is the minimum amount that we can allocate for the environment, turns out to be a really difficult question to answer; it’s easy to ask but difficult to answer,” Winemiller said.

“And these are complicated processes—there are so many stakeholders involved, and fresh water has actual dollar value. I don’t know if I’d call it liquid gold, but it’s valuable.”

When the rivers came to a halt

For much of 2011, that “liquid gold” wasn’t exactly flowing.

“It’s definitely ironic that a severe drought started in the middle of the Environmental Flows Program,” Winemiller said during a later interview.

The state on the whole received an average of 11 inches of rain in the previous year, as of Oct. 1, 2011—about 16 inches less than normal. Rainfall totals for 2011 in West Texas were comparable to those typical of the world’s desert regions, according to the Texas Comptroller of Public Accounts’ 2011 drought report. Soaring evaporation rates exacerbated the plight of already ailing rivers and reservoirs.

During such extreme drought, Rila said, streamflow for the environment or permitted water rights is very limited.

Decreased freshwater inflows to bays and estuaries also had clear repercussions.

“Impacts to estuaries due to low freshwater inflows—such as red tide, harmful algal blooms—

The Brazos River near Seymour, in August 2011 was completely dry. Photo courtesy of the Brazos River Authority.



led to the closure of the commercial oyster season,” Loeffler said. “It was a rare occurrence to see that many impacts on fish and wildlife—it really indicated how bad the drought was.”

When river segments run dry during prolonged periods of drought, threatened and endangered species can disappear, Winemiller said.

Endangered minnows in the upper Brazos River were one such example. By September 2011, some parts of the river had been reduced to isolated pools of water or were completely dry. Scientists from TPWD and Texas Tech University rescued two potentially endangered species of minnows—sharpnose shiner and smalleye shiner.

“Historically, these two fish occurred throughout the Brazos down to and below College Station,” TPWD Aquatic Biologist Kevin Mayes said at the time. “But like other prairie minnows of the Great Plains, their habitat—turbid rivers with shifting sands—has been altered by reservoir construction.”

Scientists had long been concerned about the minnows, which are found only in the Brazos River. TPWD had contingency plans to collect some of the minnows if conditions became extreme. When flows at all of the stream gages above Possum Kingdom Lake began reading zero, TPWD moved the minnows to a state fish hatchery.

Winemiller said that these species normally live a year or two and do not spawn in captivity. Fortunately, before the last pools of water vanished, winter rainfall re-established flows in most segments in the upper Brazos.

Because of TPWD’s efforts, the minnows still have a fighting chance. TPWD staff harvested the pond at Possum Kingdom Fish Hatchery on May 29, 2012, and stocked more than 700 healthy sharpnose and smalleye shiners into the lower Brazos River, where they hoped the fish would find the river suitable for spawning, Mayes said.

What the drought taught Texas

Protecting threatened and endangered species is linked to determining proper subsistence flows,

or the minimum flow at which a healthy river or stream environment can be maintained, Winemiller said, and a healthy river flow regime must include a variety of flows. The Environmental Flows Program requires each basin’s committees to identify subsistence flows, base flows, high flow pulses and overbanking flow pulses.

“This past year, we got a good look at the actual subsistence flows in many of the river basins, and some of them fell below subsistence flow targets at points,” Winemiller said. “Without proper subsistence flows in the future, there is a real possibility of more and more Texas species facing extinction.”

One of the only benefits of the 2011 drought was the increase in public interest and participation in water conservation and planning.


“After seeing rivers and streams running dry or running at very low levels (last) summer, more people are getting informed and involved in these issues,” Loeffler said.

While public awareness of water issues did grow during the drought, Winemiller said, the average person does not know that the SB 2 and SB 3 programs exist or will have direct effects on the rivers Texans use and enjoy.

“My observation during the 2011 drought was that, in many cases, we are not providing for environmental flows at present,” Winemiller said.

“Texas’ environmental flows programs (SB 2 and SB 3) are important steps towards protecting Texas rivers, streams, bays and estuaries for future generations,” Loeffler said. “As the state’s population grows and water demands increase, we all need to do our part to strike a balance that includes dependable water supplies and a sound ecological environment for Texas.”

“Last summer highlighted the fact that, yes, we need this now.”

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Some information from TPWD news releases.