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Texas' Natural Lake

Research to help restore environmental flows to Caddo Lake

Unique—a word frequently used to describe Caddo Lake on the border of Texas and Louisiana. Unique because it is the only natural lake in Texas, believed to have originally formed from a logjam on the Red River. Unique because it is one of only 19 wetlands “of unique importance” in the United States. Unique because of its bald cypress and tupelo trees that are Caddo's Lake signature.

This unique lake and its ecosystem, however, are being threatened.

Although the lake has developed several problems over time, the overriding concern, according to people involved in preserving the lake, is the amount of freshwater flowing from the Lake O' the Pines Reservoir to Caddo Lake. After the U.S. Army Corps of Engineers built Lake O' the Pines on Big Cypress Creek upstream of Caddo, the area no longer flooded as much. The regulated water flows from the dam stabilized lake levels, reducing regeneration of bald cypress forests. The cypress trees must have floods to distribute their seeds and dry spells that lower lake levels and allow seeds to germinate.

Flooding in the past also helped sweep sediment from the lake and inhibited plant growth. Invasive aquatic plants, introduced by man, are choking off water bodies; and heavy metals, including mercury found in the lignite coal used to power electricity-generating plants, are accumulating in fish tissues.

Scientists are developing plans to restore environmental flows to Caddo Lake, Texas' only natural lake.



But, efforts are under way to help the lake remain the diverse and economically important wetland that establishes its uniqueness.

Texas Agricultural Experiment Station (TAES) scientists along with the Caddo Lake Institute, The Nature Conservancy, the U.S. Army Corps of Engineers, Northeast Texas Municipal Water District, other federal and state agencies, and local citizens are working together to find solutions to the lake's problems.

The Caddo Lake Institute has worked on water quality and water flow research for the last 15 years, said Dwight Shellman, Caddo Lake Institute's former director. One question that needs to be answered, Shellman said, is "Would restoring the natural pattern of water flow help the ecosystem to respond better?"

"The existence of the dam and reservoir gives us the opportunity of restoring the natural variability patterns even if we don't restore all of the water."

The Nature Conservancy's Sustainable Waters program, designed to protect river ecosystems downstream of dams, has sponsored two workshops within the last year to determine the research needed to develop ecologically based environmental flow recommendations for Caddo Lake. Environmental flows is the amount of water that needs to flow down the river to maintain the ecological system in the lake, river and flood plain.

Dan Weber, the Conservancy's northwest Louisiana program manager, said, "We recognize several problems downstream associated with both water quality and quantity. The effort under way is a science-based approach to determine exactly how much water is really required and under what conditions for the downstream environment to persist over time, while continuing to provide quality habitat for associated flora and fauna."

These flow recommendations, when implemented by the Corps, will enhance the ecological structure and function of Big Cypress Creek, its floodplain and



Caddo Lake's signature bald cypress trees need the high and low flow of waters for distribution and germination of their seeds.

greater Caddo Lake, according to a summary report presented at the second workshop by TAES researchers involved in the project.

Although other issues affect the lake, including nutrient and contaminant loading, logging, and agricultural and residential development, the consensus of the workshop participants was that some restoration of the timing, magnitude and duration of flows in Big Cypress Creek is critical to the sustainability of the lake's ecosystem.

Kirk Winemiller, a professor in Texas A&M's Department of Wildlife and Fisheries Sciences, said the summary report synthesizes the "state of knowledge" about the geography, hydrology, ecology and environmental impacts affecting Caddo Lake and Big Cypress Creek. At the second workshop, the group reviewed all the information and developed "building blocks," describing the expected ecological responses or conditions associated with specific river flows or lake level fluctuations for Big Cypress Bayou and Caddo Lake. Winemiller said the group came up with preliminary recommendations for researching environmental flows as well as research to fill information gaps and to improve estimates. (See sidebar for top research needs.)






A critically important next step toward implementing the building blocks identified for the creek and lake is to develop a plan for conducting necessary baseline monitoring of ecological conditions in Big Cypress Bayou in 2005 and implementing Big Cypress Bayou low-flow and high-flow management strategies beginning in 2006. In addition, the plan will examine the feasibility of modifying the Lake O' the Pines outlet to improve control of lake levels, nutrient flows and cypress regeneration.

Analyzing long-term changes in the lake's ecosystem will provide a scientific baseline for current and future studies. The TAES scientists involved in the workshops are Brad Wilcox, associate professor of rangeland ecology and management, studying the hydrology; Anne Chin, associate professor of geography, studying the fluvial geomorphology; and Dan Roelke, associate professor of wildlife and fisheries sciences and oceanography, concerned with nutrients, productivity and aquatic plants. Steve Davis, assistant professor of wildlife and fisheries sciences, is studying the riparian and floodplain vegetation, and Winemiller is studying the aquatic and terrestrial fauna.

"Hopefully the process will continue," Winemiller said. "We're limited in what we can learn in water responses in two years."

Shellman has organized a research coordination network for the Caddo Lake watershed. The network will regularly call for, and coordinate, needed field research by key agencies, scientists and stakeholders to establish a permanent process known as adaptive management.

"Research and adjustment, and then more research and adjustment" is what is needed, he said.

Once additional research is accomplished, Winemiller said, subsequent workshops will make recommendations for a watershed management plan that will advise agencies involved with water planning for Caddo Lake. 

Scientists identify Caddo Lake's top research needs

Hydrology:

- Develop correlation between Jefferson flow gauging sites or re-establish gauge at old Jefferson site
- Determine gain/loss of water between Lake O' the Pines and Caddo Lake
- Assess floodwater accumulation and backwater hydraulics below confluence of Little Cypress and Black Cypress

Fluvial Geomorphology:

- Estimate sediment budget and develop better characterization of sediment composition along entire creek
- Collect baseline geomorphological data to better assess the responses during and following flow

Aquatic Ecology:

- Determine how much of the floodplain is inundated and how much fish access is available at various flow levels in different reaches of the creek
- Examine paddlefish and bluehead shiner ecology

Terrestrial ecology:

- Examine flood inundation-vegetation relationships