AGU THRIVING EARTH EXCHANGE

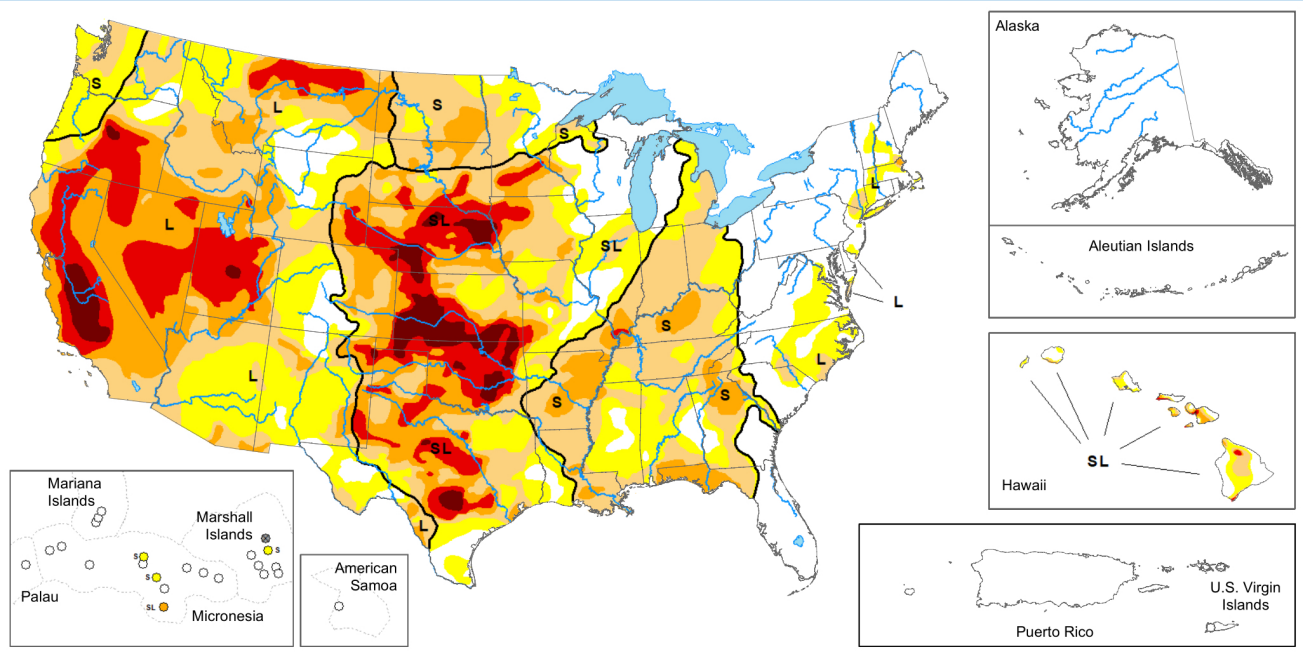
The Kiamichi River in southeast Oklahoma, pictured here looking down from Highway 271 in Pushmataha County, has been ground zero for the debate about water management and its discontents and the balance between economic, ecological, and cultural concerns. Photo courtesy Bill Redman.

Protecting community interests and planning for future needs

AGU's Thriving Earth Exchange helps concerned residents near Oklahoma's Kiamichi River collect data for better water management decisions

Drought has always been part of the landscape west of the Mississippi River, and scientists have become better at measuring it and mapping it in the last century to more accurately chronicle precipitation, temperature, groundwater, and surface water. The National Drought Mitigation Center at the University of Nebraska-Lincoln updates the data for its drought monitor each Tuesday, mapping six levels of increasing concern across the nation. Western states and a swath from the Dakotas to Texas are routinely under threat with extreme- and exceptional-drought indicators of cherry red and maroon juxtaposed with lusher regions in yellow and white. For decades, the region's rivers have been tapped, trapped, dammed, and diverted by regional authorities to deal with seasonal droughts and create more reliable water sources—often creating collateral challenges in the process related to lower river shorelines and, effectively, less water volume in rivers and tributaries, themselves.

The Kiamichi River in southeast Oklahoma has been ground zero lately for the long-running debate about resource management and its discontents. Its watershed forms a crescent running 172 miles from the headwaters near the Arkansas border to its confluence with the Red River near the Texas border. Three Oklahoma counties—LeFlore, Choctaw, and Pushmataha—draw water from the Kiamichi, which is a vital natural resource as well as a symbol of the region's multicultural communities. Over the years, harnessing the river's water has also been an economic gambit by attempting to sell water to drought-threatened Texas. The Army Corps of Engineers created the Hugo Lake reservoir in the 1960s about 15 miles southeast of Antlers, Oklahoma, within which the local town of Hugo purchased $2.5 million of "storage" space in 1974 from the federal government. Thirty years later, Hugo tried and failed to sell excess water from its share of the lake to Irving, Texas, to pay down its initial debt to the govern-ment after the state of Oklahoma passed a moratorium on water sales in an effort to conserve resources.



The National Drought Mitigation Center at the University of Nebraska-Lincoln maps six levels of increasing concern across the nation, as seen here on November 17, 2022. Western states and a swath from the Dakotas to Texas are routinely under threat with extreme- and exceptional-drought indicators of cherry red and maroon juxtaposed with lusher regions in yellow and white. Map courtesy National Drought Mitigation Center.

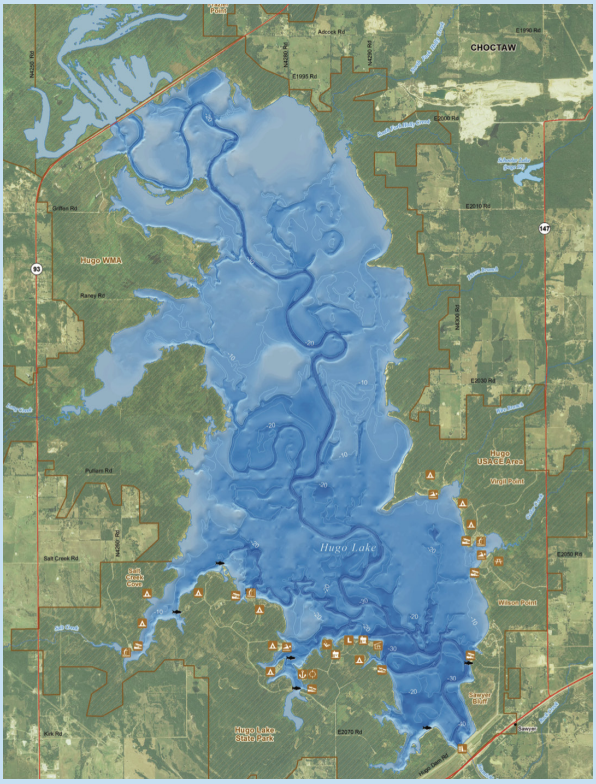
The Sardis Lake reservoir, 35 miles northeast of Antlers, has also been the scene of a legal battle. The State of Oklahoma—eager to pay off its debt to the Army Corps of Engineers since the 1980 creation of Sardis Lake—had been negotiating with Oklahoma City authorities to divert water for its growing metropolis in 2010 when Choctaw and Chickasaw Nations jointly filed a lawsuit against both city and state, as well as the Oklahoma Water Resources Board and the Oklahoma City Water Utilities Trust, claiming that such an agreement (and diversion of water) ran counter to their federal rights.

Both sides settled in 2016 and the pipeline to Oklahoma City process went ahead, but not without urgent concerns about the collateral effects of diverting water away from the watershed—chiefly a decrease in the water levels and in the volume of water flowing through the river and its tributaries.

Decreased flows increase water temperature, thereby increasing organic growth and hindering water treatment at downstream municipalities, many of which are already under economic pressure. Basin residents are also concerned about the downstream impacts of reduced flow and increased sedimentation on water quality in the river system. Overtaxing the Kiamichi River and both Sardis and Hugo Lakes—both deemed by the Environmental Protection Agency (EPA) as “impaired”—would have deleterious impacts on flora, fauna, not to mention the 176,000 residents of the tri-county area, whose median household income is about $40,000, or 54% lower than the national median of $70,000. One of those negative impacts has already come to pass, as the state now warns residents to consume limited amounts of fish from both lakes given the presence of mercury.

The Kiamichi River Legacy Alliance was formed in 2016 to call attention to the larger reality of water diversion threats. In 2021, the founder and president Kenneth Roberts approached AGU’s Thriving Earth Exchange to initiate data collection along the Kiamichi, which the group hopes will reveal the extent of current degradation and offer the Oklahoma Water Resources Board evidence that might halt future water diversion projects. Roberts assembled a team that included Lauren Haygood, a graduate student at the University of Tulsa and a member of AGU’s Voices for Science Program; Johnny Robbins, a local resident and Alliance board member; and Bill Redman, research chemist, local resident, and Alliance board member.

In August 2021, Laura Bartock joined the Alliance as a Thriving Earth Exchange Community Science Fellow, and brought aboard Randy Stotler, a hydrogeologist and isotope geochemist, and Associate Professor at the University of Waterloo and Adjunct Professor at the University of Kansas. Bartock and Stotler helped craft the group’s objectives, which included assessing exist-ing data for key gaps and critical needs, developing the community’s capacity up and down the river to assess the impacts of water diversion on sensitive native spe-cies, and scoping out a possible hydrological monitoring



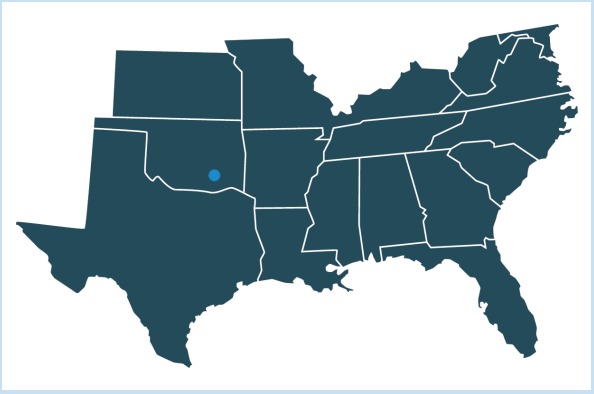
The Army Corps of Engineers created the Hugo Lake reservoir in the 1960s about 15 miles southeast of Antlers, Oklahoma, and has since sold "storage" space for excess water to the town of Hugo, which struggled for a long time to monetize its supply to pay down its debt to the federal government. Map courtesy US Army Corps of Engineers.

program that could create yet another data set—all with the goal of creating evidence that may be marshaled for publications, legal proceedings, presentations, and additional data modeling.

Bartock, now a Community Science Fellow for the Association of Science and Technology Centers, says the point of the Alliance's project with AGU's Thriving Earth Exchange is simple: Let's take a step back and make sure we are using accurate and reliable data before intervening again in the river basin.

"My community leaders on this project are making the argument that decisions have been made in the past on incomplete information, bad modeling, and poor historical records," she says. "We don't know what the data will say yet, but we just need better data. 'Follow the science' is what I'm telling people this project is about because good data collection is data that are transparent and easily accessible."

In Antlers, and in dozens of communities around the country, AGU's Thriving Earth Exchange serves as a connector and facilitator to bring together communities who have self-identified concerns, fellows who organize



Antlers, Oklahoma sits between Hugo and Sardis Lakes, and is ground zero for regional conversations about water management. For decades, the region's rivers have been tapped, trapped, dammed, and diverted by water authorities to deal with seasonal droughts and create more reliable water sources—often creating collateral challenges in the process.

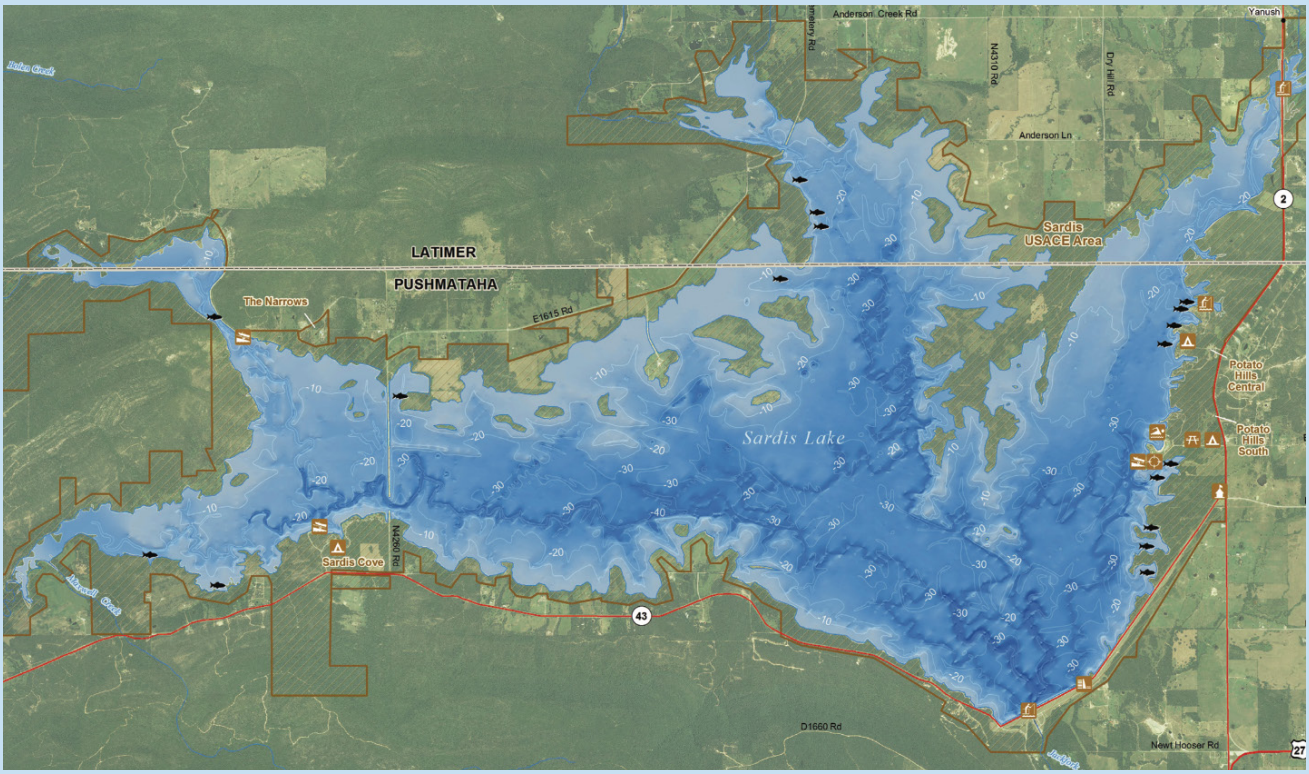
and administer community-based projects that address those concerns, and experts who can address the specific scientific issues that come to bear on the projects. The Thriving Earth Exchange trains and convenes fellows during the course of their projects, offers limited monetary support, and provides opportunities for community members to create awareness of the scientific challenges that projects raise and, ideally, help solve, as well as opportunities for fellows to share their work.

A local ecology and a regional impact

In what Bartock calls the "canary in the coal mine," a population of native river mussels have been negatively impacted by ongoing drought conditions and unresponsive water management along the Kiamichi River water basin. Upwards of 34 species live in the river, itself, including the Ouachita rock-pocketbook (*Arkansia wheeleri*), Scaleshell (*Leptodea leptodon*), and Winged Mapleleaf (*Quadrula fragosa*)—all on federal and state endangered lists and all considered keystone species, upon which much of the ecosystem depends.

"With greater pressure from climate change and more drought and drier conditions on the river—folks see those mussels as a clear indicator of changes," says Bartock.

Their decline in numbers lately have meant only one thing to the Kiamichi River Legacy Alliance: The region's authorities risk effectively forsaking the local ecology to satisfy legal debts and rapid urbanization elsewhere, impoverishing it and risking other negative impacts on the entire region. In an interview published by AGU's Thriving Earth Exchange, community leader and local resident Bill Redman says his group isn't against infrastructure or water management. They're against making future plans without the benefit of data.



The Sardis Lake reservoir, created in the early-1980s about 35 miles northeast of Antlers, has also been the scene of legal strife (now settled), around plans to divert water to a rapidly growing Oklahoma City. Map courtesy US Army Corps of Engineers.

"We're all very passionate and devoted to passing on to the future what we've been given. The land and the river is essentially unchanged from our great-grandparents' day. We're not necessarily against economic development or sharing water, but there's ways to do it that won't destroy what we've got."

As it stands, Oklahoma City—already accepting diverted water from other sources such as Canton Lake, a 1940s Army Corp project fed by the North Canadian River, via 1940s-era Hefner Lake—plans to begin divesting water from the Kiamichi River by 2035. The 2012 Oklahoma Comprehensive Water Plan published by the Oklahoma Water Resources Board is explicit about ensuring "a dependable water supply for all Oklahomans through integrated and coordinated water resources planning" and explicit about its intentions as an information gathering hub "for water providers, policy-makers, and end users to make informed decisions concerning the use and management of Oklahoma's water resources."

Given this explanation, it seems that a cache of data provided by the Alliance would be welcomed by the water resources authority, which expects total demand statewide to increase by more than 33% by 2060 (with crop irrigation expected to require 20% more water and municipal/industrial uses expected to require 28% more water by 2060). Better resource management is better for the environment, observers say, which works in tandem with the economic goals of local and state governments to free themselves of old debts while also creating the infrastructure for future economic prosperity.

Bartock and her colleagues are hopeful that the kinds of data they're interested in collecting by monitoring dozens and dozens of miles of river at strategic locations will keep the river basin healthy while also keeping development authorities informed.

"It's not about having a perfect plan—which is impossible," she says. "The advice I'd give to a community science fellow like me thinking of pursuing a project like this is to stay focused on what's important and what's possible, and figuring out the right next step."

"Assessing the hydrologic regime of the Kiamichi River to support sustainable management" is a project of AGU's Thriving Earth Exchange, which advances community solutions to some of the most vexing environmental challenges. Thriving Earth Exchange helps scientists, community leads and sponsors work together to conserve natural resources, mitigate climate change and create awareness of natural hazards and their impacts on communities.

Learn more at thrivingearthexchange.org.

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