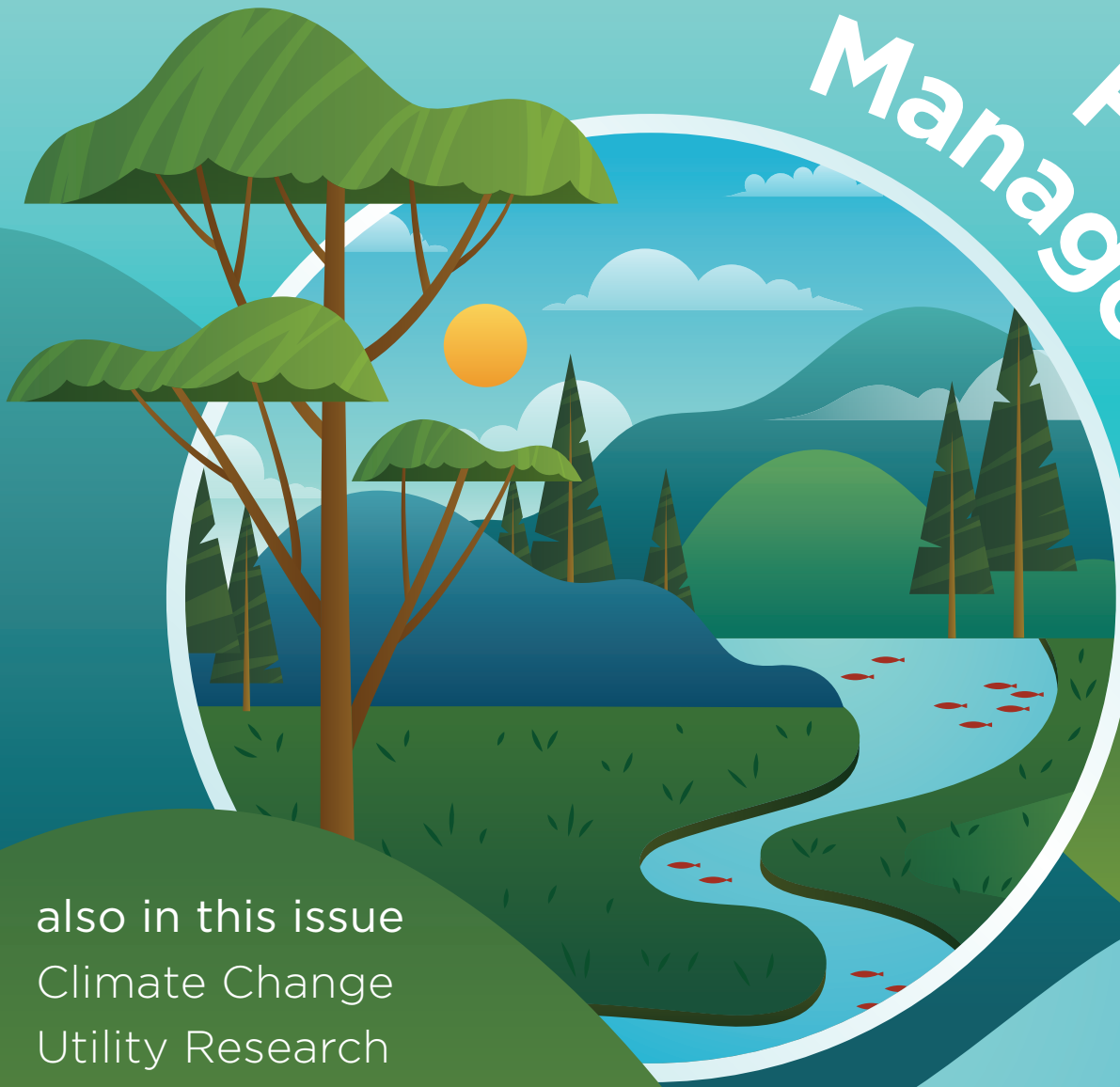


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# Managing Forests to Protect Drinking Water Quality





## Prescribed burns and other forest management strategies can play key roles in source water protection.

By Raven L. Lawson, Central Arkansas Water

**A** crew gathers under a heavy forest canopy mid-morning. Dressed in bright yellow flame-resistant shirts and hardhats, they wield a suite of gear ranging from heavily outfitted utility terrain vehicles hauling tanks of water to an assortment of rakes, hand tools, and metal cannisters that drip fire onto the ground. These workers are meeting up for their prescribed fire safety briefing before the day's events get underway. A recognizable scene for some—especially for folks in the southeastern part of the United States—you might be surprised to learn that this crew is employed by a local drinking water utility: Central Arkansas Water (CAW). For CAW's Watershed Protection Team, this is just another day at the office, and a growing part of their daily job duties (Figure 1).

Central Arkansas Water is Arkansas' largest water utility, serving safe, reliable, high-quality drinking water to more than 500,000 Arkansans each day. An elaborate network of more than 2,600 miles of pipes and two treatment plants distributes water to community members day-in and day-out. This water's journey starts at the utility's source water reservoirs, Lakes Maumelle and Winona, both nestled in the Ouachita Mountains west of Little Rock.

CAW created its Watershed Protection Program (Program) following recommendations from the 2007 *Lake Maumelle Watershed Management Plan* (Plan; Tetra Tech 2007). The Plan provides guidance on how to implement measures throughout the watershed's 88,000 acres to protect the 8,900-acre Lake Maumelle, which supplies two-thirds of



Source: Courtesy of Ben Thesing, Central Arkansas Water

**Figure 1. Crew meeting before a cooperative burn with The Nature Conservancy of Arkansas**

the utility's daily water demand. The Plan proposes a series of strategies, such as managing the impacts of new development, promoting household best management practices, and maintaining good land management practices, including using prescribed fire and ecological timber thinning as management tools for improving forest health.

For the areas around Lakes Maumelle and Winona, CAW set forest management goals to improve the health of the watersheds and maintain the quality of drinking water in central Arkansas. When forests are healthy, watersheds are healthy, and each of these watersheds boasts more than 90% forest cover—a figure that drives much of the Program's activities. While Lake Winona's watershed is primarily within the Ouachita National Forest, Lake Maumelle's lies just a few miles from Arkansas' largest metropolitan area and remains largely unprotected from forest conversion.

### Land Acquisitions

CAW'S LAND ACQUISITION program stands at the forefront of our watershed protection strategy. Urban sprawl and rural development pose some of the largest threats to southeastern forests, which are becoming valuable assets to those longing to move away from the threats of wildfires and the diminishing water availability of the western United States. Without large, intact, and well-managed forests, however, the southeast could face similar issues. Our land acquisition goals are to keep as much of these lands as possible in forest cover, paying particular attention to riparian areas and tributary corridors across contiguous landscapes in our watersheds.

Since the adoption of the Plan, CAW has purchased more than 5,000

acres of land, and owns and manages a total of 24,000 acres of land and water sources. How does a public water utility buy land? In 2008, rate payers asked CAW to implement a watershed protection fee to carry out the Plan's land purchasing goals (1,500 acres at the time of adoption). This fee was added as a transparent line item to customers' bills in May of 2009 as a monthly charge of \$0.45 per meter, which went unchanged for more than a decade. Today the fund nets just over \$2.2 million per year through a \$0.90 per meter per month charge on consumer bills dedicated to land acquisitions and watershed land conservation. Having this fund has allowed CAW to be innovative in extending land holdings and placing privately owned lands under permanent protection through conservation easements. CAW has been able to successfully leverage these funds against grants and buy and flip properties with conservation easements (a strategy we term "buy-protect-sell").

In 2020, CAW issued the world's first-ever Green Certified Bond to

purchase forestlands as part of water infrastructure (CAW 2021). CAW views forests as a critical part of our utility's infrastructure and a key factor in the Program's success. As with any traditional infrastructure, these assets need regular maintenance and monitoring. Central Arkansas Water believes that a managed forest is a healthy forest, and healthy forests foster healthy water—a true forests to faucets approach to providing water to our communities.

### Prescribed Fire as a Management Tool

PRESCRIBED FIRE ENHANCES, maintains, and restores natural forest communities, while simultaneously improving public safety and increasing recreational opportunities. In the last decade, Arkansas has increased the amount of land managed with prescribed fire (Figure 2) to average about 300,000 acres annually across the state—a number that grows every year. This positive trend can be attributed to the partnerships among state and local agencies, nonprofits,



Source: Courtesy of Bryan Rugar, Central Arkansas Water  
**Figure 2. Prescribed burn at Lake Maumelle**

and NGOs who make up the Arkansas Prescribed Fire Council (Council), of which CAW is an active member.

In 2016, the utility developed its Fire Support and Safety Team. The team's original intent was to assist contractors on burns, ensure proper protocol usage, perform maintenance fires, and assist agencies in emergency response, all while keeping the utility's goals for utilizing fire at the forefront of every burn. As of 2021, the utility has eight employees on the team, each of whom has attended the Arkansas Prescribed Fire School: a week-long, intensive, hands-on state training program put on by members of the Council for practitioners of prescribed fire. In 2020, CAW hired a registered forester and trained burn boss to join the Program as the land conservation coordinator; this position now leads the utility's prescribed fire efforts. Enhancing capacity in this way has dramatically increased the number of utility-owned acres that are treated annually. Utility employees can now tackle a larger portion of the burn work that was previously 100% dependent on hired contractors. Since the start of our burning program in 2011, CAW has burned nearly 5,600 acres, with 42% of those acres burned in 2021 and the first half of 2022. Nearly 30% of the acres burned in 2022 were burned by the utility's own employees.

For CAW, forest management is multi-faceted. Our top priority in utilizing prescribed fire is to reduce the amount of total organic carbon (TOC) that enters the reservoir from the landscape. Prescribed fire breaks down and removes downed timber and accumulated leaf litter from forests, ensuring that less TOC enters our lakes than would if the timber was left to decay naturally. TOC in raw water supplies can lead to the formation of

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disinfection byproducts (DBPs), many of which are federally regulated drinking water contaminants that utilities are required to control. While several methods of DBP removal exist, limiting the input of TOC to raw water sources is the best control for DBP formation. If we reduce the amount of TOC in forests, we reduce the amount entering surrounding reservoirs, leaving the treatment plant with less to manage. Any time a contaminant can be reduced before it reaches the treatment plant, there are fewer energy, time, and chemical needs to treat the water to meet federally required levels for safe consumption—a cost-savings we gladly pass along to our customers.

Secondarily, the combination of prescribed fire and ecological timber thinning enhances water filtration on the forest floor. In dense and crowded forests, more organisms compete for limited nutrients and water, making the vegetation more susceptible to drought, disease, and pests. Prescribed burns control undesirable vegetation and allow more sunlight to reach the forest floor, reducing competition. Prescribed fires also return valuable nutrients to the soil through the resulting ash, thereby improving conditions for new plant growth. These changes promote an abundant and diverse grassy understory with more resilient vegetation. The robust root complexes and new vegetation

growth help slow and absorb runoff, turning the forest into a first line of defense against pollutants that could enter the lake from rain events.

Forest management also reduces wildfire risks. Much of CAW's forestland had not been managed in over 50 years, resulting in dense and overcrowded forests with an abundance of leaf litter, downed woody debris, and potentially diseased or damaged vegetation that burns easily and at high intensity. Heavy fuel loads can be responsible for intense fires that move into adjacent forests and cause serious damage to standing timber or buildings. With the proactive implementation of prescribed burns, we can remove heavy fuel loads and provide opportunities for firebreak installations, which aid in wildfire containment and response should a wildfire occur. Wildfire is not only detrimental to landscapes, habitats, and communities in the traditional sense; for a water utility, the onslaught of material and TOC flushed into water supplies after catastrophic fires (often followed by heavy rain events) is very hard to treat and increases the potential for DBP formation. Many utilities in the western United States experienced this as wildfires have increased in size and intensity over the past 25 years. Reacting to wildfires often involves changes in water treatment processes and rebuilding of landscapes, which can cost tens of

millions of dollars, making proactive management a desirable and cost-effective alternative.

CAW also utilizes prescribed fire to enhance wildlife habitat, increase plant and animal diversity, and create recreational opportunities. Burning activities stimulate the growth of seeds that are often buried beneath leaves and debris. Without burning, these seeds can lay dormant for many years until conditions become favorable for growth. In the short duration of the CAW prescribed burning program, the diversity of native wildflower species in demonstration areas and other treated lands has increased. One reason for this is that approximately 46% of the state's rare terrestrial plants and animals depend on fire at some point during their life-cycle. Some of the plants now growing in CAW prescribed burn areas had

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not been found in abundance there in years, if at all. One of the recently recorded plant species is an obligate host plant to a rare moth. Others are endemic to the immediate region, and state botanists track them as species of interest. These native grasses and wildflowers provide food and habitat for wildlife, including pollinators and migrating bird species. This valuable



Source: Courtesy of Raven Lawson, Central Arkansas Water

**Figure 3. Prescribed fire demonstration using different fuel types**

ecological process provides optimal habitat for a diverse mix of plants and animals, including game species like quail, turkey, and deer.

The Program's forest management efforts don't stop at prescribed fire and ecological thinning. In 2021, CAW became the first water utility to certify its lands (in the Lake Maumelle watershed, in this case) under the Sustainable Forestry Initiative standards for forest management, demonstrating a commitment to responsible stewardship. The Program has also planted more than 130,000 trees since 2016,

most recently working to restore areas of native short leaf pine that were heavily harvested and replaced by non-native, timber-producing species.

### **Forest Management Education and Outreach**

THE SIMPLE REALITY OF A utility owning land is that those lands

must be maintained and managed. However, building a forest management program within the organization wasn't easy. It took a decade to obtain the necessary resources and begin observing the success we see today. We had to obligate funds within our small operations and maintenance budget, increase the number of trained staff, add critical personnel, and purchase equipment. Even with all those pieces in place, educating others on the importance of active forest management, both internally (within the utility's leadership and employees) and externally (our customer base and local landowners) was one of our toughest challenges.

Internal support was easier to obtain. Presenting sound science and the connections of forest management to our end water product was effective, but creating the internal capacity to execute a portion of this management in-house took some time. Today, we carry out most of our internal education through tours of our forest management demonstration area, where interns and employees visit the watershed and enjoy a

# A critical part of this multi-barrier approach is prevention: preventing contaminants from entering source waters.


2.3-mile interpretive hike lead by Program staff.

External support has slowly built over time. It's rare for a water utility to assume an active role in natural resource management. Most consumers pay their bills and turn on a tap without giving much thought to the process of delivering that water safely and reliably. Some may connect the lines back to the treatment process, but, in reality, a large number of consumers do not know where their water originates. So, when a water utility begins the very visible act of dabbling in forest and recreation management, fears arise. Customers fear that this will create higher water bills, nearby landowners see fires along roadways and worry about wildfire inundating their lands, and general questions about the "what" and "why" emerge quickly.

To ease the minds of both consumers and landowners, CAW has taken to educating the community in a few different ways. At a higher level (and at the biggest benefit to rate-paying customers), we have given presentations at many local civic and city organizations' regular meetings and have provided burn demonstrations for student and teacher workshops (Figure 3). We also host a larger utility effort called the Citizen's Water Academy twice a year. This academy is for local leaders in city, civic, and business organizations. They spend an entire day touring utility operations "from forest to faucet" and learn

about the inner workings of the services we provide to the community. For the nearby watershed landowners, we have utilized a mailing campaign over the years. This campaign begins each burning season (autumn), using maps to forecast projected burn areas and acreage and sending a letter to explain the "why" of our prescribed fire efforts. In 2015, after a few years of burning a small number of acres each year, we spearheaded a monthly postcard campaign that provided updates about our burning efforts for that season and answered frequently asked questions. Today we perform an annual mailout, and run a listserv for those wishing to receive day-of-burn announcements. Each year, we've seen progress from these efforts as more community members and leaders understand the importance of forest management and share our story.

Protection of water quality at modern utilities is done in accordance with the Safe Drinking Water Act's "multi-barrier approach." These barriers are actions taken throughout the storage, treatment, and distribution of drinking water to ensure its safety. Multiple barriers must be breached for the customer to receive water that does not meet safe consumption standards. A critical part of this multi-barrier approach is prevention: preventing contaminants from entering source waters. This can be accomplished through sound watershed forest management.

CAW is taking a proactive approach to ensure healthy forests through the use of prescribed burns and ecological forest thinning. These approaches have many benefits, including improved source water TOC management, enhanced water filtration through the forest floor, reduced wildfire risk, healthier habitats, and an increasingly supportive customer base. The community is so supportive that some customers have become forest management ambassadors. The benefits of active forest management far outweigh the costs of reactionary measures. At CAW, we believe that forest management is an important part of water quality protection. 

## References

- CAW (Central Arkansas Water). 2021. "Certified Green Bond." Accessed August 31, 2022. <https://lakemaumelle.com/pages/caw-is-first-in-world-with-certified-green-bond-to-protect-drinking-watershed-for-water-quality/>.
- TETRA Tech. 2007. *Lake Maumelle Watershed Management Plan*. Little Rock, AR: Central Arkansas Water. [https://carkw.com/site/assets/files/1476/lake\\_maumelle\\_watershed\\_management\\_plan\\_-\\_revised\\_-\\_february\\_2007.pdf](https://carkw.com/site/assets/files/1476/lake_maumelle_watershed_management_plan_-_revised_-_february_2007.pdf).