

# Overcoming the “water cycle” myth: Conserving water in Oklahoma City

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**Abstract.** *Stubborn drought in Oklahoma has been the precursor for water conservation programming in the City of Oklahoma City. Oklahomans have grown accustomed to plentiful water resources; however, due to persistent drought across the state, competition between municipalities, and population growth, water policy is becoming a serious concern. In 2013, the Oklahoma City Utilities Department contracted with the Oklahoma State University Department of Horticulture and Landscape Architecture (OSU) and the Oklahoma Cooperative Extension Service (OCES) to help promote outdoor water conservation throughout the city. Providing resources and education for homeowners and irrigation managers is a critical step to prepare for long-term drought conditions in a state with limited water restrictions. A citywide telephone survey revealed many barriers for educators to overcome including participants' uncertainty in their ability to conserve water outdoors and lack of confidence on how to determine water needs of the landscape. This program has created many educational tools and outreach opportunities for homeowners, golf course managers, and irrigation contractors.*

**Keywords.** Conservation, education, sustainability, turf/landscape, water provider, consumer preference

## Background

Public water utilities across the United States are recognizing the value of water conservation awareness programs. Cities have seen both the direct and indirect benefits resulting from water savings including decreased pressure on operating systems and increased capital. Some water districts have found that water conservation programs decrease the need for additional water supply storage and infrastructure expansion (Kennedy and Goemans, 2008). The Western Resource Advocates determined that “Urban water conservation is often cheaper, faster, and smarter than traditional ‘concrete and steel’ water supply approaches; conserving water allows us to do more with less.” Currently, Oklahoma is experiencing a prolonged, four year drought which is predicted to remain in the western part of the state through December 31, 2014 (National Oceanic Atmospheric Administration, 2014). Drought is often the precursor for water conservation planning (Anderson-Rodriquez, 1996). In recent history, Oklahomans have experienced wetter than normal conditions from 1985 to 2010 creating a skewed viewpoint of climatic conditions across the state. Due to this viewpoint, many Oklahomans are accustomed to over-irrigating their landscapes with no repercussions, and the majority of Oklahoma City residents may be unaware of the importance of water conservation. Often times, the water cycle is cited to support why homeowners do not need to conserve water, and many Americans assume that their water supply is reliable and abundant (Attari, 2014). It has been shown that water consumption is dependent on many factors including attitudes and belief towards water use (Renwick and Archibald, 1998; Mayer and DeOreo, 1999; Renwick and Green, 2000). However, studies have shown water supplies will become more variable as climatic factors such as precipitation and temperature change. In Oklahoma City, approximately 30 to 50 percent of household water use is consumed in the landscape. Reducing water applied in excess of plant water need is crucial for conserving water supply. To help reduce peak water demand and promote water conservation the city implemented a mandatory odd/even water schedule. Once the combined lake supply drops to 50 percent, the water restrictions will go to 2 day per week watering restrictions.

Oklahoma City relies on water from the North Canadian River, Atoka Lake and McGee Creek Reservoir. The water rights are assigned by the Oklahoma Water Resources Board (OWRB). The Oklahoma City Water Utilities Trust (OCWUT) has the permitted rights for 423,334 acre-feet per year. Although this is the permitted right during years of drought, evaporation can reduce the surface water availability. Oklahoma City owns four water supply lakes including Overholser, Hefner, Atoka and Draper and water rights in Lake Canton and McGee Creek Reservoir. Lakes Overholser, Hefner and Draper are within city limits. Atoka and McGee Creek Reservoirs are in southeast Oklahoma and Lake Canton is located in northwest Oklahoma. The entire state has experienced a three year drought which has been detrimental to Lake Canton which is currently at 20 percent of maximum capacity. Lakes Canton, Hefner and Overholser receive water from the North Canadian River and Lake Draper receives water from Lakes Atoka and McGee Creek via a 100-mile pipeline. OCWUT currently serves approximately 600,000 municipal, domestic and industrial users with a current demand of 241,768 acre-feet per year (AFY). With a projected water demand of 353,965 AFY in 2060.

In 2013, the OCWUT approached Oklahoma State University Department of Horticulture and Landscape Architecture (OSU) to promote outdoor water conservation through education and outreach programs targeted at different customer groups. The current program is slated to end in 2015; however, OCWUT may continue the partnership with OSU for an additional three years.

## **Program objectives**

The OKC program includes six distinct objectives: 1) Educate homeowners, managed property owners, irrigation installation companies, and golf course managers through workshops, publications and seminars; 2) Build outdoor water conservation demonstration research areas; 3) Develop a public service announcement campaign; 4) Assess overall educational program effectiveness; 5) Evaluate environmental impacts of recycled water irrigation water, and 6) Assess specific educational programs and landscapes using pre-and post-surveys. The following sections discuss the specific goals in detail.

### **Educate homeowners, managed property owners, irrigation installation companies, and golf course managers through workshops, publications, and seminars**

Public support is crucial for water conservation program acceptance and success (Howarth and Butler, 2004). Typically public awareness campaigns are expected to reduce demand by 2 to 5 percent (Wang et al., 1999). Billing and Day (1989) found that the conservation effects due to publicity only exist as long as the publicity continues. Therefore, continued education and awareness campaigns are needed for long-term success. In Oklahoma City, education efforts are currently directed toward three distinct OCWUT customer groups; 1) Homeowners; 2) Commercial and managed property managers; and 3) parks and recreation, golf course, and sports field managers. Oklahoma State University has conducted multiple workshops geared toward homeowners. The workshops cover plant selection, turfgrass management, smart irrigation technology, and irrigation audits. Many publications have been created for use across the state and are utilized for homeowner education programs. In addition, OSU has visited with over two dozen homeowner and neighborhood associations to encourage responsible water use in the landscape. Many homeowners are unaware that they may be watering more than plant water need. A large proportion of homeowners do not know the source of their tap water, or that Oklahoma is in its fourth year of consistent drought conditions. Continuous education targeted towards irrigation companies and homeowners will increase best management practices in the landscape. The OSU team has created several publications that are free for the public, including a water conservation guide and a drought-tolerant plant guide for Oklahoma.

### **Build outdoor water conservation demonstration research areas**

To effectively educate and promote best management practices in the landscape, OSU has created two demonstration areas and will construct three additional gardens. Each garden is located in very visible areas in high traffic locations. The largest demonstration garden is located at Oklahoma State University-Oklahoma City (OSU-OKC) and will be used for homeowner workshops and for OSU-OKC irrigation planning and design, and landscape planning classes. The OSU-OKC garden includes three irrigation controllers, a soil moisture sensor and an evapotranspiration sensor. The OSU-OKC garden was completed in May 2014 and the Myriad was completed in January 2014. The additional three gardens will be located at the OKC Zoo, Woodson Park, and Bluff Creek Park which are dispersed through Oklahoma City. The demonstration gardens provide homeowners with hands on training and easy ways to save water in the landscape. Oklahoma State University is focused on promoting the seven xeriscape principles, which are displayed throughout the demonstration garden areas. The gardens have been featured on *Oklahoma Gardening* which airs on Saturdays at 11:00AM and Sundays at 3:30PM on Oklahoma Educational TV Authority (OETA/PBS).

## **Develop a public service announcement campaign**

A survey of 600 utilities customers in OKC found that 24 percent of those asked about the importance of water conservation stated that it was somewhat or not at all important. In general, Oklahoma residents may be less concerned with water conservation practices. To increase general water conservation awareness, the OSU team attends tradeshows, conferences and provides literature for a city-wide “Neighbors night out” event. The water conservation program is frequently highlighted in the water bill insert. Oklahoma City provides a water conservation website, SqueezeEveryDrop.com with information provided by OSU. The public service campaign has created a general awareness of the need for water conservation in Oklahoma and has provided tools for homeowners to utilize in their home landscapes. Public awareness campaigns have shown water use reduction. Eight urban California water agencies showed an average of 8 percent water savings due to public awareness campaigns (Renwick and Green, 2000). A remarkable 22 percent reduction in water use was determined due to San Diego’s intensive education and advertising campaign (Shaw et al., 1992). Savings are typically only achieved for as long as the campaign continues. In the future, the OSU team will work with nurseries to provide informational leaflets to distribute to customers.

## **Assess educational program effectiveness through pre- and post- city wide surveys**

A pre-telephone survey was completed in February 2014 and included 803 valid completed responses. The post-telephone survey will be replicated at the end of the program in 2015 to determine change in behavior. The pre-survey revealed that many of the respondents were unsure about how much water they actually use for irrigation. Only 9 percent of 529 respondents knew how much water they put on their lawns. Over 65 percent used their own judgment when watering the lawn and only 16 percent used the local weather. The majority of respondents, 77 percent out of 685, stated that they do not feel confident in their ability to conserve irrigation water. The survey revealed that there is an educational gap in Oklahoma City. Many homeowners could benefit from water conservation educational programming. Some other cities across the United States are mobilizing free or low-cost audit teams to educate the homeowners about proper watering techniques. Oklahoma City may benefit from this type of service. The majority of respondents, 51 percent out of 685, stated that they could tolerate a lighter green turf if it would result in a lower bill. While 16 percent stated they could not tolerate a lighter turf even if it lowered their bill. Results from the pre-survey showed that access to educational tools such as the Oklahoma Mesonet, the statewide weather monitoring system, and OSU websites and plant lists may help increase customer confidence and increase water conservation program success.

## **Evaluate environmental impacts of recycled water irrigation water**

Reclaimed or recycled water is waste water that has been treated to levels suitable for reuse (Smith, 2011). Reclaimed water use reduces the need for purchasing water in other parts of the state, and decreases pressure on water municipalities during times of severe drought. Providing recycled water for irrigation and commercial purposes protects drinking water resources for human consumption. There are potential risks associated with the use of recycled water in urban environments; however, appropriate management and controls help reduce this risk (Toze, 2008). Reclaimed water contains various amounts of dissolved solids, nutrients and other elements (Qian and Mecham, 2005). Excess salts can build up in the soil profile and lead to plant mortality. Some of these nutrients are required for turfgrass growth and vitality, and should be considered in a landscape management plan. Starting in 1996, the City of Oklahoma City began offering recycled water to large industrial water users including OG&E, Redbud electric, and to the Gaillardia Country Club. Three out of the four wastewater treatment facilities in Oklahoma City can produce and deliver recycled water to industrial consumers, saving the city more than 1 billion gallons of drinking water per year (Chavez, 2012). The recycled water benefits the city as well as

Oklahoma City residents and businesses. To evaluate the environmental impacts associated with reclaimed irrigation water, five golf courses that receive irrigation water from various water sources including: reclaimed water, untreated surface/lake water, Oklahoma City treated water, and groundwater mixed with creek water were selected. Soil and water samples have been collected and results will be used to determine the effects of reclaimed water on soil properties. Reclaimed water could potentially be used to irrigate additional golf courses, athletic fields, and commercial industrial parks.

### **Assess specific educational programs and landscapes using pre-and post-surveys**

On July 20 and August 10, 2013, two workshops were administered in Oklahoma City in order to provide homeowners with the tools to properly maintain their landscapes. During these workshops pre- and post-workshop surveys were administered. At the beginning of the workshop, prior to any presentation, participants completed a pre-survey to assess prior subject knowledge. At the end of the workshop, a post survey was administered to assess learning. As a third step, an internet follow-up survey was also conducted with willing participants a month after the workshops. The follow-up survey collected information on implementation of the home irrigation audits, barriers to auditing, and suggestions for improvement. In total, 70 and 30 people attended the first and second workshops with a response rate of 78 percent for the July workshop and 77 percent for the August workshop pre and post surveys, and 22 people responded to the follow-up survey.

In the pre-survey, 44 percent of respondents indicated understanding of the simple irrigation audit procedure. After the workshop, 68 percent of attendees understood how to do an irrigation audit, which was a major goal of the workshop.

Within 6 weeks of the workshop, participants were given a follow up survey. Forty percent of the 22 people who completed the follow up survey indicated that they audited their irrigation or watering systems, while 60 percent had not. When asked why the participants had not audited their irrigation systems, 11 percent of them indicated that they did not have enough time, 33 percent indicated that the weather kept them from conducting the audit, and 11 percent of them indicated that they needed an irrigation professional to help them. None of the workshop respondents indicated that not being able to remember how to conduct the audit and to program and run the irrigation system among the reasons for not auditing their system. However, 45 percent of them indicated other unnamed reasons for being unable to audit their system. Looking at the statement about whether they agree with the assertion that “The simple irrigation audit was easy to conduct,” 31 percent of people who took the follow up survey strongly disagree with the statement, 19 percent of them simply disagree, 13 percent neither agree nor disagree. Only 37 percent of them agreed or strongly agreed with that statement that the audit was easy to conduct, indicating the presentation or implementation could be tweaked or phone support provided after a workshop. More than half of the participants in the follow-up survey, 60 percent, indicated that their watering habits changed and over half, 67 percent, indicated that their watering schedule changed to late evening or early morning.

Homeowners many lack the understanding of how to maintain an attractive landscape while saving water. The goal of workshops and classes is to show, scientifically, that landscapes typically do not require irrigation every day or every other day. Through education, many homeowners change their habits and irrigate only when needed or during the correct time of day.

### **Conclusions**

Many water users attribute the natural water cycle as proof that water is a renewable, abundant resource; unfortunately, the urban water cycle is often more representative of the actual process. Through education

and increasing drought pressure, residents are becoming more aware of water issues facing Oklahoma. Awareness paired with changing regulations will prepare Oklahomans for continued drought conditions. Oklahoma municipalities should continue to work with irrigation contractors, universities, and extension to create a comprehensive program to change minds and overcome the “water-cycle” myth.

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