

Urban Landscape Water Use in Texas

• A SPECIAL REPORT BY THE TEXAS WATER RESOURCES INSTITUTE

Urban-municipal use is the second largest category of water use in Texas. Within this use category, lawn and landscape water use is a significant, but largely unmeasured, component. Landscapes are important components of urban environments and provide an array of economic, environmental, human health and social benefits. A recent report in the *Texas Water Journal*, summarized in this publication, evaluated urban landscapes in Texas and associated water use and offered strategies and practices that can significantly reduce water use for urban landscape irrigation.


Texas Water
Resources Institute
make every drop count



Nursery, Green House and Sod Industries: Irrigated Acres and Water Use

- 59,212 acres are used in production of ornamental horticulture crops and sod with 36,805 acres in sod production and 18,230 acres in nursery crops (Table 1).
- Ornamental crop and sod production are associated with the highest reported irrigation rates in Texas, which approach 84 inches per year (Table 1).
- Potential statewide annual water use for this green industry sector is 0.414 million acre-feet (Table 1).

Golf Courses: Irrigated Acres and Water Use

- In Texas, there are approximately 1,000 golf courses covering an average of 115 acres each, thus producing an estimated total golf course area of 115,000 acres for Texas (Table 1).
- The annual irrigation rate for Texas golf courses averages 38 inches and ranges from 29 inches in the east to 47 inches in the west (Table 1).
- Based on this, potential total water use for the golf industry is estimated at 0.364 million acre-feet annually (Table 1).

Urban Landscapes: Irrigated Acres

Landscapes for single and multi-unit housing landscaped area encompass 1,248,206 acres:

- In 2011, Texas had 7,675,050 single family housing units. With each unit having an average mixed landscaped area of 0.15 acres, there are a total of 1,151,258 acres for all the single residential housing units in the state.
- A conservative one-acre of landscaped area was assigned to each of the additional 96,948 multi-unit housing structures (complexes with an estimated average of 25 units for each).

Other irrigated urban landscapes encompass 360,193 acres:

- municipal landscaped areas (parks, etc.): 209,811 acres, with approximately 104,906 of those acres being irrigated,
- business and commercial landscapes: 228,776 acres, and
- educational institutions landscapes: 26,511 acres.

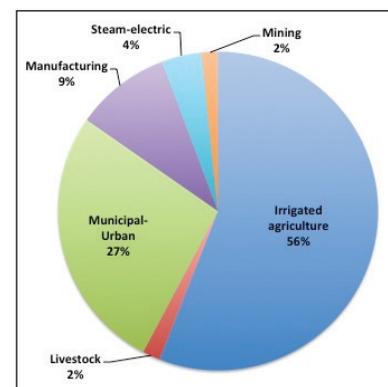


Figure 1. Relative water demand projected in 2010 for various activities in Texas.

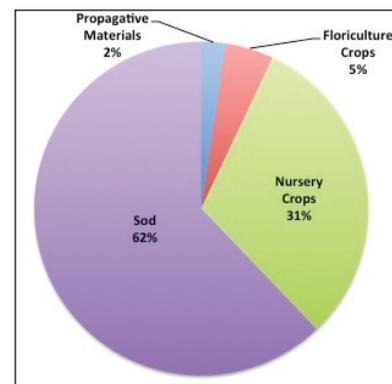


Figure 2. Relative distribution of the area devoted to the production of ornamental commodities and sod in Texas.

The Big Picture: Water Use in Urban Landscapes

Combining Texas' residential, municipal, business and educational landscape areas in the state amounts to 1,608,399 acres (Table 1), and together with golf courses, reaches a grand total of 1,723,399 acres (Figure 3).

Based on a conservative estimate of 14.2 inches of irrigation per acre, 1.898 million acre-feet (Table 1) is used annually for landscape watering in Texas.

When this is combined with water use by golf courses, the total annual urban irrigation is 2.262 million acre-feet per year, representing 46.6% of municipal water use and 12.6% of the total annual water demand in Texas (Figure 1), positioning it as the state's third largest water user, after agricultural irrigation and other urban (in-home and municipal) uses.

Table 1. Estimated area, average irrigation rate and total water use by irrigated agriculture and green industry activities in Texas.

Commodity	Area (acres)	Average annual irrigation rate (feet (inches))	Estimated total annual water use (million acre-feet)
Irrigated agriculture	6,170,000	1.54 (18.5")	9.502
Green industry activities			
Nursery-greenhouse-sod	59,212	7.00 (84.0")	0.414
Golf courses	115,000	3.17 (38.0")	0.364
Lawns/landscapes*	1,608,399	High 2.50 (30.0")	High 4.021
		Low 1.18 (14.2")	Low 1.898

*Includes landscaped areas in residential, municipal, commercial (business) and educational sectors. See Figure 3 for its distribution.



Economic Impacts

Urban landscapes have been shown to enhance real estate value/appraisal of residential and commercial properties, reduce energy consumption (heating, cooling) and costs, attract and positively influence consumer attitudes and spending, reduce stress at home and work, promote exercise activities, reduce pollution, and minimize soil erosion. The economic benefits from these are significant and largely undocumented.

Landscaping activities are a component of the ornamental horticulture industry, also known as the green industry. Green industry components include greenhouses, nursery and sod growers, and other services and goods provided by florist shops, retail garden centers and tree care/maintenance companies. The total economic contributions of all green industry activities in Texas for 2011 were estimated at \$17.97 billion in output, plus \$10.7 billion in value added and providing employment for 200,303 people.

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Landscape type	Acres
Residential	1,248,206
Municipal	104,906
Commercial	228,776
Golf Courses	115,000
Educational	26,511
TOTAL	1,723,399

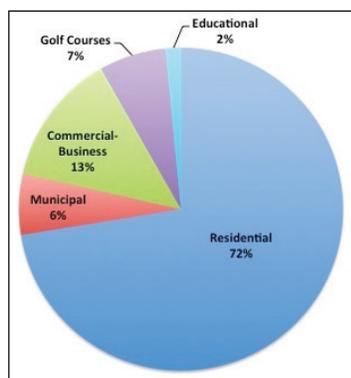


Figure 3. Distribution of the urban landscape (and lawn) area in Texas, including golf courses.

Drought and Population Growth

The severe drought experienced by Texas since 2011 has brought devastating effects throughout the state. During 2011, the drought resulted in a loss of \$7.62 billion to the state's agricultural industry, making it the costliest drought on record.

While estimating what portion of those losses was from green industry is difficult, the drought-related loss of 5.6 million trees in urban landscaped areas provides an insight. Similarly, drought-related losses of trees in the state's natural forests in 2011 amounted to 301 million trees, accounting for an average 6.2% mortality rate.

Across the state, many cities and municipalities have enacted restrictive ordinances on urban landscape irrigation to conserve water as supplies dwindle due to continuing drought. As of June 24, 2013, the Texas Commission on Environmental Quality reported that 972 (20.8%) of the state's 4,665 community water systems were under voluntary or mandatory use restrictions.

Population growth in Texas, largely in urban areas, is expected to increase 82% in the next 50 years, from 25.4 million in 2010 to an expected 46.3 million in 2060. Likewise, demand for municipal water over the same period is also expected to increase by 71.4%, from 4.9 million acre-feet in 2010 to 8.4 million acre-feet in 2060. To meet the needs of this growing population, innovative strategies will be needed.

An El Paso garden designed by Texas A&M AgriLife Research scientists uses graywater irrigation to produce vegetables (left). Using water-efficient landscape irrigation systems as well as basing irrigation applications and scheduling on climatological and soil moisture conditions are viable water conservation practices (right).





Palisades Zoysiagrass, a water-efficient turfgrass variety, is used throughout the Texas A&M AgriLife Research and Extension Center at Dallas grounds, seen here in July (left). The WaterSense® labeled home at the center features drought-tolerant landscapes, turfgrass and native plants, all of which are irrigated by rainwater (right).

Opportunities for Water Conservation in Urban Landscapes

Water-efficient Landscapes and Plants

Homeowners and landscape designers choosing water-conserving, regionally appropriate plants and landscapes can help improve urban water conservation. There are published and online listings of resource-efficient plants (such as Earthkind®) trees and turfgrass species, both native and adapted, that can be targeted to specific areas in the state. Many utilities, water districts and municipalities in Texas promote and provide guidance on the use of these plants through rebates and incentives. With proper design and maintenance, these landscapes can be aesthetically pleasing and have little-to-no need for supplemental water.

Smart Irrigation Controllers and Rain Sensors

Landscape irrigation applications and scheduling based on climatological (i.e. ETo) and soil moisture conditions have been investigated and promoted as viable water conservation practices. These concepts have led to the technological development of irrigation systems run by smart irrigation controllers (based on ET or soil moisture sensors). The use of ET-based controllers has been shown to be only marginally effective to date but is improving. Rain sensors, which interrupt the communication between timers or smart controllers in response to rainfall and stop unneeded irrigation, have been attributed significant water savings despite their erratic performance.

However, any drawbacks of smart irrigation controllers and rain sensors, which are becoming more efficient in each generation, can be overcome by proper and specific design of the irrigation system to the site, soil, plant materials and their hydrozoning, and a thorough follow-up and fine-tuning after installation. Incorporation of landscape crop coefficients to ET-based irrigation, effectively a deficit irrigation protocol, is a refinement that offers the potential for additional water savings while maintaining the aesthetic quality and function of ornamental plants and amenity turfgrasses.

Alternative Water Sources for Irrigation

Another viable option to conserve potable water in urban environments is to irrigate landscape plantings using alternative waters such as saline (brackish) water, reclaimed water and graywater. Brackish groundwater is abundant in Texas, with an estimated volume of more than 2.7 billion acre-feet, and is a viable alternative in many areas of the state. Municipal reclaimed water has been considered a viable alternative for landscape irrigation as well; however, its availability and supply is currently limited due to tightly regulated procedures and required separate pipeline systems. Depending on the quality of reclaimed water, its use in landscape irrigation might also require the use of modified sprinkler systems or drippers.

The successful use of both saline (brackish) and reclaimed waters requires judicious use of salt-tolerant plant and grass species, appropriate irrigation systems and techniques, leaching requirements, and short- and long-term management of urban soils and their associated watershed to minimize the accumulation of salt build-up and undesirable effects on the overall urban ecosystem.

Condensate water from air-conditioning systems is a potential source for outdoor irrigation, particularly in sites with a relatively large indoor footprint versus landscape footprint, and can be high-quality water requiring minimal treatment for storage and/or immediate use. An additional alternative water source that has potential for landscape irrigation is graywater, which is residential wastewater from laundry, showers and bathtubs. Graywater constitutes up to 60% of the total wastewater from a household, and might yield up to 30,000 gallons per year for an average family of four.

Urban Irrigation in Texas: Making Every Drop Count

Population and economic growth, competition and environmental changes (i.e. drought) are putting tremendous pressures in the overall water balance (demand-availability) for Texas today and in the decades ahead. While the agricultural sector has been the largest user of Texas water resources, the increased growth and economic development in the state's urban sector are shifting water use and allocation patterns, and concurrently highlighting our limited knowledge on the actual water-use efficiency by this latter sector and the documented improvements in the former. Increased focus and resources to address current knowledge gaps and develop practices and recommendations that significantly enhance water conservation and use efficiency in urban activities, particularly landscape irrigation, is necessary to the economy of Texas.

For more information, data and references, see *An Evaluation of Urban Landscape Water Use in Texas* in Volume 4, Number 2, of the *Texas Water Journal*, available at texaswaterjournal.org.