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Why is Texas out of water during severe droughts?

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An island exists with one interior lake of limited size as a water supply. The folks on the north side of the lake have water-use permits with pumpage restrictions--on the south side, however, some folks have limited pumpage regulation and others have none. A severe drought occurs. For the north-shore, landscapes die and folks have barely enough water to maintain households. Meantime, on the south shores of the lake, large yards are irrigated, swimming pools installed and filled, and golf courses and other commercial developments that use substantial amounts of water are built. The drought continues until the water supply is almost depleted. Emergency water transmission pipelines are quickly built, and water is trucked into the area. Many people are about to completely run out of water and the cost for the limited water that is available is about to increase considerably.

Where is this island and when would this scenario occur?

The hypothetical island is Texas, which is indeed a hydrologic island--99% of the water in this state comes from precipitation within its borders. The above scenario could occur during the next severe drought. There are three major reasons why Texas has water shortages during drought: (1) lack of authority to regulate water usage and waste, (2) lack of funding for Water Management Strategies that would address some water shortages, and (3) wasted water. These issues are described below.

Does Texas have water shortages?

During severe drought, Texas water demand (use) exceeds the existing supply. The 2012 Texas Water Plan (http://www.twdb.state.tx.us/waterplanning/swp/) written by the Texas Water Development Board identifies, for the next 50 years, the areas of water shortage and projected shortage volumes during severe drought. For example, based on current (year 2010) conditions, about one-fourth of the nearly 2600 water user groups (i.e., municipal utilities and water districts) endure water shortages during severe drought. In many cases the shortages substantially exceed the existing supply; in some cases the shortages are more than double the supply.

The current statewide total shortage is about 3.6 million acre feet per year (about 166 times greater than the water storage in Lake Austin). This amount increases to about 8.3 million acre feet per year by the year 2060. Of the total, the current municipal (urban and rural) shortage is 315,000 acre feet per year, increasing to 3.4 million acre feet per year by 2060. The average residential use of water is about 0.1 acre feet per year per person, thus the municipal shortages include residential water for many millions of people. Documentation of the water shortage amounts for the Texas Hill Country is presented on a PowerPoint presentation entitled “Current and future water shortages" online at http://www.hillcountryalliance.org/HCA/Presentations.

The Water Plan identifies Water Management Strategies that are projected to address much of the anticipated needs. However, the capital cost for the strategies totals about 53 billion dollars, of which only a small fraction has been funded by the Texas Legislature. Additionally, the annual cost to operate and maintain the strategies is in the billions of dollars.

Doesn't Texas regulate water usage?

In Texas, surface-water use is permitted and most of the permits have restrictions that curtail or prohibit water usage during drought. However, groundwater use is addressed by limited regulation for areas covered by groundwater conservation districts (GCDs); for other areas, however, essentially no regulation of groundwater use exists. Additionally, the Texas Supreme Court recently ruled that landowners own the groundwater beneath their property, thus potentially limiting the authority of GCDs to regulate pumpage. With respect to the island metaphor, surface-water users are represented by those on the north shore of the lake, while groundwater users are represented by those on the south side.

Is groundwater an important part of Texas water?

Groundwater is the source of more than half the water used in Texas.

The average rainfall on Texas is about 28 inches, of which about 89% is lost to evaporation or transpiration: the remaining 11% becomes runoff (Reed and others, 1997). About 72% of all runoff occurs during storms--most of which refills reservoirs or flows to the Gulf of Mexico. The remaining 28% of runoff leaks through stream channels to recharge aquifers. Most of this recharge moves through aquifers and discharges back to streams as base flow during dry conditions. These base flows comprise essentially all surface water during dry periods, especially during droughts. Additionally, groundwater is the "hidden" source of thousands of springs throughout Texas. Recharge to groundwater occurs throughout the State. Without the groundwater that provides this baseflow, there would be no surface water to regulate.

Can't water supplies be increased?

Yes. The Texas Water Plan identifies Water Management Strategies that would increase water supplies to meet much of the water shortage. This information and data are presented online at http://www.twdb.state.tx.us/publications/state_water_plan/2012/07.pdf. The volume of water produced by surface water strategies recommended in 2060 is five times greater than that produced by recommended groundwater strategies. The strategy type that produces the largest supply is "Other Surface Water" which usually requires additional infrastructure such as new pipelines to divert and convey water from an existing source to a new point of use. Irrigation conservation is the second largest strategy category recommended.

Is Texas wasting water?

Yes. Several examples follow.

1. The largest category of water use is agriculture irrigation, which represents 56 percent of the total demand. Much irrigation water is wasted, mostly because of outdated water-conveyance systems and inefficient water-distribution methods. Water loses for irrigation systems include: transmission from the water source (conveyance), evaporation, and overwatering, the total of which often exceeds the volume needed by plants.

2. Water-thirsty vegetation is prevalent throughout Texas. Examples include landscaping and gardening that require frequent irrigation relative to that of xeriscaping, and lack of land management to control

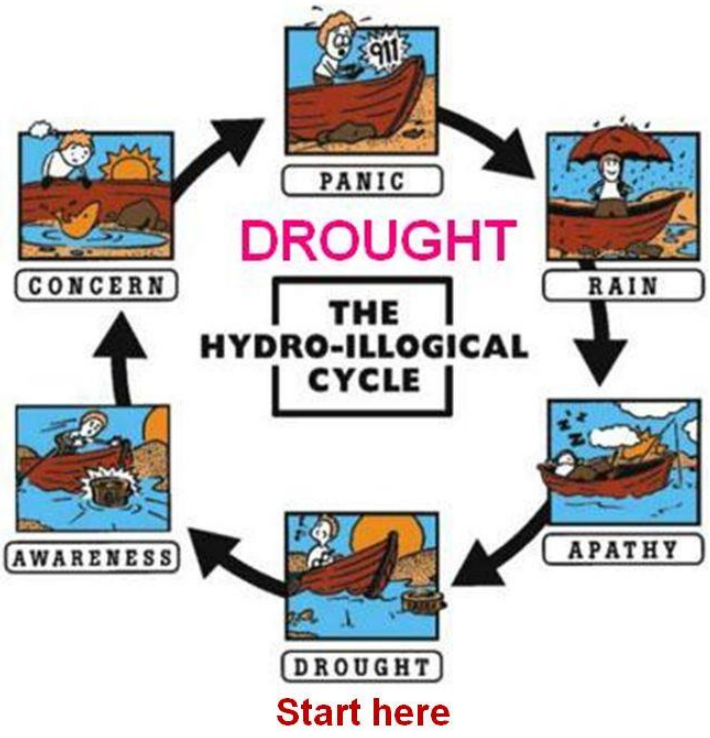
phreatophytes and other vegetation that transpire (consume) large volumes of water. About 89 percent of precipitation in Texas is lost to evaporation and transpiration; much of that loss could be reduced with effective controls on the location and extent of water-thirsty vegetation. For example, the water loss due to transpiration from salt cedar and mesquite in the flood plain of the Colorado River in west Texas is equivalent to the long-term mean flow in the river (Slade and Buszka, 1994, p. 42).

3. Leaky water-transmission pipes and canals cause much water to be lost. Water conveyance losses in Texas are estimated to be about 600,000 acre feet per year, a value equal to about 17% of the Statewide water shortage (Solley and others, 1998, p. 9).

4. Lack of widespread rainwater-collection systems and greywater irrigation systems (http://en.wikipedia.org/wiki/Greywater) cause much water to be wasted. Almost all municipal and residential water comes from runoff, which, as stated earlier, is only 11 percent of precipitation. Rainwater-collection systems capture almost all rain falling on their catch areas. The same amount of rainfall that supplies one house with water from runoff could supply about 8 houses that have rainfall-collection systems. About half of household water use is for irrigation, thus each greywater system would reduce household use by about half.

5. Much municipal water is wasted. For example, the average per capita water use ranges from about 100 gallons per day for some cities, up to about 250 gallons per day for others. Municipal demand is 26 percent of the total water demand. Frisco, Midland, Plano, Richardson, and Dallas have the largest per capita use. San Angelo, Killeen, Pearland, Pasadena, and Missouri City have the lowest per capita use. Use of additional or increased municipal conservation measures could create substantial reductions in municipal shortages.

When the next severe drought occurs, public perception of the importance of water conservation will increase, which could prompt politicians to enact rules to promote conservation. However, by that time, it likely will be too late to avoid many of the predictable water shortages. In reality, the extent to which water drought problems are addressed is directly proportional to the severity of the drought, as portrayed below.



How can Texas better manage its water shortages?

Three major schemes are needed: (1) increased conservation of water to minimize waste, (2) funding for at least some of the most-promising Water Management Strategies, and (3) consistent water-use regulation for both groundwater and surface water.

The collective water-conservation measures addressed above would decrease much of the recognized water shortage. However, most are relatively or prohibitively expensive to implement and many individual measures would reduce water shortages by minimal amounts. Additionally, the public and city, county, and state politicians are reluctant to develop rules mandating water-conservation measures, as they recognize the Texans they represent are addicted to the water they use.

If Texas fully funded, built, and maintained all the identified Water Management Strategies, the current water shortage would be reduced from 3.6 million acre feet per year to 2.2 million acre feet per year, which would continue to be a substantial shortage volume. Additionally, it is unlikely that the Legislature will increase funding for the Water Management Strategies, considering that they have known of the water shortages for many years and thus far have funded only about 2 percent of the anticipated capital cost. In 2007, 2009, and 2011, state lawmakers appropriated only $1.47 billion in bonds--despite the $53 billion needed. Of that allocated, only $100 million (less than one-fifth of one percent of that needed) was appropriated in the 2011 session. Finally, the economic loss to Texas for not meeting water supply needs currently is about $13 billion dollars per year; that value increases to about $126 billion per year by the year 2060.

Unlike most other western states, Texas has a statewide regulatory program only for surface water, and not for groundwater. Unless their property lies within a groundwater conservation district, Texas landowners are generally allowed to pump as much groundwater as they want from beneath their land, regardless of the effects on neighboring wells, so long as they are not "wasting" the water; this is sometime referred to as the "rule of capture." Groundwater districts may impose some limits on pumping from wells within their boundaries, but the Texas Supreme Court's recent ruling [in the Edwards Aquifer Authority v. Day case] makes it clear that a landowner may sue the district for compensation if the limits go too far. The court did not provide clear guidance on how much regulation is too much.

Groundwater is not static--it moves: the water under any given property at any given time "was" under another property and "will be" under yet another property. Any water captured from beneath one property is no longer available to the owner of the adjacent property. Additionally, groundwater pumpage creates "drawdown" (lowering) of surrounding groundwater levels. Increased pumpage causes increased drawdown. Groundwater moves toward areas of drawdown, even water that would not otherwise move into that area. Such captured water would no longer be available to the owner of the land from which it flowed--from where it previously "was". Under current groundwater law, the biggest pump gets the most water, including water captured from neighboring properties.

As mentioned earlier, during periods of drought, groundwater is the source of almost all surface water in the state. Texas permits and regulates surface water--however, it is ironic that such regulation is most critical during drought conditions when substantially all the surface water comes from groundwater, which has limited or no regulation. Because of this inadequacy in regulation authority, water will be wasted and much needed water will be unavailable during drought--when it is most needed.

As throughout the world, surface water and groundwater are fully exchanged and thoroughly interconnected throughout Texas. The most equitable and cost-effective method to minimize water shortages during drought would result from legislated authority to regulate groundwater with the same veracity as already exists for surface water. Only then will rules exist to manage, to the fullest practical extent, whatever water exists during droughts.

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The Hill Country Alliance is a non-profit organization whose purpose is to raise public awareness and build community support around the need to preserve the natural resources and heritage of the Central Texas Hill Country. To learn more about Hill Country Alliance initiatives, please visit the HCA website www.hillcountryalliance.org

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