
Water
Conservation
on Campuses
of Higher
Education in
Texas

GISWR Term Paper

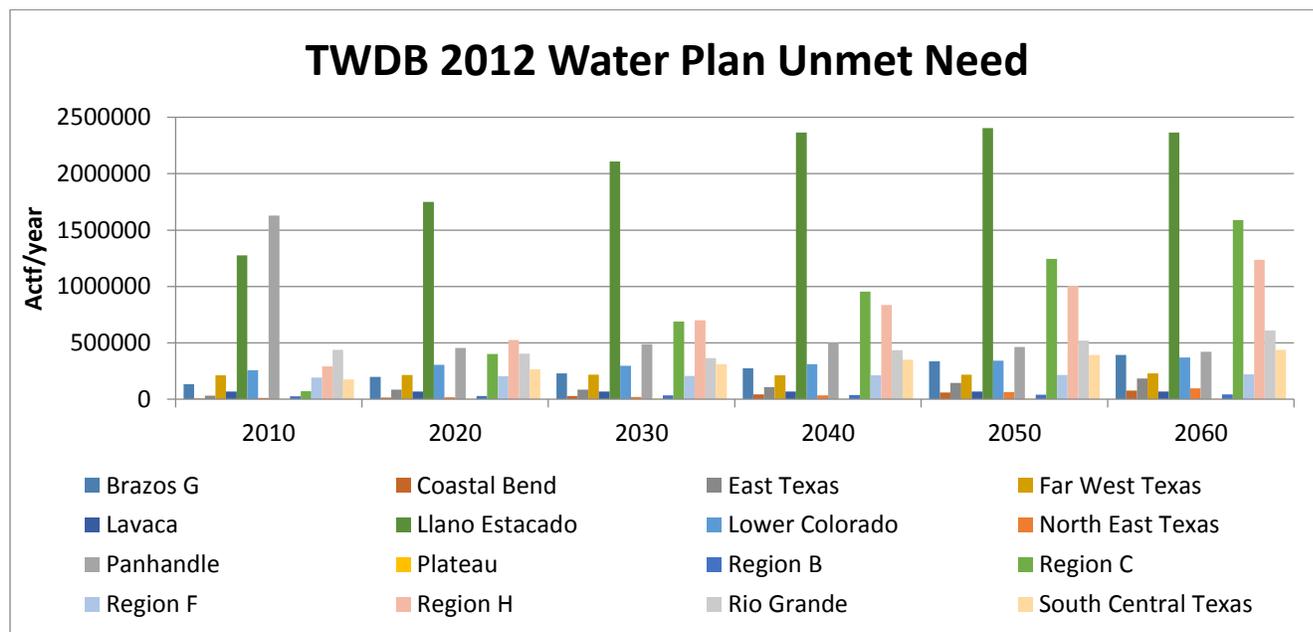
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Introduction

Water Conservation

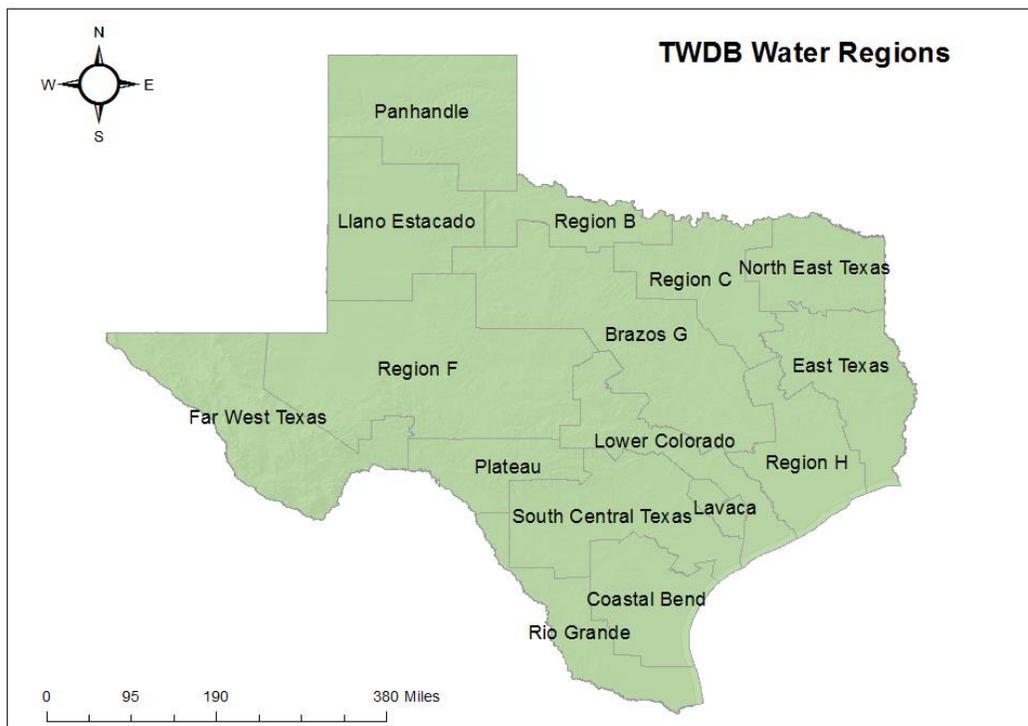
Recent extreme drought conditions in the state of Texas have forced policy makers and utility providers to reevaluate regional water resources. Many areas, notably the city of San Antonio, have come to rely on water conservation techniques as the cheapest mitigating weapon in fighting the drought¹. The San Antonio Water System (SAWS) may see between \$0.7 and \$1.3 billion in savings (2003 US dollars) in the next 50 years attributed to their conservation efforts. Water conservation efforts reduce costs by lowering the demand for developing expensive new water sources. In many arid regions of Texas, additional water sources can be very limited and have large upfront costs. These factors have made water conservation strategies increasingly more appealing.

The Texas Water Development Board's (TWDB) 2012 Water Plan shows the growing demands, relatively constant supply, and looming water deficits for its 16 regions. Providing the unmet demand will increase costs for consumers in many regions. Several regions have water conservation strategies and projects included in their Regional Plans in order to reduce the need for more costly new water resources².



¹ "SAWS Water Conservation Cost Savings," BBC Research & Consulting. May 13, 2003.

² "Water For Texas," 2012 State Water Plan, Chapter 2: Regional Summaries. Texas Water Development Board.



Water conservation strategies and techniques aim to reduce water demand and increase the efficiency of a water system. Common strategies include water reuse programs where gray- or non-potable water is recycled for repeated use, installing water-efficient appliances and plumbing fixtures, and maintenance and leak detection to avoid waste. These strategies can be effective when used in a one bedroom house or an entire university campus.

Water Conservation on Campuses of Higher Education

Sustainability, in general, and water conservation, in particular, has seen growing trends on campuses of higher education worldwide. Higher education institutes (HEI) play an important role in the developing idea of sustainable living for several reasons. Many universities can be studied and analyzed as small cities in terms of population and the quantity and variety of resource use. The scale of HEI allow for manageable yet meaningful resource use analysis. Research universities especially, act as living laboratories where policies influence technical research and the results can be implemented on the campus³. Many HEI feel a sense of responsibility to practice what they preach and both develop sustainable technologies and execute them on the campus. Behavioral innovation is also a very important contribution.

³ Marinho, M., et al., Water conservation as a tool to support sustainable practices in a Brazilian public university, *Journal of Cleaner Production* (2013), <http://dx.doi.org/10.1016/j.jclepro.2013.06.053>

Students on sustainable universities acquire learned behavior that will likely stay with them after they leave their campus.

Objective

The purpose of this study is to take an inventory of water conservation strategies on campuses of higher education throughout Texas. The implementation and effectiveness of these strategies have a strong spatial and temporal correlation that can be explored effectively through ArcGIS. Varying climates and hydrologic resources as well as recent droughts may have affected higher education institutes policies and attitudes towards water resources and water conservation.

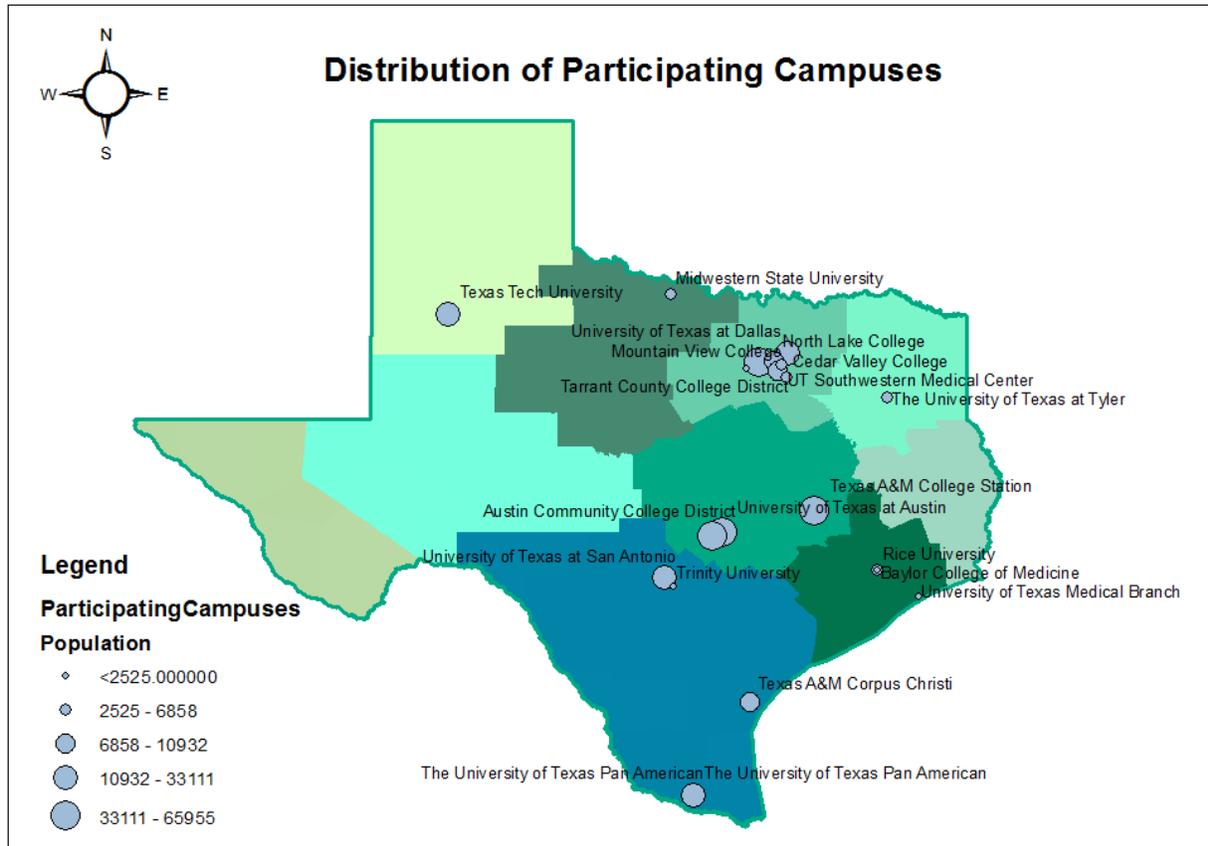
Methodology

TRACS Water Conservation Survey

In order to assess what water conservation techniques are being employed on higher education institutes in the state, a comprehensive online survey was designed and distributed to all 176 HEI in Texas with assistance from the Texas Regional Alliance for Campus Sustainability (TRACS). The survey contained six sections that could be completed by multiple individuals for any institution. The sections included irrigation and landscaping, building use (general and education, and auxiliary), utilities, education, and governance and policy. The first three survey sections asked about what water conservation strategies were utilized on campus, to what extent they were utilized, and how effective were the strategies. The education section asked about workshops, classes and degrees pertaining to water conservation that could be offered to staff, faculty and students. The final section covered administrative policies and water conservation project plans and funding.

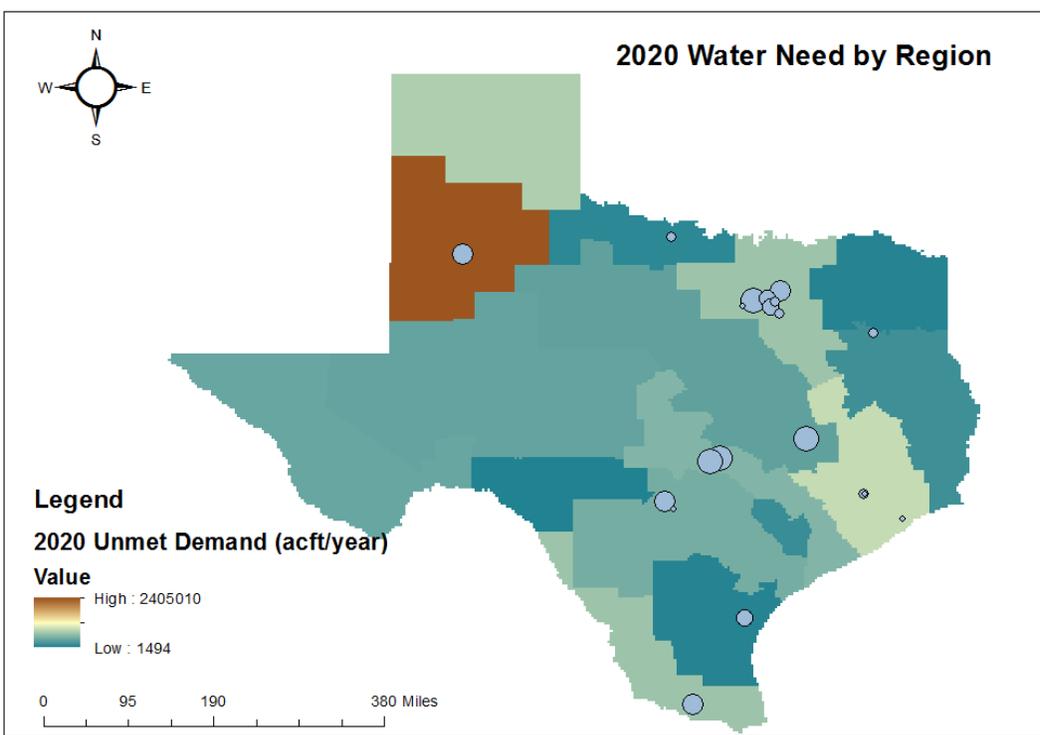
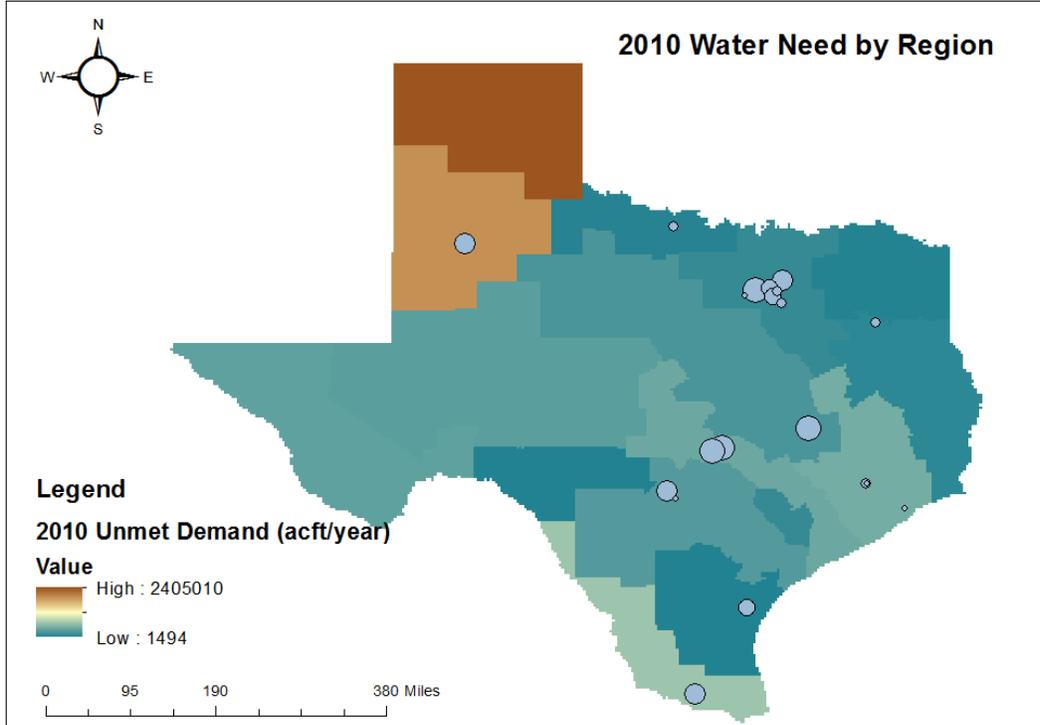
Results

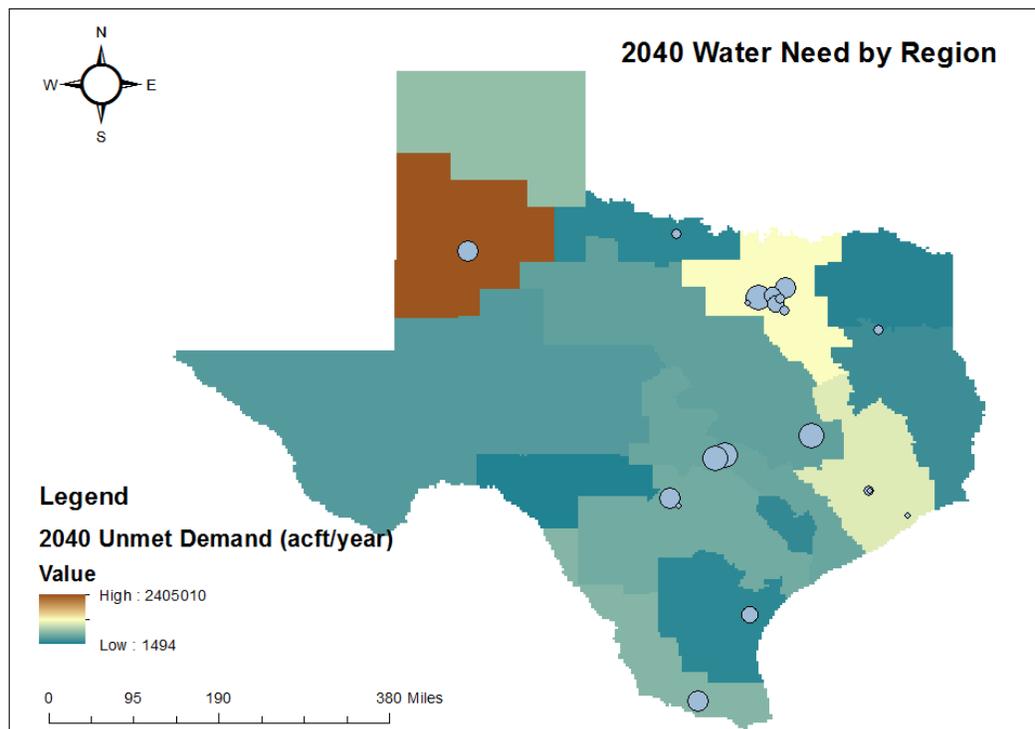
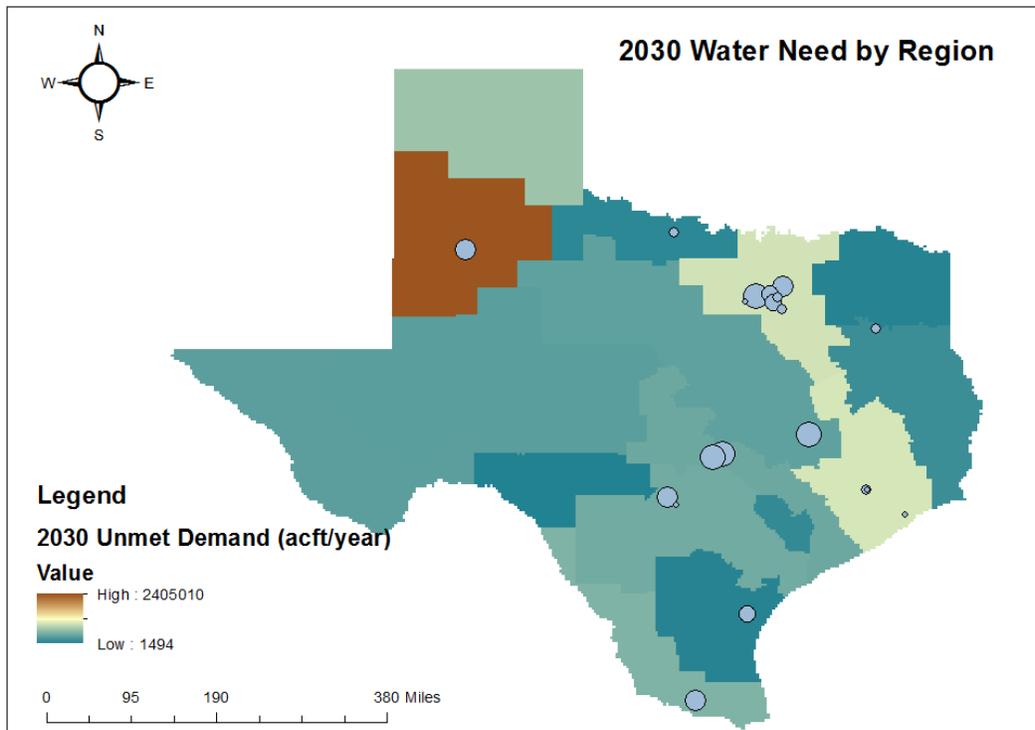
The survey results were not very robust and have little statistical relevance. Not many schools participated in the survey and very few could complete the survey. Due to the lack of substantial data, I took two different approaches to my analysis. One focused on the locations of participating campuses and the projected unmet water demands in their respective water planning region. The other focused on the effect of recent drought on Higher Education Regions.

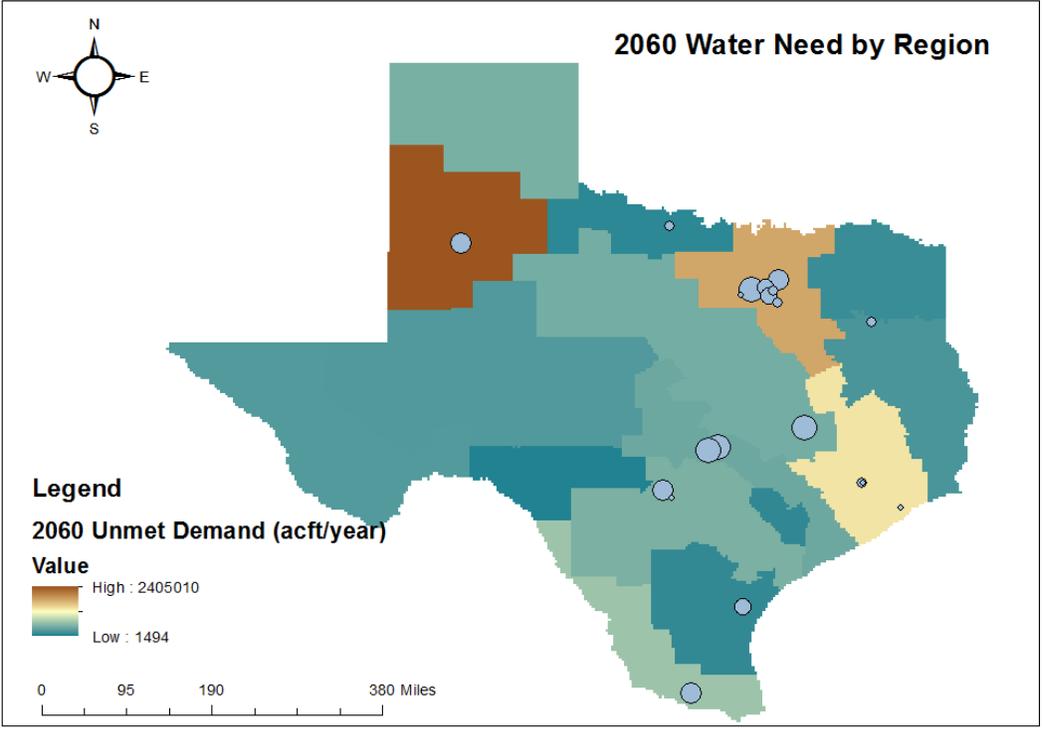
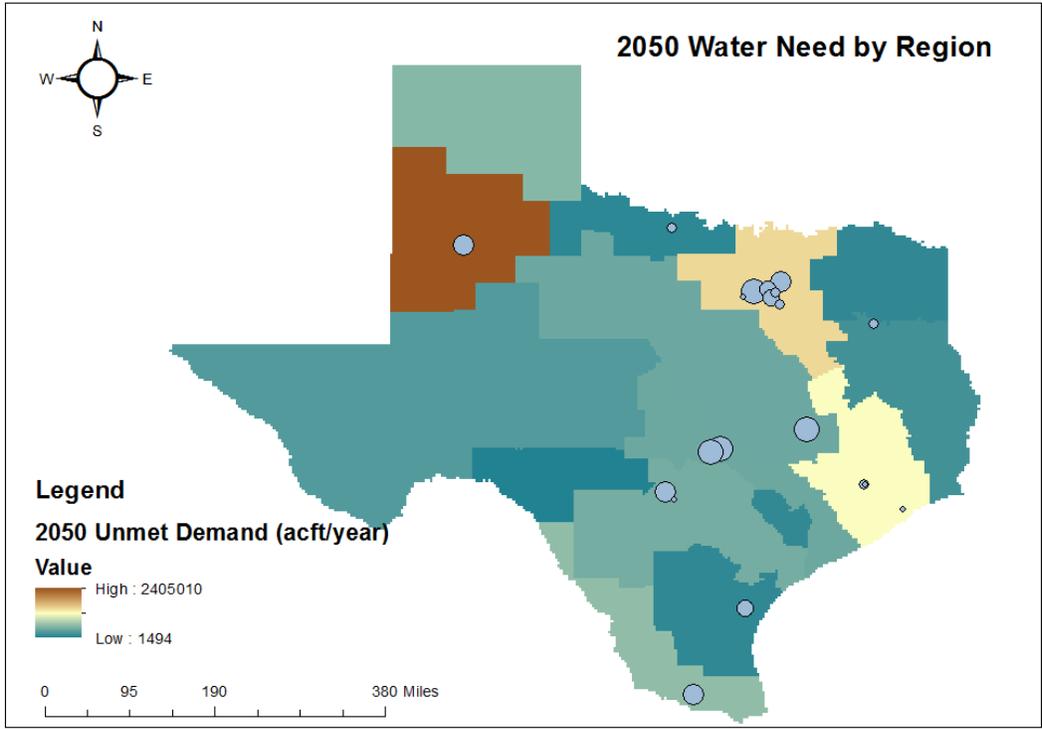


Unmet demand

The TWDB's 2012 Water Plan shows the projected existing water supply, demand, and the unmet demand or needed supply for 2010-2060. The demand is based on projected population growth and the unmet demand is simply the projected supply subtracted from the projected demand. I mapped the amount of unmet demand for each region for the 50 projected years with the plotted locations of the participating schools. I normalized the highs and lows to be the greatest high and lowest low projected in the water plan so each decade's map would be comparable. The Panhandle, Llano Estacado, Region C and Region H are projected to have the most unmet demand in the next 50 years.

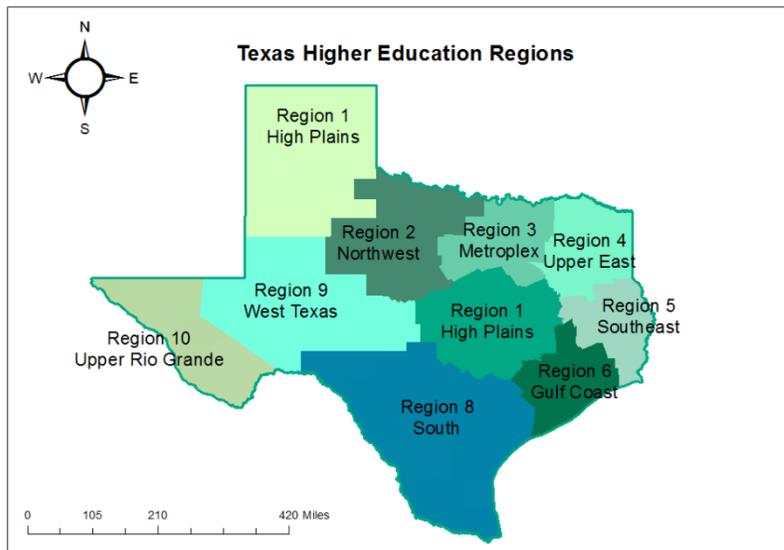






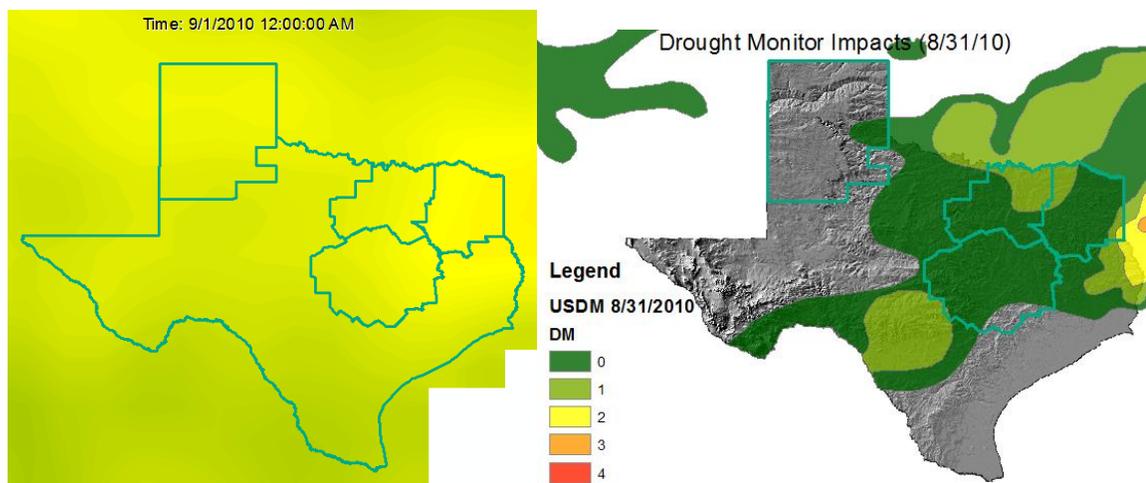
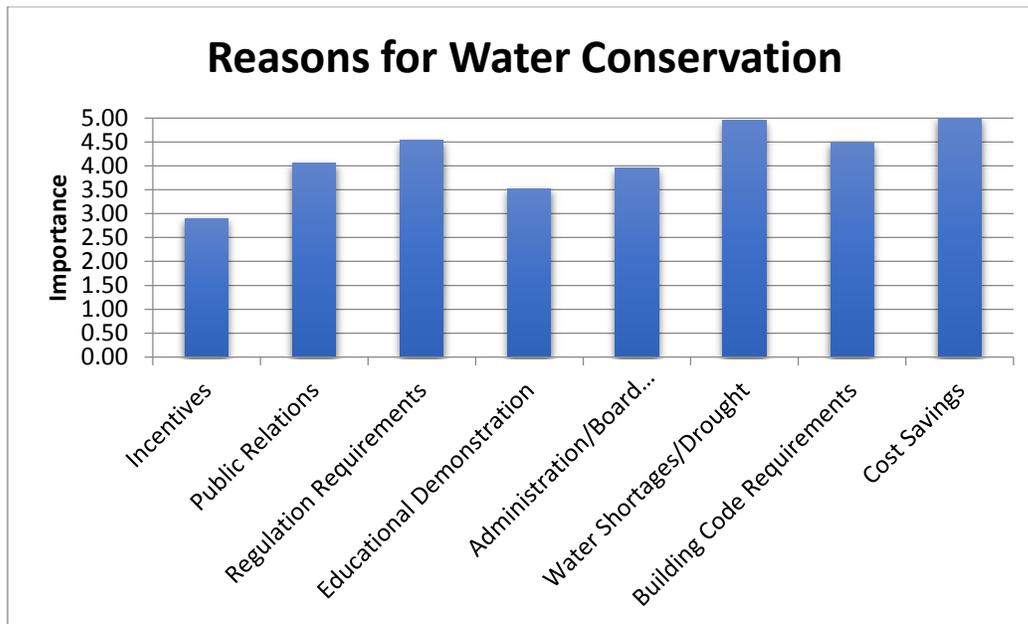
Past Drought

I interpolated the survey results from individual schools to Higher Education Regions designed by the Texas Higher Education Coordinating Board in order to form a more regional understanding. I focused on one particular survey question which asked the participant to rank the importance of reasons for implementing water conservation strategies. The reasons listed included incentives, public relations, regulation requirements, educational demonstration, administrative/board demand, water shortages/drought, building code requirements, and cost savings. Water



shortages/drought and cost savings were ranked overall as the most important reason to conserve water. The regions that contained institutes that ranked water shortages/drought as the most important (regions 1, 3, 4, and 7) are currently experiencing or have experienced severe drought in the recent past. I ran a ten year time series of GRACE Total Water Storage from 2/1/03 to 9/1/13 and compared times of low total water storage in those highlighted regions with shapefiles of the Palmer index of drought impacts from the Drought Monitor⁴ near those same times. The drought monitor data and the GRACE data both indicate that the regions with HEIs that ranked water shortage and drought as the most important reason for implementing water conservation techniques have been in drought conditions several times in the past decade.

⁴ National Drought Mitigation Center (NDMC), the U.S. Department of Agriculture (USDA) and the National Oceanic and Atmospheric Administration (NOAA).



Conclusions

All of the institutes of higher education that participated in the survey responded that they utilize some form of water conservation and many of the HEIs are located in water stressed regions. Some of those regions are currently experiencing or have experienced drought in the past ten years. The TWDB's projections for the next 50 years indicate that while some regions are reducing their unmet needs, others are only increasing. The Panhandle, Llano

Estacado, Region C and Region H are projected to have the most unmet demand in the next 50 years and HEIs in those regions should continue or expand their water conservation programs.