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CE 394 K - Project Proposal

# "Effects of the 2011 Texas Drought on Water Stability and Soil Moisture Capacity in the Lake Somerville Basin"

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## Background

In 2011, Central Texas experienced the hottest summer and most devastating drought on record. During this summer, water flow in many rivers and estuaries diminished, water storage in aquifers and lakes receded to critical levels, and soil throughout the region dried up. These drastic deteriorations in water and soil characteristics resulted in state-wide rationing and a severely decreased capacity for agriculture.

As part of this phenomenon, Lake Somerville dropped nearly ten feet in water level, a record low, and the soil in the Somerville Basin became incapable of supporting sufficient vegetation. This impact has been devastating to the Somerville area communities that rely mostly on agriculture. What is not understood, however, are the long term impacts of the drought in this region or what will be required to restore the water resources and soil characteristics to pre-drought conditions.

The experience of this summer and the current situation for Central Texas communities is further complicated by the increasing awareness of the effects of global warming and predictions by meteorologists that significant rain is not expected this winter, meaning that ranchers may be unable to recover before another potential drought in the year 2012.

## Scope

The goal of this project is to assess the impacts of the 2011 drought on the Lake Somerville Watershed, including the Yegua Creek. Included in this assessment will be an analysis of precipitation, evapotranspiration, and flow data in the watershed as well as soil moisture and capacity data in the surrounding area.

## Method

The proposed method to complete these goals is to:

- Establish general hydrology characteristics for the Brazos Valley River Basin, including subwatershed delineation and flow characteristics.
- Conduct slope and hydrology analyses of the Somerville Watershed including precipitation, evapotranspiration, runoff, and temperature analysis and identify potential impacts of the 2011 drought on flow and storage.
- Map and analyze soil moisture and capacity data in the Somerville Basin and identify the potential effects of the 2011 drought on these characteristics.

## Update

Most of the relevant datasets have been downloaded and uploaded into ArcGIS. A basemap has been created that, so far, includes the Texas basins and subbasins that define the areas of interest and operation and hydrological properties within the watershed itself. Other feature classes that have been added to the basemap include reservoirs, major and minor aquifers, and precipitation splines. See the figures below.

Figure 1. River basins in Texas and subbasins within the Brazos River Basin.

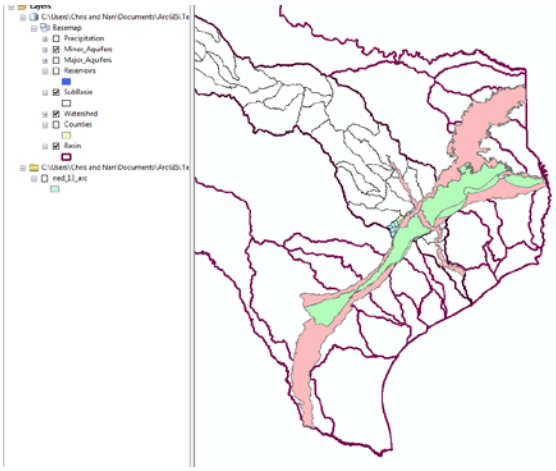


Figure 2. Minor aquifers that intersect the Somerville watershed.

Figure 3. Somerville watershed with precipitation spline by range.

Before the target evaluation can be completed, additional datasets need to be imported into the basemap as feature classes. These include evapotranspiration, flowline, land cover data, and soil data. Additionally, the pertinent datasets required to analyze precipitation, temperature, evapotranspiration, and soil moisture trends across the time domain have been identified but not engaged.

**Data Sources Utilized**

The data utilized so far include data from the following sources:

- The National Hydrography Dataset, http://nhd.usgs.gov.
- Water Resources of the United States, USGS, http://water.usgs.gov/maps.html.
- Seamless Data Warehouse, USGS, http://seamless.usgs.gov/.
- The Texas Water Development Board, http://www.twdb.state.tx.us/.

Data has been downloaded from the following sources that have not utilized yet:

- Lake Somerville. U.S. Corps of Engineers. http://www.swf-wc.usace.army.mil/somerville/.
- The National Hydrography Dataset, http://nhd.usgs.gov.

Data that has not been downloaded yet include data from the following sources:

- The Texas Commission on Environmental Quality, http://www.tceq.texas.gov/agency/water_main.html.
- The Texas General Land Office, http://www.glo.state.tx.us/gis/.
- The NASA Land Data Assimilation System, http://ldas.gsfc.nasa.gov/.