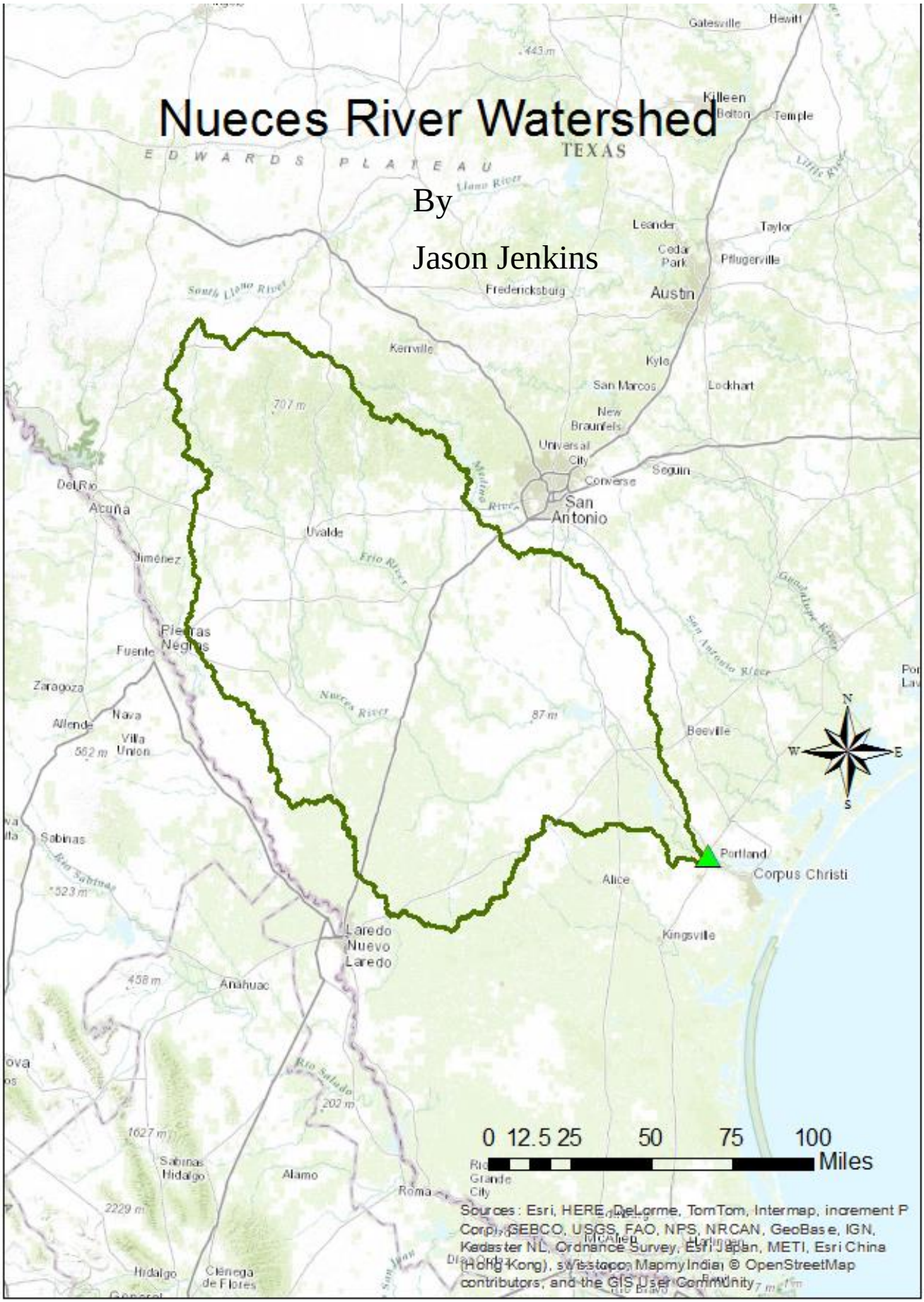
Nueces River Watershed
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Introduction

Estuarine systems provide invaluable services for coastal ecosystems and environments. For all the many benefits estuaries provide to the local economies and ecosystem, they are just as vulnerable to droughts and urbanization. The Texas Gulf Coast is a perfect example of how these dynamic systems not only provide valuable economic resources by providing nursery areas for commercial fish and crustaceans, but they also proved an important service of protection from coastal erosion. These estuarine systems are dependent on the supply of freshwater from the rivers that empty into them because this is the only source of freshwater. This freshwater inflow helps reduce salinity levels, temperatures, and flushes the system of excess nutrients and pollutants. Otherwise evaporation and high summer heats can cause salinity and temperature levels to exceed those that plants and animals can survive. Several factors can have an effect on the amount of water that ultimately makes it to the ocean including agricultural, industrial use, aside from the initial amount Mother Nature provides. Future drought predictions and rising temperatures are increasing the strain estuarine systems are experiencing and will experience and thus the more we can do to better manage our water supply the healthier our estuarine systems will be.

This study focuses on the Nueces Salt marsh and estuarine system located in southern Texas and the freshwater inflow it receives from the Nueces River Watershed. This watershed is the sole input of freshwater into this estuarine system and thus into the Nueces Bay. Recent droughts have taken a harsh toll on the volume of water that makes it into the estuary. High temperatures coupled with dwindling precipitation rates, have reduced the supply of freshwater that ultimately makes it to the coast. By presenting the properties of the watershed that feeds into the system, I hope to develop a better understanding of the characteristics of this watershed and help lay a foundation for future freshwater management policies. The main objective of this report is to delineate the Nueces River watershed, observe soil, precipitation and land use properties along the Nueces River and to try and pin point trouble areas along the Nueces River that may contribute to lower fresh water inputs into the estuary.

Methods

Watershed Delineation:

To delineate the Nueces River watershed I used a gauge point from the USGS Water Resources web site for the lower point of the Nueces River. With this point I used the ArcGIS watershed delineation tool to capture the watershed. To verify the watershed area I compared the results to the area selected from the national watershed data set selecting all the HUCs with the same HUC 6 for the Nueces River Watershed.

Stream Flow Data:

Stream flow data was taken from the NHDplusv dataset off the ArcGIS landscape database. This stream flow data illustrates quite efficiently the amount of water that flows down

each stream and river. This is necessary to show where the water is coming from and going too. This dataset also gives us water flow information and allows us to calculate the runoff ratio.

Elevation Data:

Elevation data was taken from the National Elevation Dataset 30m (NED30) and overlaid over the watershed. This data is essential in understanding the flow properties of the watershed and developing a general idea of where the water wants to go.

Soil Properties:

Soil property information was taken from the USA soils dataset from the landscape ArcGIS server database. This dataset provides information on the amount of water the soil can hold/retain and how much is expected to turn into runoff and enter into the river system. This is important to quantify because the soil properties throughout the watershed are the single most important variable other than precipitation in how much water ultimately makes it to the Nueces Bay

Calculations:

Runoff Ratio

Q/P = Runoff Ratio

Q - Stream Flow

P - Precipitation

Results

Figure 1 shows the delineated watershed divided up into its different HUC 8's along with the plotted gauge point taken from the USGS Water resources website. The Nueces River watershed contains 11 HUC 8's, 71 HUC 10's, and 432 HUC 12's. Figure 2 illustrates the river and stream data from the NHDplusv dataset. This dataset helps illustrate the major streams and rivers within the watershed. The two largest and most notable rivers are the Nueces and Frio rivers. The soil available water storage data is shown in Figure 3. This figure shows how the soil water retention properties change as you move South and West through the watershed. Figure 4 shows the elevation data for the watershed taken from NED 30 dataset. Of note is the decrease in elevation as you move South and East. Figure 5 is taken from the waterdatafortexas website and shows the available water storage and reservoir levels for the Corpus Christi area. Note the dramatic increase in reservoir storage capacity as different lake reservoirs were added through the years. Also of key importance is the actual reservoir levels and the fluctuation they experience over the years. Figure 6 shows the runoff ratio calculated for the watershed.

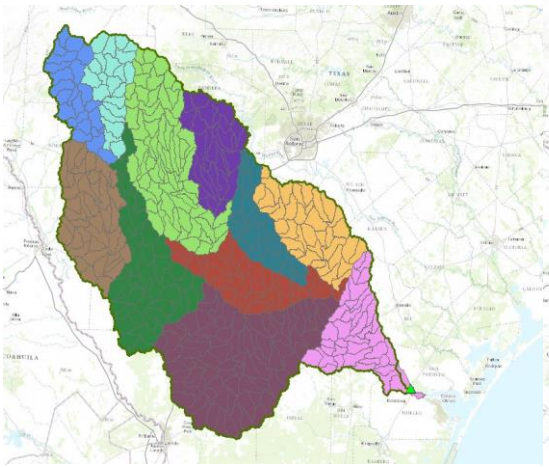

Figure 1 Nueces river watershed and corresponding HUC8's, HUC10's, and HUC 12's.

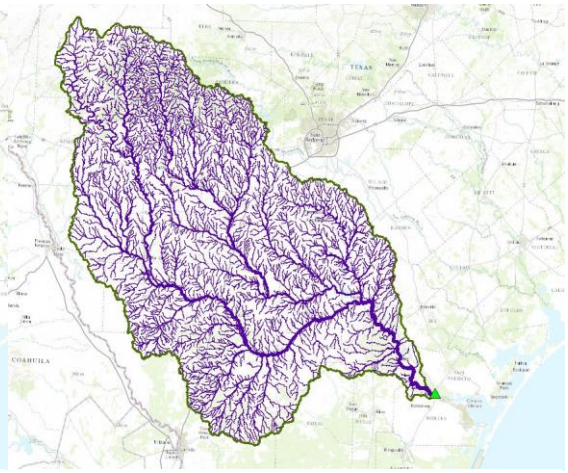

Figure 2 NHDplusv river and stream data. Darker and thicker blue lines represent higher flow rate.

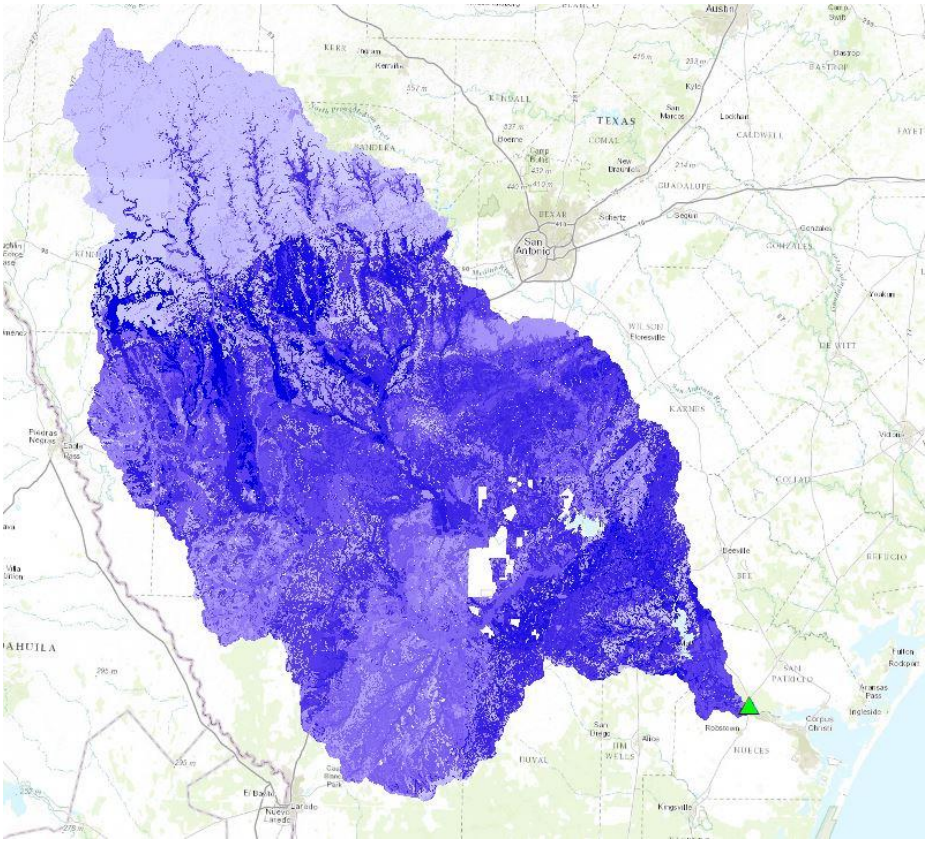

Figure 3 Soil available water storage data. Darker blue indicates higher percentages of the first meter that can store water.

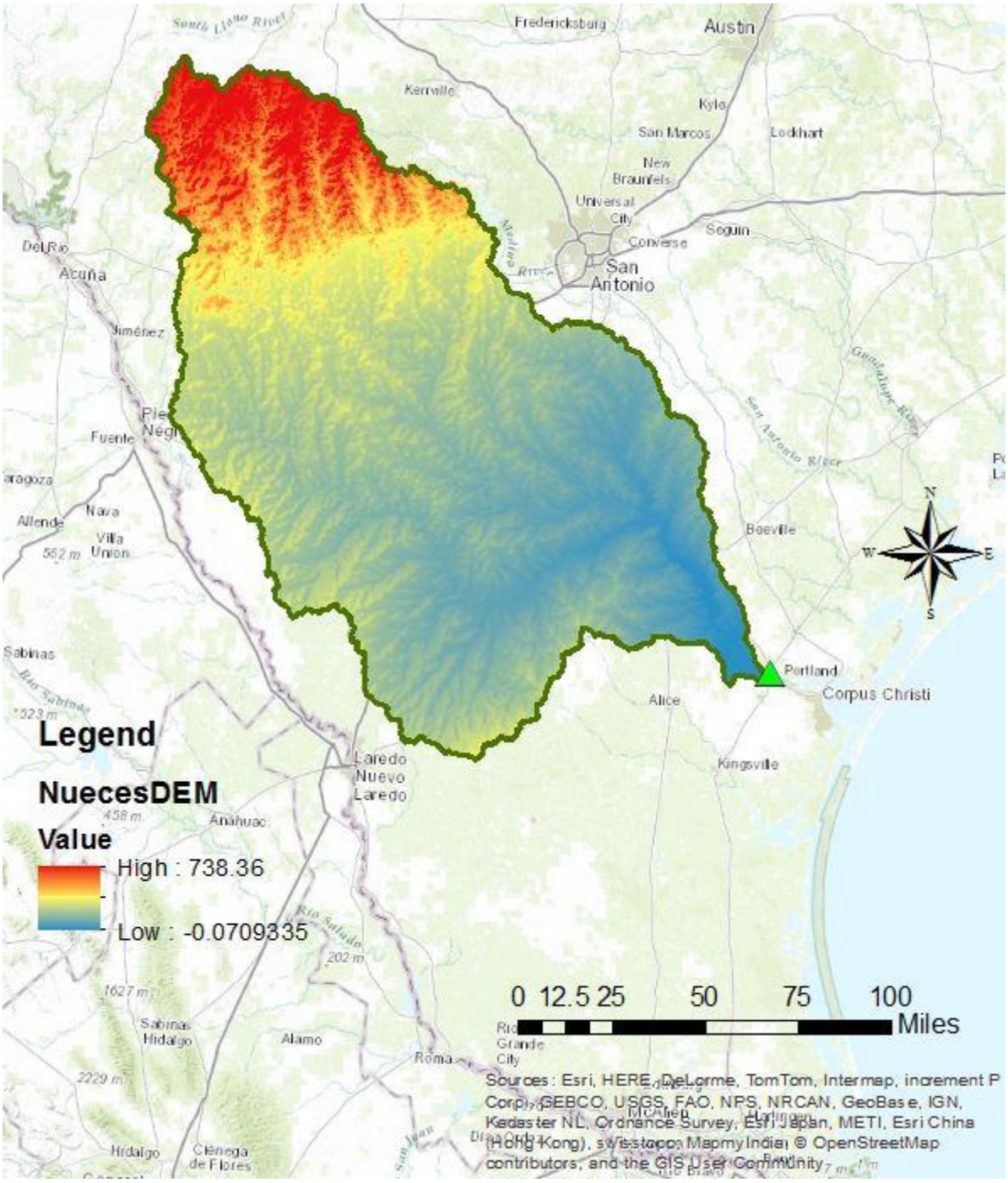

Figure 4 Digital elevation model DEM of Nueces River Watershed.
Elevation data is in 30 meter resolution.

Figure 5 Reservoir data for Corpus Christi area

Average Precipitation P	Annual Stream Flow Q	Runoff Ratio Q/P
$1.25 \times 10^{12} ft^3$	$1.97 \times 10^{10} ft^3$	0.0157

Figure 6 Calculated runoff ratio for Nueces River Watershed

Discussion

The Nueces River watershed is a large watershed that is easily subjected to numerous stresses that can alter the amount of available freshwater. The characteristics and properties that are illustrated in this report show that various factors influence the amount of freshwater that ultimately finds its way into the Nueces Bay. The most noticeable factors that influences these amounts are the soil properties and the water holding characteristics of the various areas of the watershed. Figures 3 and 4 show a close relationship to the soil water holding properties and the elevation. The stream flow data shown in Figure 2 shows that stream flow volume is not nearly as high as the precipitation amounts. The soil data in Figure 3 clearly shows that more water is soaked into the ground as you move South and West through the watershed. This soil readily soaks in rain water and stays relatively dry year round. As precipitation rates decline and drought conditions worsen, less and less water will runoff and make it into the river system and ultimately into the bay. The calculated runoff ration averaged for the watershed in Figure 6 shows that only about .015 percent of precipitation makes it to the estuary system. This value is a result of several factors including the soil properties, reservoir filling, industrial and agricultural use and urban utilization.

Figure 5 clearly shows a striking fact that as water demands increase and reservoirs are built to meet these demands and increasing capacity, ultimately the levels are dependent on the amount of water that flows into them. Corpus Christi, which is a large urban area within the watershed, is a fast growing community. As oil and natural gas wells continue to grow, so does the need for labor and support for these communities. This industry along with others is causing an explosion in the population and an alarming demand on freshwater resources. This demand further reduces the amount of water that makes it to the coast and further shows the necessity for adequate water conservation and management policies.