Introduction
Chile was recently ranked among the top countries in the world to face water stress in the next 40 years. Socio-economic trends and environmental studies that predict the most vulnerable regions to water scarcity put the Metropolitan Region, the seat of the country’s capital city, at particularly high risk. When Cape Town scrambled to reduce water consumption to avoid Day Zero, a local newspaper headline read, “As water canals are closed in Cape Town: Expert warns that Chile ‘isn’t too far’ from having no water.”

From 2011 to 2015, central Chile experienced a prolonged drought known as the Mega Drought, categorized by 30-70% annual precipitation deficits and the warmest 6-year period on record (see graph above). Downstream users suffered the most critical impacts from the Mega Drought of 2011-2015, revealing existing gaps in water distribution and vulnerabilities to climate change.

The Maipo River is legally divided into three sections, each treated as individual flows. Sectioning has been praised for facilitating the organization and management of water rights along the Maipo. However, the recent drought has highlighted vulnerabilities for downstream communities in the second and third section, calling into question the current water management model. As mandated by the Water Code each section is managed as “one natural flow,” and water rights reflect the available streamflow in each section. Some argue that this makes it possible for upstream users to completely dry out the supply downstream.

Conclusion
For future work it would be ideal to acquire more accurate boundaries for the Maipo River Basin to draw more conclusive theories about the effects of sectioning on water distribution. In addition, at least one-third of the data on concessions was missing spatial or water use information. In spite of these limitations, the initial results support the growing literature that water access is more concentrated in the first section of the basin. This, compounded with other factors, including a history of water scarcity, poverty indicators, and data on minors and elderly indicate that the most vulnerable populations are in the second and third section. As the region braces for a future with more people and less water, it will become increasingly important for water users and policymakers to work together across the Maipo Basin to seek innovative solutions to manage water across the basin equitably and sustainably.

Methodology
Data Collection & Cleaning. Irrigation and potable water flows were latitude/longitude points converted to XY coordinates. Census and water scarcity data were obtained as shapefiles and poverty data was entered manually. All of the information was collected or synthesized into communes.

ArcGIS Analysis. Using Spatial Join, water concession points were converted into polygons. The Georeferencing tool was used to digitize the Maipo Basin sections, which are not publicly available. The border can be observed in the final map (above).

Vulnerability Assessment. Water Scarcity Risk was assessed using government data on water scarcity emergency decrees, which were issued to communes in times of “extraordinary drought” between 2008-2018. Water access (potable and irrigation), vulnerable populations (minors, elders, and low-income) were weighted equally and assigned a vulnerability score from 1-4. All of the results were normalized by population.

Data Sources
Water Concessions and Scarcity Decrees. Chilean Ministry of Water in Chile, contains a detailed and updated (2018) list of water concessions and scarcity decrees throughout the country.


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Cartographer: Andrea Becerra
Course: DHP-P207 GIS for Int'l Applications
Projection: WGS 1984 UTM Zone 19S