GISWR Project Proposal: Drought & Regional Flood Vulnerability in Sacramento, CA
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Not unlike Texas in recent years, California is currently in the midst of an exceptional drought. According to the United States Drought Monitor data for last week, 92.4% of the state was classified as being in "Severe Drought" or greater [25.08% of which is in "Severe Drought", with 21.28% in "Extreme Drought", and 46% in "Exceptional Drought"]. The drought, reaching the end of its fourth year, has undoubtedly impacted the Californian terrain.

Looking ahead, California faces an El Nino that could be one of the strongest on record. For California, an El Nino year usually means heavier than normal rains in the winter. While one would expect increased precipitation to be welcomed, the forecasted strength of the upcoming El Nino has caused some alarm regarding increased risk of floods and mudslides in a parched California. The 2015 Memorial Day floods in Central Texas were a reminder that when abnormally high amounts of precipitation fall on dry earth, the results can be especially destructive. Thus proper analyses should be carried out on vulnerable regions.

For this project, I wish to investigate the flood vulnerabilities during El Nino rain events for Sacramento, California, a region that has been categorized as in "Extreme Drought" since November of 2013. In addition to very dry conditions, the city also lies in close proximity to a network of rivers. I wish to produce a series of maps showing various hazard classifications in the event of three El Nino events of varying size (small/medium/large). I aim to establish four regional hazard classifications based on my analysis: Major Hazard, Moderate Hazard, Moderate Concern, and Minor Concern.

A Geographic Information System will be utilized in this analysis, both to visualize information and make spatial calculations. This analysis will be accomplished by first determining the runoff characteristics of the region. Rainfall runoff responses will be evaluated by looking at land use, percent impervious, soil moisture, and/or infiltration rate data for the drainage area (upon availability). For this part, I need to do more research to determine the standard methods for modeling runoff given these parameters. I think it would be interesting to investigate the impact of soil moisture on flood risk. For example, comparing the flood risks with current low soil moisture levels, and flood risks during non-drought years.

After calculating the amount of precipitation expected to become runoff, I will combine this with a digital elevation data model that can be processed using ArcHydro tools to delineate the drainage areas within Sacramento. The precipitation and elevation analyses will then be combined to develop a hydrograph for the city. I will compute a flow direction grid from the elevation grid, which will allow me to determine the direction of flow, the flood accumulation, and ultimately, the flood risk associated with resulting stream flows.

Data Available (Source)

- Elevation data (use GRACE to show the settling due to GW withdrawal)
- Infiltration rates for various soils (Sacramento County)
- Land Cover (National Land Cover Database)
- North American Land Data Assimilation System (NLDAS) monthly data sets. (Consisting of monthly accumulations for precipitation, runoff, evaporation, and snow melt)
- Parcel Land Use Data (Sacramento County)
- Population layer (US Census)
- Precipitation Data (NOAA)
- River Reach Data (EPA river reach files)
- Stream flow (USGS annual stream flow data)
- Streams and Rivers (Sacramento County)