Abstract:

Multiple USGS studies examine the spread of Bromus Rubens and other invasive wild grass species in the Mojave region. Invasive grasses, especially Bromus Rubens, provide threats for wildfires, which can hurt the natural ecosystems of the Mojave. These studies cite the lowering precipitation and/or global warming as potential candidates for spreading invasive species. We plan to observe the temperature and precipitation levels to see if we can corroborate these claims. Included in the study will be NOAA weather station readings from 2006 until 2022, and a 1970s USDA FS study. We will attempt to connect precipitation and temperature to the spread of Bromus Rubens. We will examine two of the USGS studies of the Mojave region and juxtapose them with time-series analyses of Death Valley's temperature and precipitation. There is a large lack of data on the actual growth rates of Bromus Rubens, but this analysis will attempt to serve as a starting point for understanding potential trends of the spread of Bromus Rubens.

When observing the Death Valley data under a linear regression model, there is almost no change over 16 years, just under half a degree Celsius and half a millimeter of rain. This amounted to less than 0.03 for each per year. Looking a little more closely, we were able to disregard temperature in our data, as the temperatures fluctuate wildly from very cold to very hot throughout days and nights, affecting the monthly average wildly. Not only does the data become a little bit unclear with the average temperature, we also know that any grass would have to survive this wide range of temperatures anyway, so any minor fluctuation shouldn't really affect growth. When observing the time series under a Lowess model, we can construct a trend of a 5-6 year period, with 2-3 years of higher rainfall, and 2-3 years of lower rainfall. Although there are plenty of outliers, as most months are close to 0 rainfall in Death Valley and the months with rainfall stick out, these tend to not affect the yearly average as much as more consistent, lower monthly rains.

The above trend relates to an old dataset from the USDA FS. This older study outlines a more qualitative coverage of Bromus Rubens, but includes one quantitative study of relative abundance and rainfall over a 6 year period. In the height of rainfall, Bromus Rubens' growth is actually stunted, where they spread more often in mid-low ranges of precipitation. This connection shows us that Bromus Rubens and other invasive species' growth can be tied to the 5-6 year

trend, with native grass flourishing when rainfall is relatively high, and marshes can fill up in the desert.

Our conclusion involves geographical data of Bromus Rubens spread throughout the entire Mojave Desert, specifically after the during a low-precipitation period (2013) and during a high-precipitation period (2020). According to our data above, Bromus Rubens should be more prevalent in the 2013 image, and less widespread in the 2020 image, which seems to be true. We also notice there are still large spots of Bromus Rubens in the Mojave, especially in Death Valley, so there is much more research needed in this field (specifically more quantitative data on the abundance/growth of Bromus Rubens). One notable takeaway is that 2022 is close the the bottom of a low-precipitation period, which means that this (or 5 years from now) might be a pivotal time in working to control the spread of Bromus Rubens, either through controlled burns or spreading of native grass seeds.

Sources:

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