# Invasive Species: Bromus Rubens

## An exploration of Mojave Region Grass, Temperature, and Precipitation

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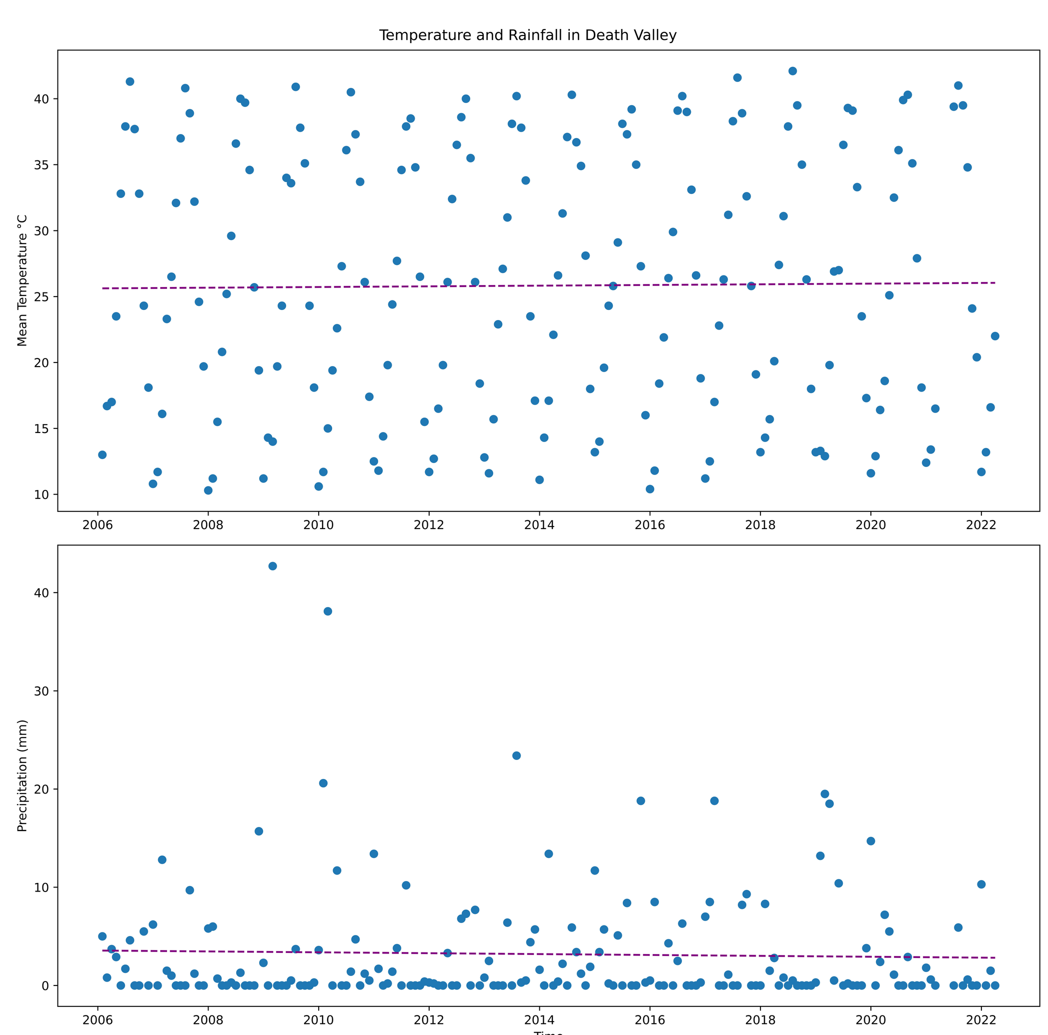
Bromus Rubens

**Introduction:**

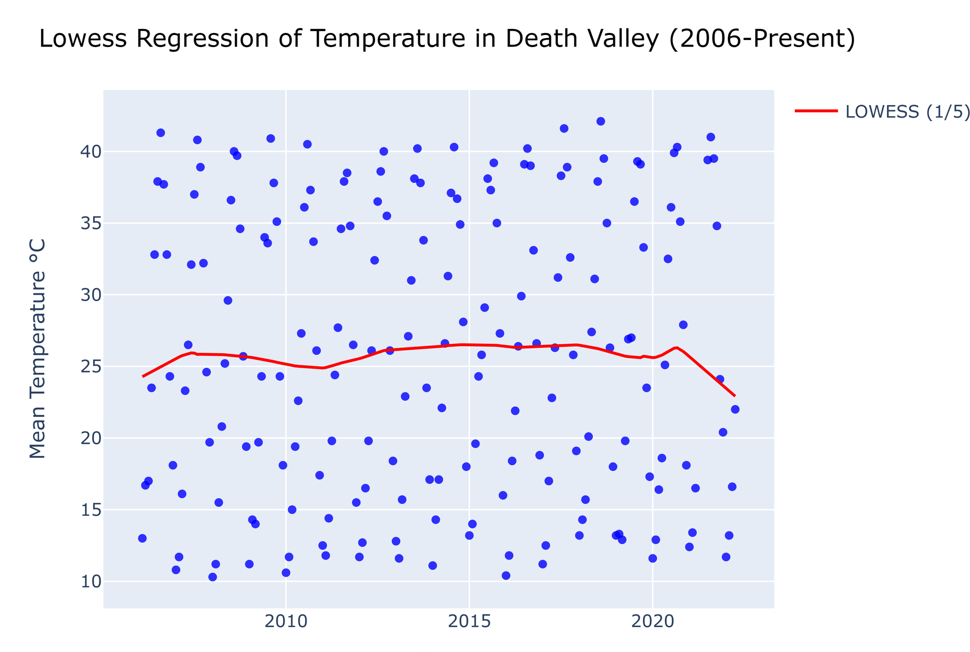
Multiple USGS studies examine the spread of Bromus Rubens and other invasive wild grass species in the Mojave region. Invasive grasses, especially Bromus Rubens, provide threats for wildfires, which can hurt the natural ecosystems of the Mojave. These studies cite the lowering precipitation and/or global 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.

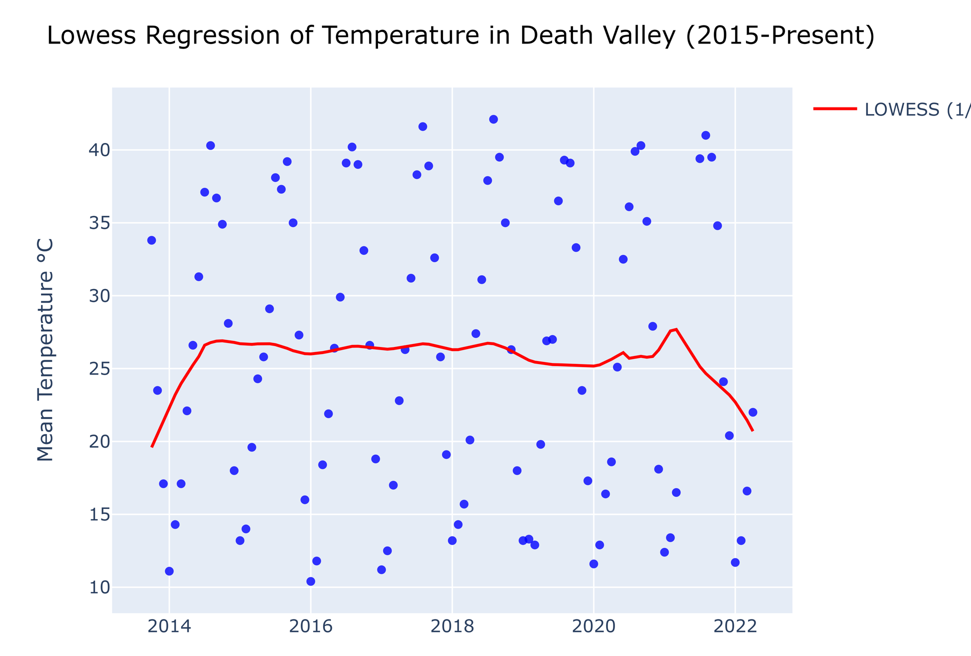
**Analysis:**

The following is Rainfall and Temperature data scraped from a Death Valley weather station from the NOAA.

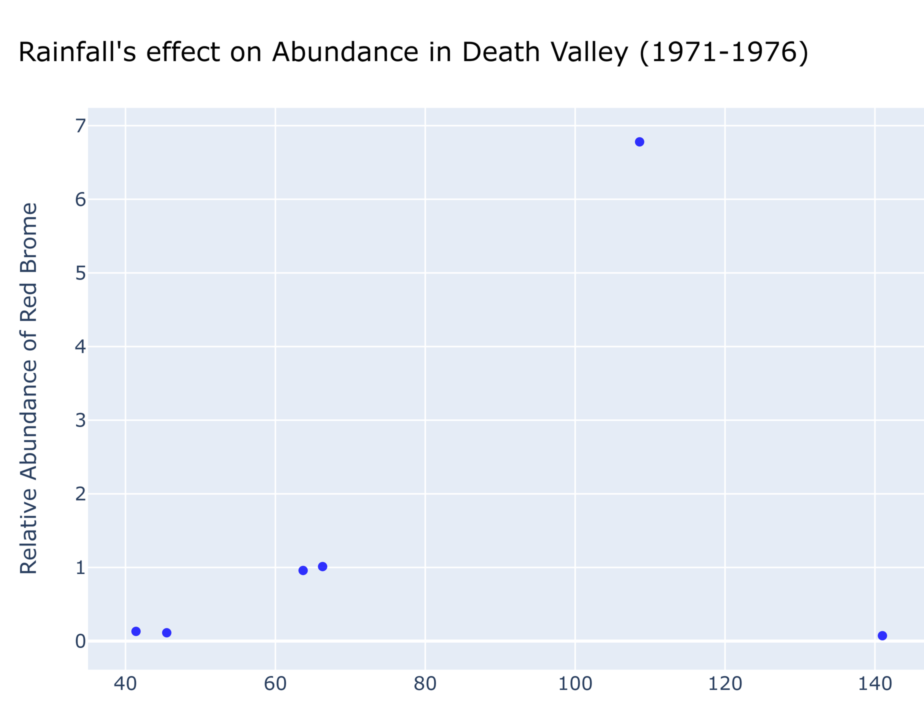



When observing Precipitation and Temperature as a whole from 2006 to the end of 2022, we can see that Linear Models show almost no change (<0.5°C and <0.5 mm over 16 years). For a more accurate time series, we will use LOWESS models.

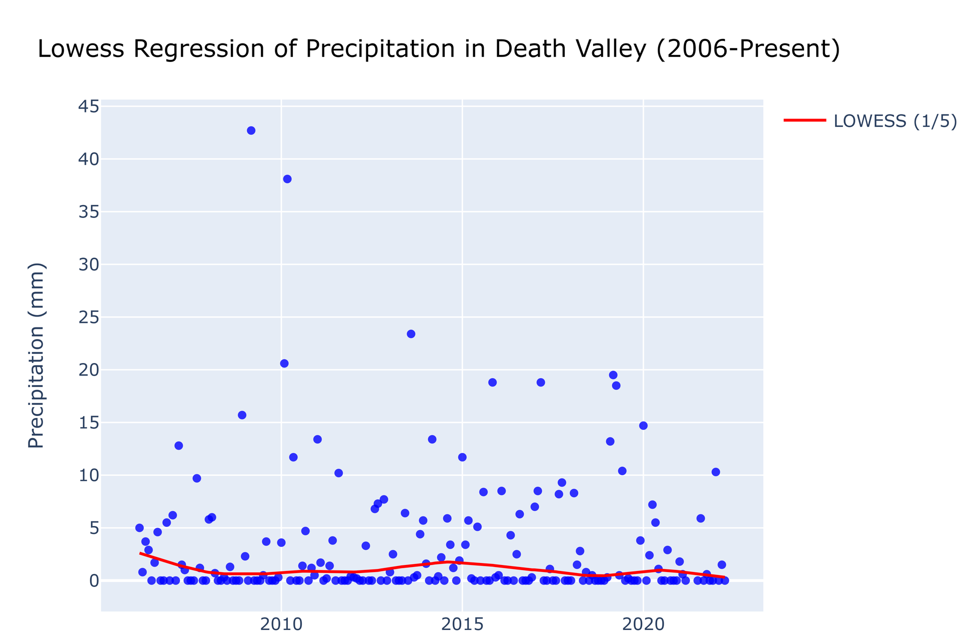


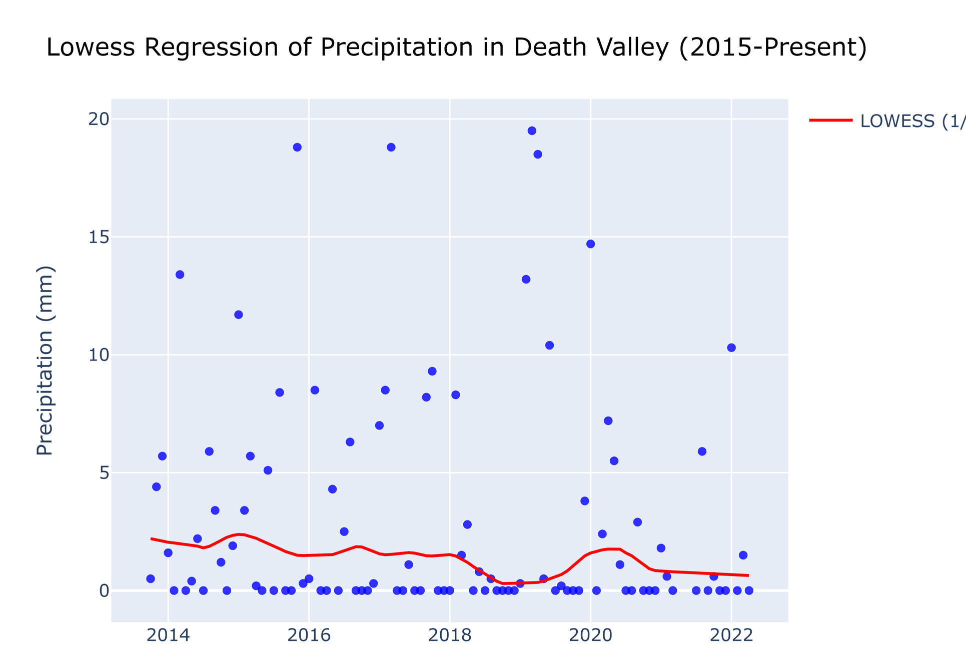




When observing average temperature from both 2006 and 2013 until present, temperature seems to follow a 5-6 year seasonality of "high" temperatures, and then "low" temperatures. However, because these temperatures swing so wildly due to cold nights and hot days, any species of grass will need to survive a large range of temperatures, anyway. This means the ~3°C swing that appears could have little to no effect on Bromus Rubens' growth.



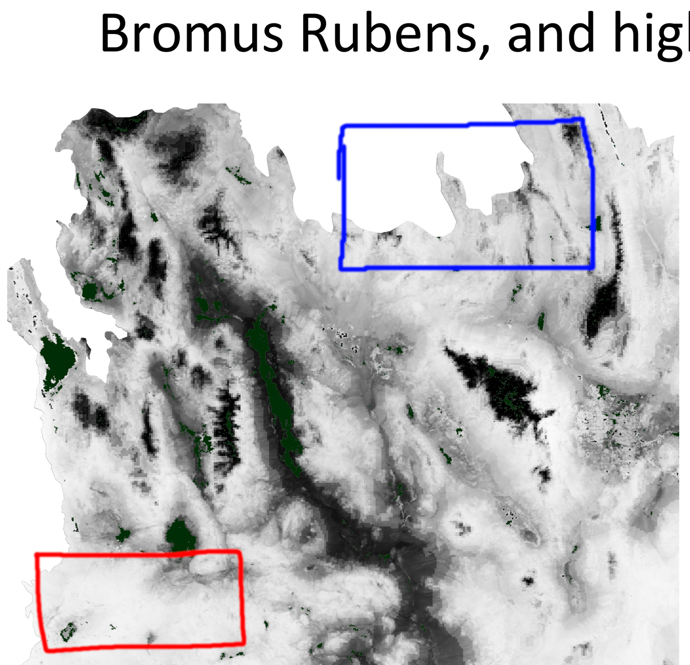

The data above is pulled from a 1970s USDA Forest Service study. Although the data does not span a long time, it does record data from all across Death Valley. They find that when rainfall is especially prevalent annually (over 120mm), Bromus Rubens actually does not spread as far as one might think, and instead stays close to 0 abundance. However, there is much needed further study in this area. Overall, there is a correlation with low-medium levels of rainfall spreading Bromus Rubens, and high levels stunting it.



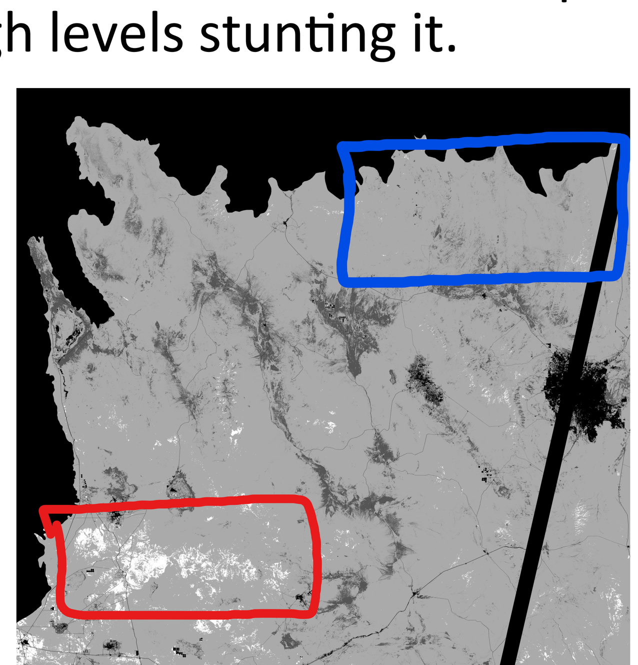




When observing average precipitation from both 2006 and 2013 until present, we can see that there are 2-3 year periods of higher and lower rainfall. Most months in Death Valley, there is zero or close to zero rainfall. Months where rain does fall excessively (the outliers) does not seem to affect average yearly rainfall as much as having more consistent and lower rainfall months throughout the year. These periods of rainfall seem to swing from close to 0mm monthly rainfall to approximately 2-3mm monthly rainfall. While those numbers do not seem high, in a desert environment, anywhere from 20-30 mm annual rainfall can change entire ecosystems, as water is known to collect in basins on the lower parts of hills and plains, where both invasive and native grasses grow.

If the data from the USDA Forest Service study is bolstered by further study, it is safe to say that Bromus Rubens would grow more frequently in the low rainfall periods, and would stagnate during the high rainfall periods.



Bromus Rubens Heatmap (2013)
Death Valley (Red)
Northern Mojave (Blue)



Bromus Rubens Hotspots (2020)
White (High) → Black (Low)
Relative Abundance

**Conclusions:**

The maps on the left show that Bromus Rubens were prevalent across the Mojave in 2013. This is a time right after a low-precipitation period, which is expected by our analysis. By 2020, only Death Valley was considered a hotspot, while the Northern Mojave wasn't. 2020 is at the peak of a high-precipitation period, which can help explain why most of the Mojave isn't still covered in Bromus Rubens, and why the North is not a hotspot. What this means is that while precipitation can explain the spread of Bromus Rubens in the Mojave, this isn't the only factor. 2022 is also the reaching the minimum of a low-precipitation swing, so this might be a pivotal time in helping control Bromus Rubens in Death Valley, through operations like controlled burns and the spread of native grass seeds.