

The 2020 California Wildfires and its Effect on Abundance Among Native Yellow-faced bumble bees (*Bombus vosnesenskii*)

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Background

California singlehandedly is responsible for 13% of the nation's agricultural value. When breaking it down further, California produces over 400 commodities, with over one-third of the country's vegetables and two-thirds of the country's nuts coming from the state. For this industry to continue, we rely on numerous bee species to pollinate these plants. In fact, when we look at the food we consume daily, bees are responsible for every third or fourth bite you take. For over a decade now, honeybees have been steadily declining in population; farmers and scientists are starting to realize the benefits of native bee species, which pollinate 200 times more efficiently than honeybees (California Department of Food and Agriculture, 2020). However, after this past summer, all bee species are being threatened – by climate change and wildfires.

Motivation

The 2020 California wildfires burned nearly 4,300,000 acres and destroyed almost 4% of all habitat for bees in California in a single year (Oregon State University, 2020). Therefore, we will be analyzing how the massive wildfires affect the abundance of native Yellow-faced bumble bee (*Bombus vosnesenskii*) in the state of California. This study would provide new-found and up-to-date data to better help fellow ecologists understand pollination populations, patterns, and processes.



Figure 1. Yellow-faced bumble bee. Powell, 2015.

Hypothesis & Prediction

I hypothesize that there is a relationship between the 2020 California wildfires and the abundance of native Yellow-faced bumblebees (*Bombus vosnesenskii*). As the wildfire burns more acres of vegetation, abundance in native yellow-faced bumblebees will decrease because there are fewer crops to pollinate and less habitat to use. A study that has done a similar experiment in a different region noted that while habitat increased, the real limiting factor is vegetation and food resources (Mola, Miller, O'Rourke, Williams, 2020).

Predicted Yellow-faced Bumble Bee Abundance in Relation to Acres Burned

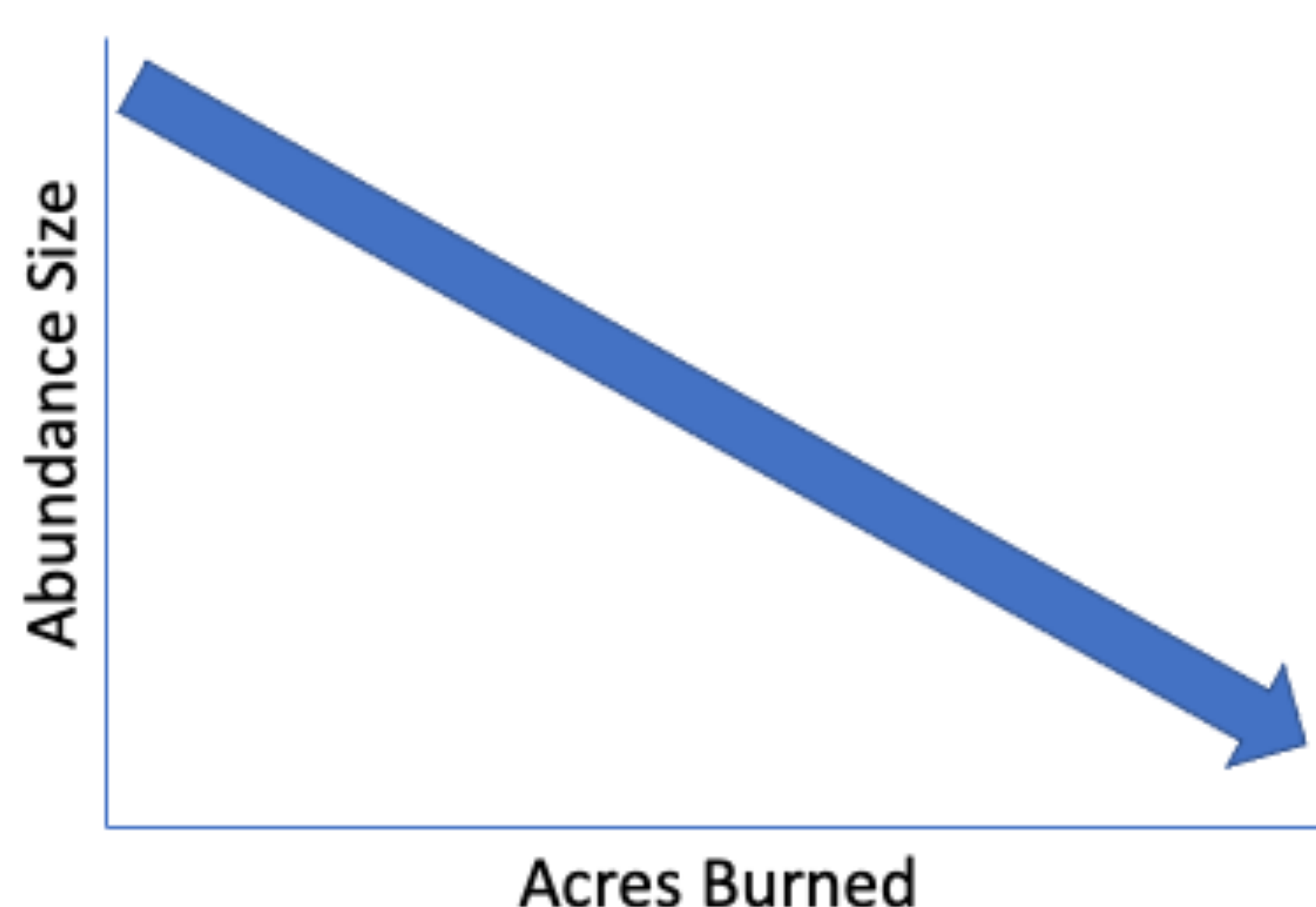


Figure 2. My prediction about how as more acres are burned in wildfires, there will be a decrease abundance of yellow-faced bumble bees.

Study Design

This study will be a natural experiment as we are trying to see the effects of wildfires, a natural occurrence, on the native bumblebee population. To see if there is a change in abundance, we will take two measurements of the species population before and after a season of California wildfires. These measurements will be taken every other year to determine patterns and trends. These figures will be collected through several lethal methods such as bee bowls (specifically white and yellow-colored), targeted netting, and a blue vane trap to see the overall pollinator variability (Shrestha, Dyer, Bhattarai, & Burd, 2014). Unfortunately, it is essential in this experiment to use lethal sampling as it is the only way to get accurate and representative results.



Figure 3. Methods for bee collection. Yellow-faced bumble bees are most attracted to yellow and white. However, a blue vane trap is going to be used to observe of pollinators in the area for competition considerations.

Intended Analysis

Given that both the independent variable (acres burned via wildfire) and dependent variable (abundance of a yellow-faced bumble bee) are continuous, we will analyze the data collected using a regression. This will help determine whether a correlation is equal to causation and see the strength of the correlation.

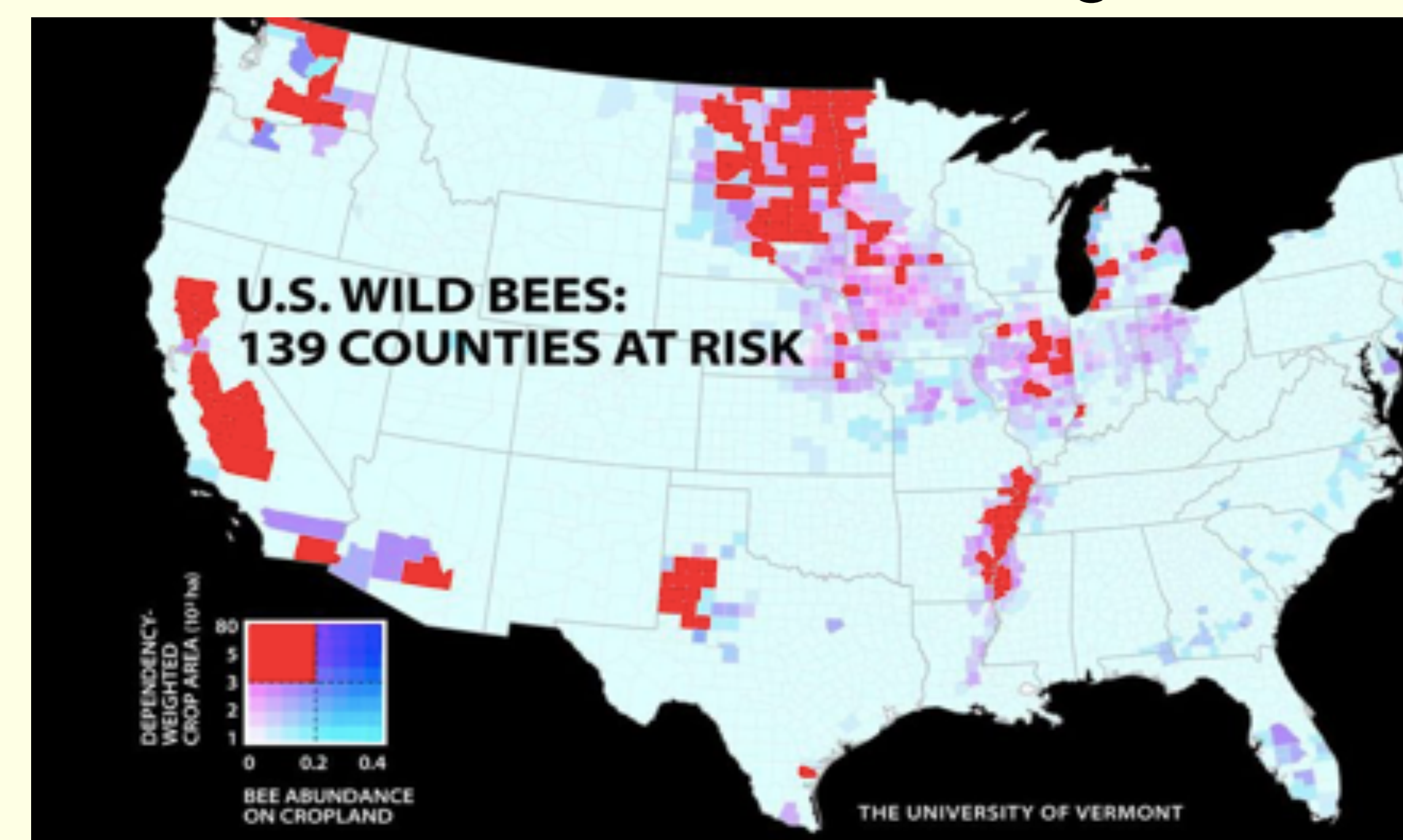


Figure 4. Map showing California counties at risk of decline in native bee populations.

Koh, Lonsdorf, Williams, Brittain, Isaacs, Gibbs, Ricketts, 2015

Expected Benefits

The Yellow-faced bumble bee is essential to ecosystem services and our current food system. The hope for this experiment is to determine the effects of wildfires on the native bee population, and with this information, we can hopefully move forward in finding ways to prevent habitat loss for this species and ensure that their survival continues.

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