Effect of Wildfires on Bee Numbers

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Introduction

Wildfires, exacerbated by climate change, are increasing in frequency and severity, creating significant ecological challenges. This study investigates the impact of fire severity on bee populations, which are essential pollinators. Wildfires can alter habitats by clearing dense forests, but they may also facilitate floral regrowth, which could benefit bees. The long-term effects of varying fire severities on bee populations, however, are not well understood.

Understanding the effects of fire severity on bee populations is crucial for effective land management and wildlife conservation, especially in areas prone to wildfires. This research could provide valuable insights into how fire severity influences bee density and could inform post-fire recovery strategies aimed at supporting pollinator populations.

There is limited understanding of how the severity of wildfires affects bee populations over time, particularly in relation to fire intensity.

Research Question

Does the intensity of a wildfire affect the density of bees in the area after the fire has occurred?

Null Hypothesis: There is no linear correlation between the severity of a wildfire and the percent change in bee counts after the fire. ($r = 0$)

Alternative hypothesis: There is a linear correlation between the severity of a wildfire and the percent change in bee counts after the fire. ($r \neq 0$)

Methods

External Data Sources

•*Fire Severity Data*: Spatial data from the BAER (Burned Area Emergency Response) program was used to measure fire severity in Oregon wildfires (U.S. Geological Survey, n.d.).

•*Bee Population Data*: Bee population data from the Oregon Bee Atlas (OBA) was used, which includes bee counts within a 25 km radius of fire locations.

Data Tidying and Manipulation

•Reprojected spatial data to a common coordinate reference system (CRS) to ensure accurate spatial alignment.

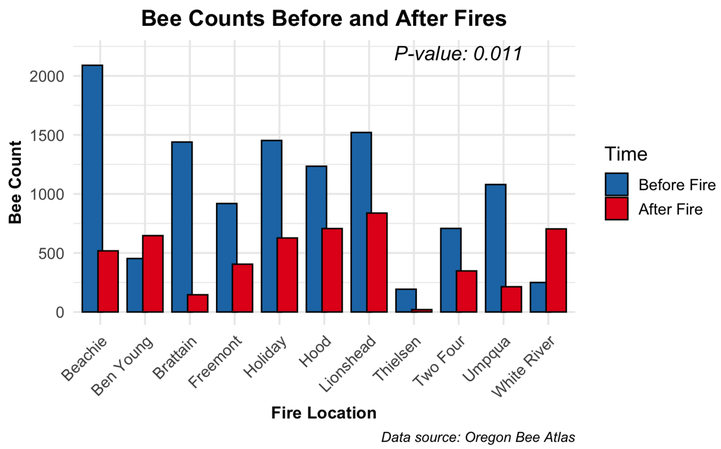
•Filtered bee population data for 2020, focusing on the 24 months before and after each fire to ensure consistent data before and after fire events.

•Calculated percent changes in bee counts before and after fire occurrences.

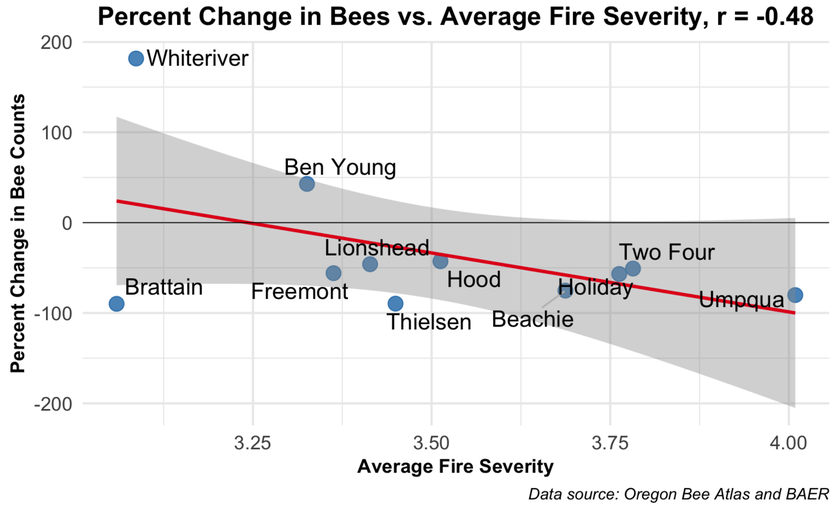
General Workflow

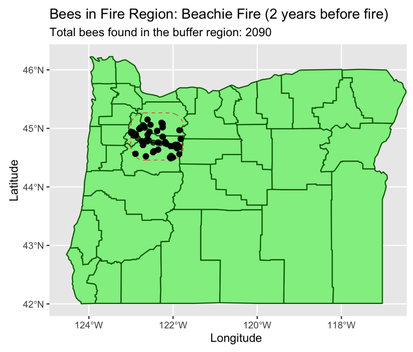
1.Acquire and preprocess fire severity and bee population data.
2.Reproject spatial data for alignment and accuracy.
3.Calculate percent changes in bee populations before and after fire events.
4.Perform Pearson's correlation analysis to assess the relationship between fire severity and bee population changes.
5.Conduct a paired t-test to compare bee counts before and after fires.
6.Visualize and summarize the results.

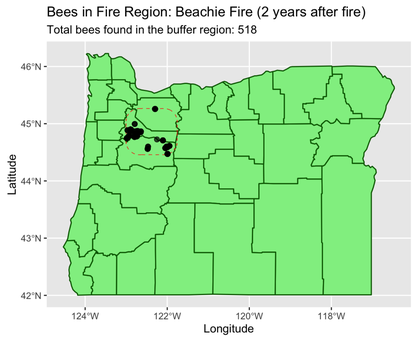
Result 1



Result 2







Conclusions

Our analysis did not show a linear relationship between fire severity and a decrease in bee population count when comparing the year before and the year after a fire within a 25 km radius (see result 2). Therefore, we fail to reject the null hypothesis (P-value = 0.134699 > 0.05).

However, we found a statistically significant difference in bee population counts before and after a fire of any severity ($p = 0.011$, see result 1). Based on existing literature, we suspected that fires would increase bee populations by creating more open space for foraging, but we observed a decrease in populations post-fire. This finding may reflect a shift in citizen scientists' willingness to collect bee specimens in burned areas rather than a true change in bee populations. Alternatively, the long-term effects of severe fires on plant regrowth could be a contributing factor, as the slow recovery of plants may reduce available pollination resources for bees.

Contrary to our findings, Oregon State University researchers found that 4 to 5 years after a fire, bee populations thrived around the fire's region. This further supports that the data in our sample (ranging from 2018 – 2023) may have not been comprehensive enough to show the long-term effects of a fire on the ecosystem. To best capture the effects of the fire, we chose 2020 so that we could consider data from 2018 to 2020, and then compare this with data from 2020 to 2022. With a larger sample size, this could be further investigated.

References

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