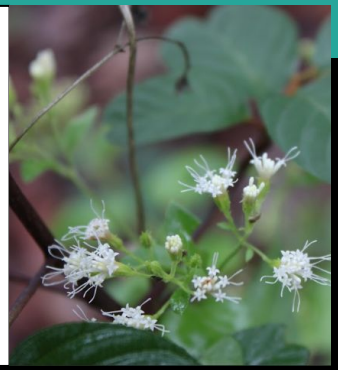
Bees vs Precipitation in Southern Arizona

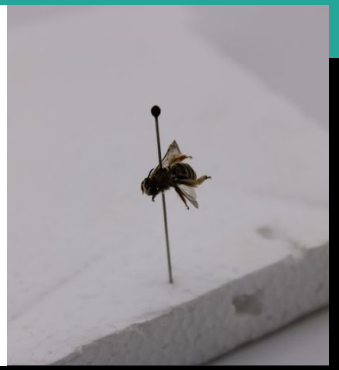
Research Question:

How does the difference in precipitation from 2024 vs. 2025 influence the abundance and diversity of bees collected?



Results:

There was more precipitation in fall 2024 vs 2025. Less bees were collected in fall 2024 vs 2025. Bee diversity was the same both years.



Method:

1. Collect bees
2. Remove middle leg
3. Pin bees
4. Photograph & document bees

Conclusion:

More bees were collected in 2025. This could be due to the lesser amount of precipitation that year compared to 2024. Precipitation did not affect diversity.

Importance of Bees

Figure 1: Bee Collected in 2025.

- Bees are important to agriculture because they are usually the primary crop pollinators.
- Many types of fruit will not grow without pollination.
- Roughly 90% of the world's plant species are pollinated by animals: most of which are bees.
- Specific types of bees are the only pollinators of specific plants in some Arizona ecosystems.

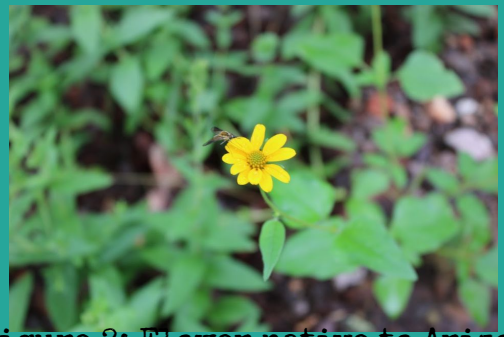


Figure 2: Flower native to Arizona.

Urgency of Bee Preservation

- Climate change is a growing risk that leads to drought and poses a threat to bees and the food resources.
- No bees are listed under the U.S. Endangered Species Act, even though many bee species are known to be in steep decline or possibly extinct.
- Habitat loss has been a major problem to the decline in bee populations.

Research Question

How does the difference in precipitation from 2024 vs. 2025 influence the abundance and diversity of bees collected?

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Sweat Bee

?

—

Longhorned-Bee

?

Figure 3: Precipitation in Southern Arizona.

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Leafcutter Bee

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Honey Bee

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Hypothesis

The abundance and diversity of bees collected will be higher in 2024 vs. 2025 due to the larger amount of precipitation in 2024 compared to 2025, which caused more flowers to bloom and supported more bees.

Independent Variable: Precipitation

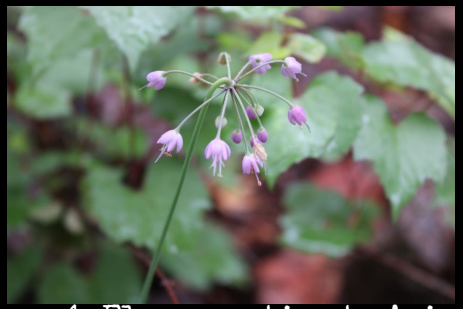
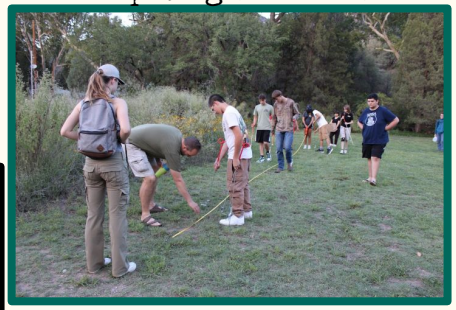


Figure 4: Flower native to Arizona.

Dependent Variable: Bee Abundance/Diversity

Figure 5: Students setting bee sampling transect.



Methods

Phase 1: Collect bees from two different areas 1x weekly

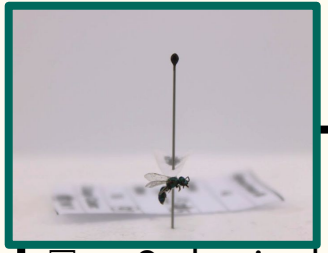
- ❑ Cups containing soap water were placed in shady and sunny areas near SHS.
- ❑ After 24 hours, bees were collected from cups.

Figure 6: Students removing bee legs for DNA analysis.

Phase 2: Label and Classify Bees

- ❑ Right middle leg was removed for DNA analysis
- ❑ Bees were pinned and labeled with collection information

Figure 7: Pinned and photographed bee (side view)



Methods(cont.)

Phase 3: Pin bees

- ❏ Stab pin through the middle of larger bees or tip smaller bees on a small triangular piece of paper with hide glue.
- ❏ Poke each pin in a piece of styrofoam along with its identification paper.

Phase 4: Photograph and document bees

- ❏ Take a picture of each bee individually in a small photo booth
- ❏ Document each bee along with its information into the data sheet

Phase 5: Gather data

- ❏ Searched for publicly available weather data
- ❏ Downloaded data from both study periods from local weather station

Figure 8: Pinned and photographed bee (top view)

Results

- The precipitation in fall 2024 was much higher than in 2025.

- Although there was more precipitation in October 2025, the rainfall during the study period in 2024 was almost double that of 2025.

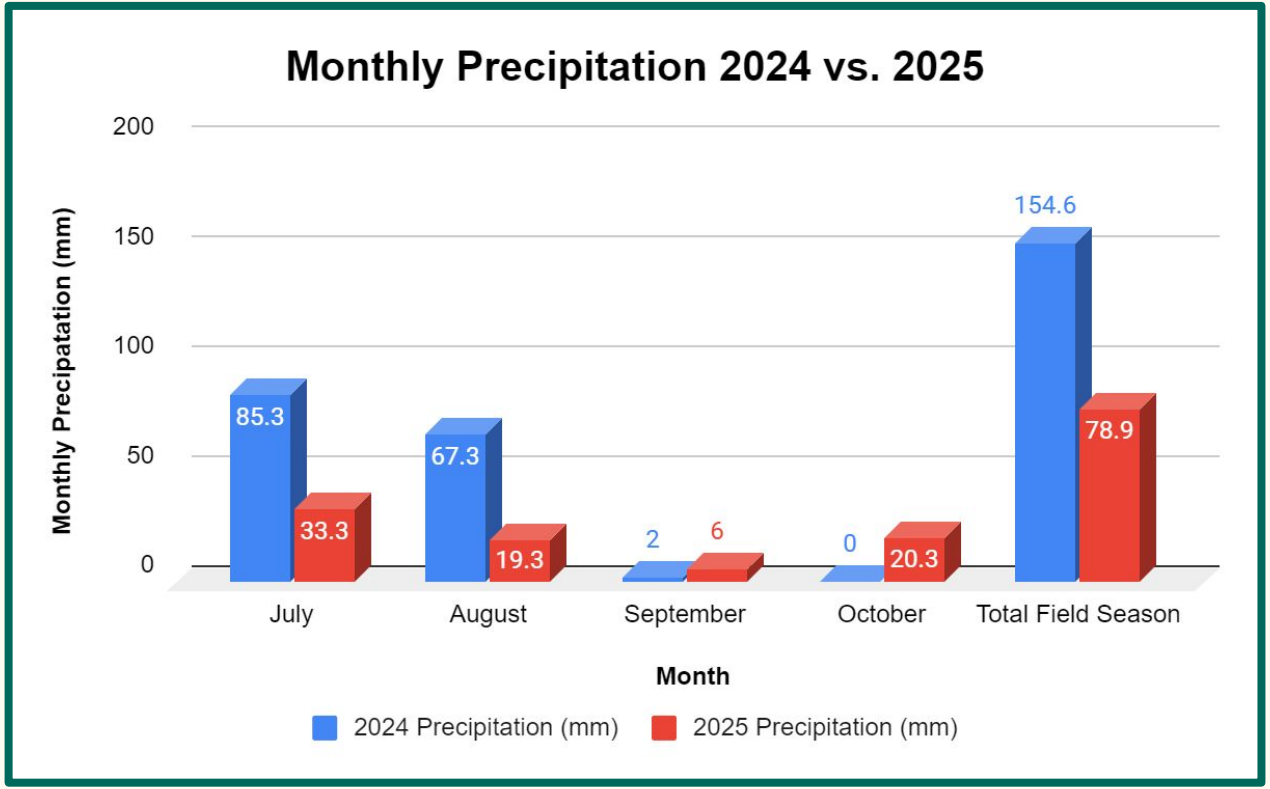


Figure 9: 3D Bar Graph showing the monthly precipitation around Tucson, AZ in 2024 vs. 2025

Results 2

- The most common plants flowering during Aug - Oct 2025 wer Creosote bush, Desert Broom, and Desert Willow.

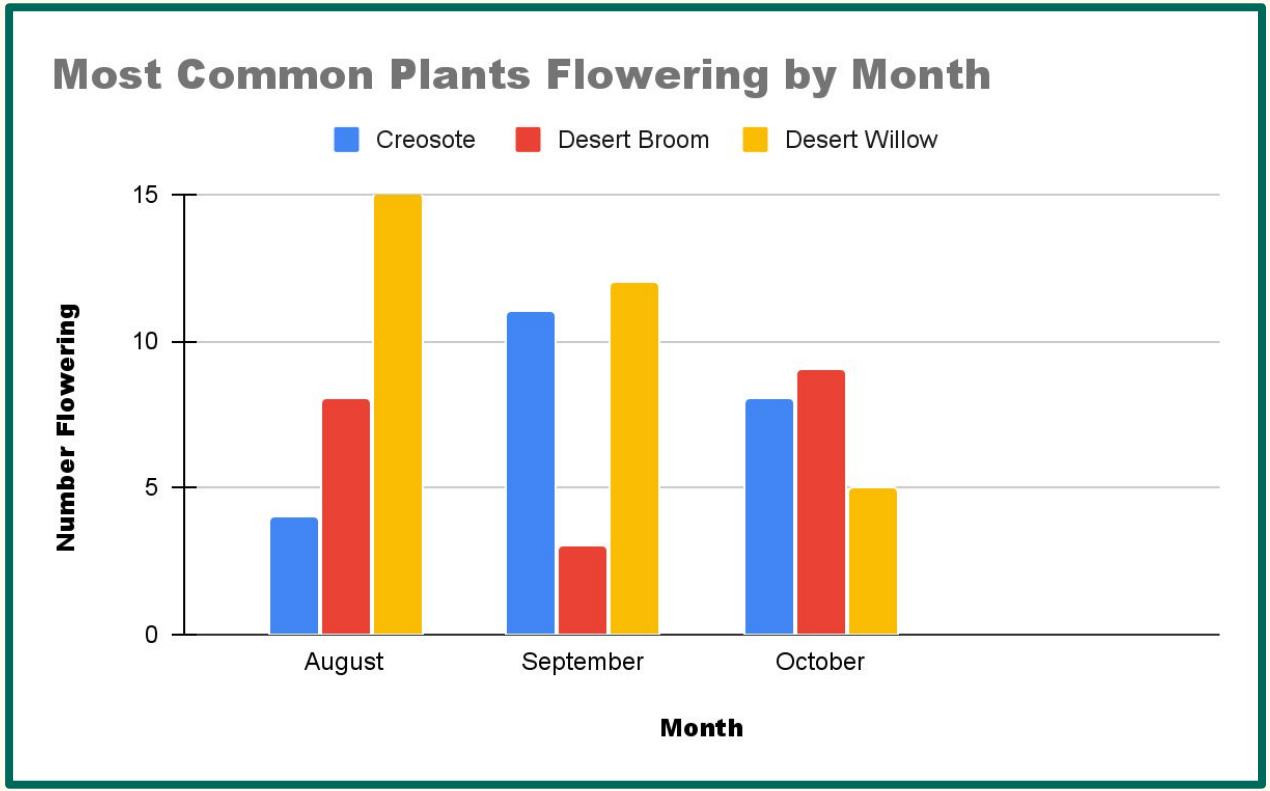


Figure 10: Bar graph showing the number of plants flowering around Tucson, AZ by month in 2025.

Results 3

- The amount of bees collected in 2025 was greater than in 2024.
- Longhorn bees were the most common bees collected in 2024.
- *Lasioglossum* sweat bees were the most common bee collected in 2025.

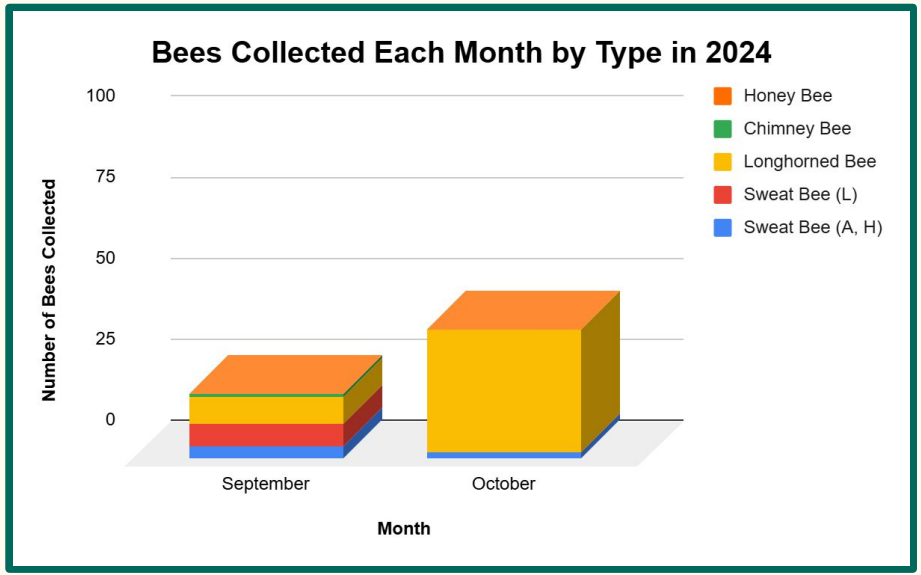


Figure 11: Stacked bar graph showing the amount of each type of bee collected in fall 2024.

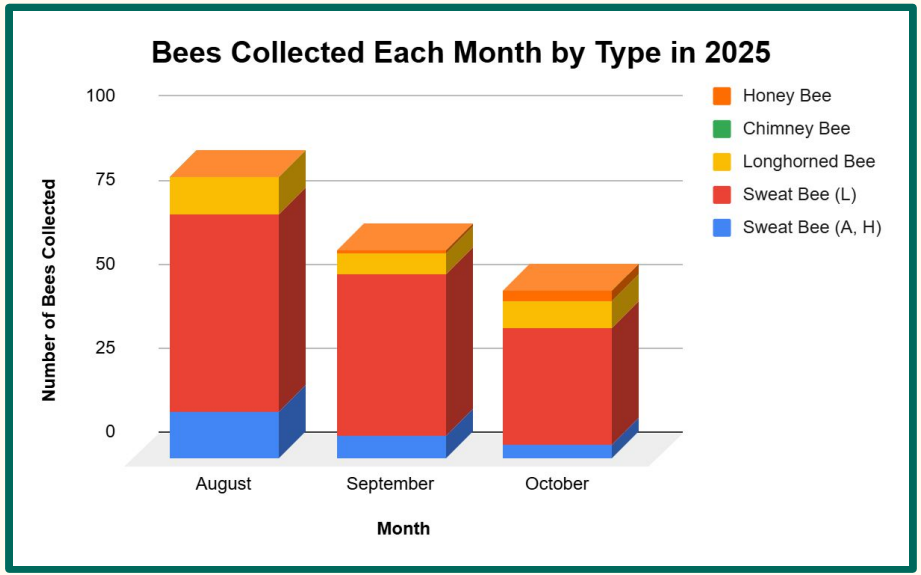


Figure 12: Stacked bar graph showing the amount of each type of bee collected in fall 2025.

Results 4

- In 2024, the amount of bees collected increased as rainfall decreased

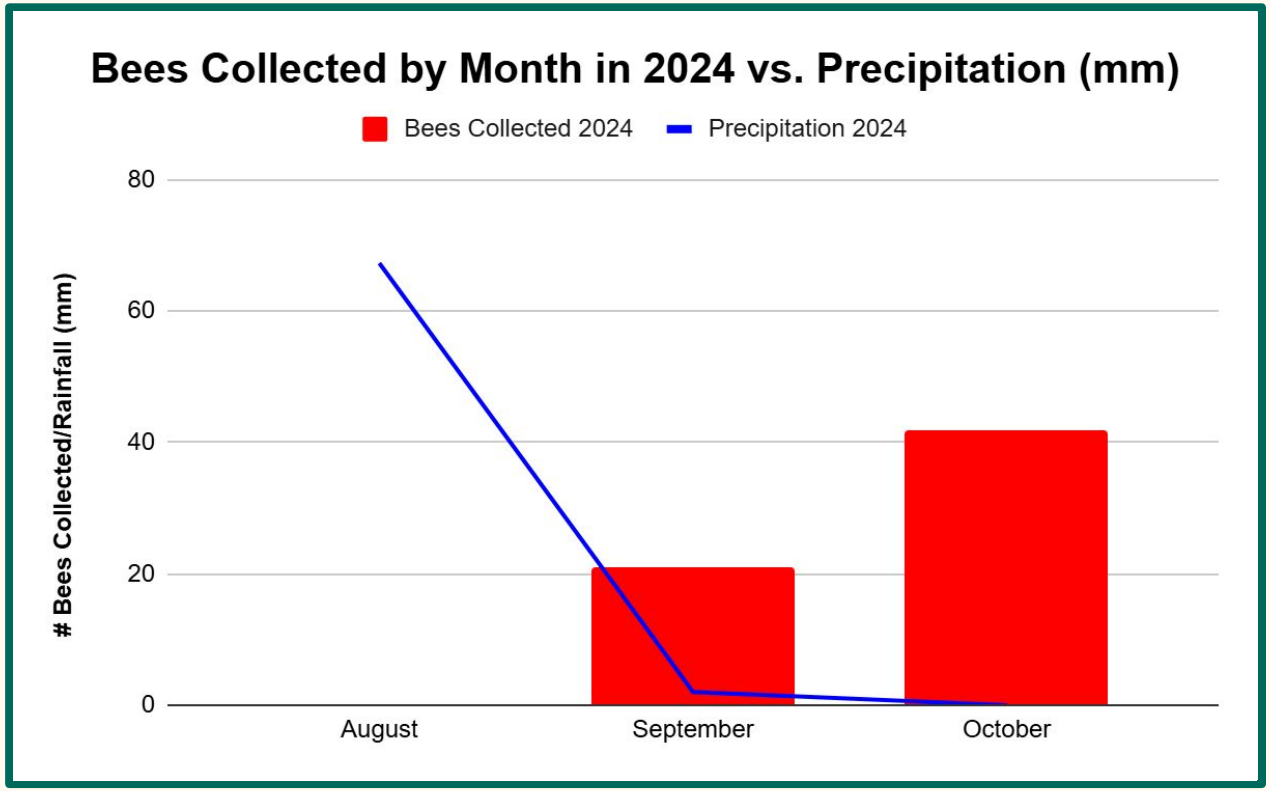


Figure 13: Bar and line graph showing the amount of bees collected compared to the amount of precipitation in fall 2024.

Results 4 (cont.)

- In 2025, there was little correlation between rainfall and the number of bees collected.

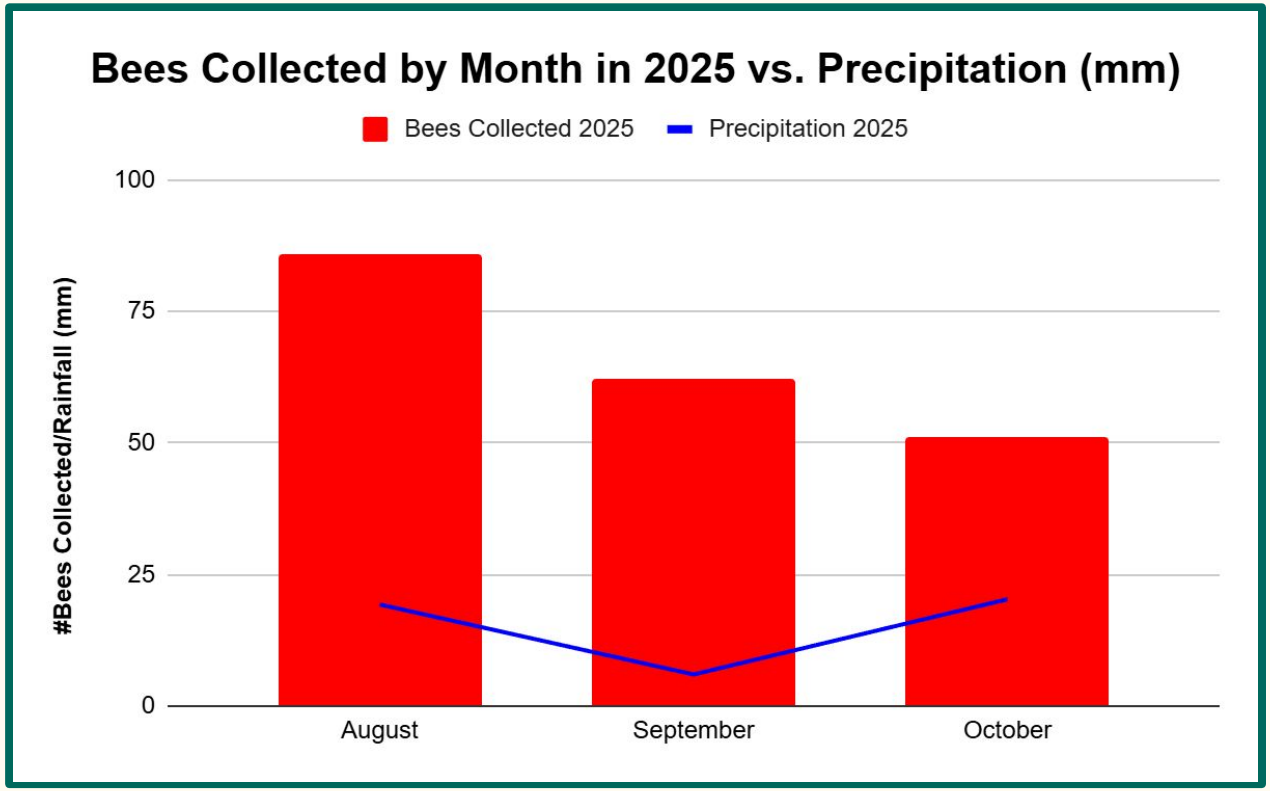


Figure 14: Bar and line graph showing the amount of bees collected compared to the amount of precipitation in fall 2025.

Conclusion

Figure 15: Front view of bee collected in 2025

- The larger amount of precipitation in 2024 vs 2025 caused less bees to be collected in 2024 vs 2025 overall.

- The larger amount of precipitation in 2024 vs 2025 didn't affect bee diversity.

Conclusion

Figure 15: Front view of bee collected in 2025

- This was the first year that students gathered weather data alongside bee data. Overall weather data was easy to attain and download.
- We plan to continue to build on our dataset to see if trends emerge related to bees collected vs. precipitation.

Works Cited

1. Winfree, R. (2010). The conservation and restoration of wild bees. Annals of the New York academy of sciences, 1195(1), 169-197.
2. Kędzior, R., Agnieszka Ziernicka-Wojtaszek, Czekońska, K., & Sylwia Łopuch. (2025). Impact of climate change and drought threat on the honey bees food collection. The Science of the Total Environment, 1004, 180761–180761. https://doi.org/10.1016/j.scitotenv.2025.180761
3. Campbell, C. (2020). An approach for creating site-specific planting palettes to support pollinators in the sky islands. Air, Soil and Water Research, 13, 1178622120950269.