



Invasive species distribution model from the effects of climate change in Arizona



Kayla Yazzie, Sara Southern, Clare Aslan and Collin VanBuren
Research and Mentoring for Post-baccalaureate (RaMP) Scholar
Northern Arizona University

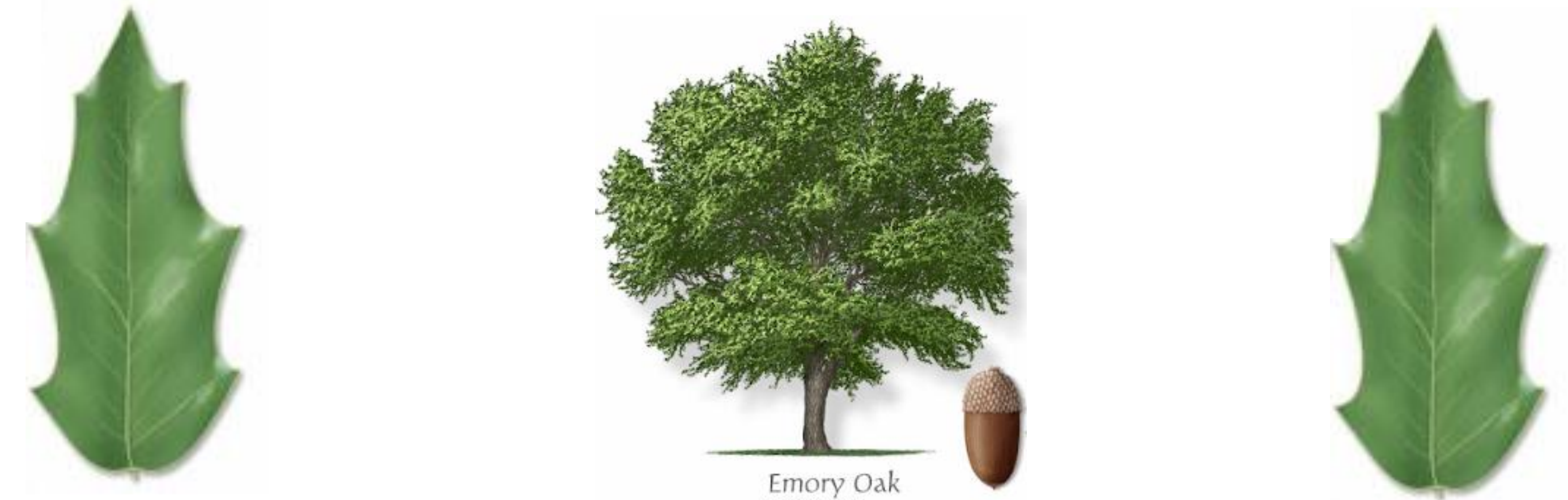


Background Information

- As the climate changes, species distribution of non-native plants is also predicted to shift, which causes displacement of native plants, fisheries, and wildlife.
- Non-native species are difficult to maintain and control due their rapid growth rate from obtaining available water and nutrient resources.
- Species Distribution Models SDM in this study will be used to identify non-native species distributions within the woodland Emory oak ecosystems.
- SDM's utilize available datasets such as: NDVI metrics for vegetation, elevation, historical precipitation and temperature regimes, and human disturbances and activities.
- One method to help monitor these exotic species is to create SDM's to help calculate and give predictions of the level of invasion that these species have before and after restoration treatments using RStudio.
- The monitoring of native and non-native species can help create restoration and management plans for climate scenarios.

Research Questions

- How will the distribution of native and non-native plants be affected by restoration activities within the Emory oak ecosystem?
- How will the distribution of native and non-native plants be affected by projected climate change scenarios within the models?



Shared Socioeconomic Pathways

a) Global surface temperature change relative to 1850-1900

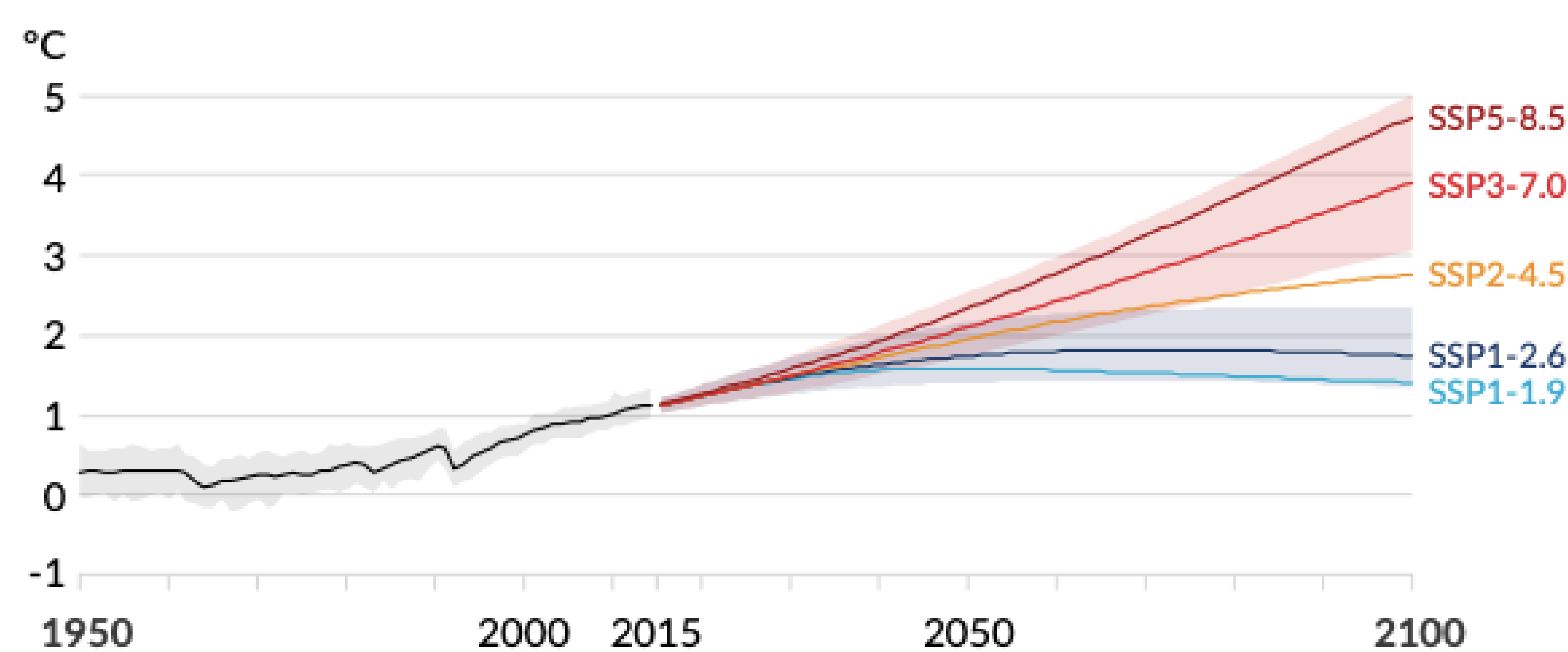


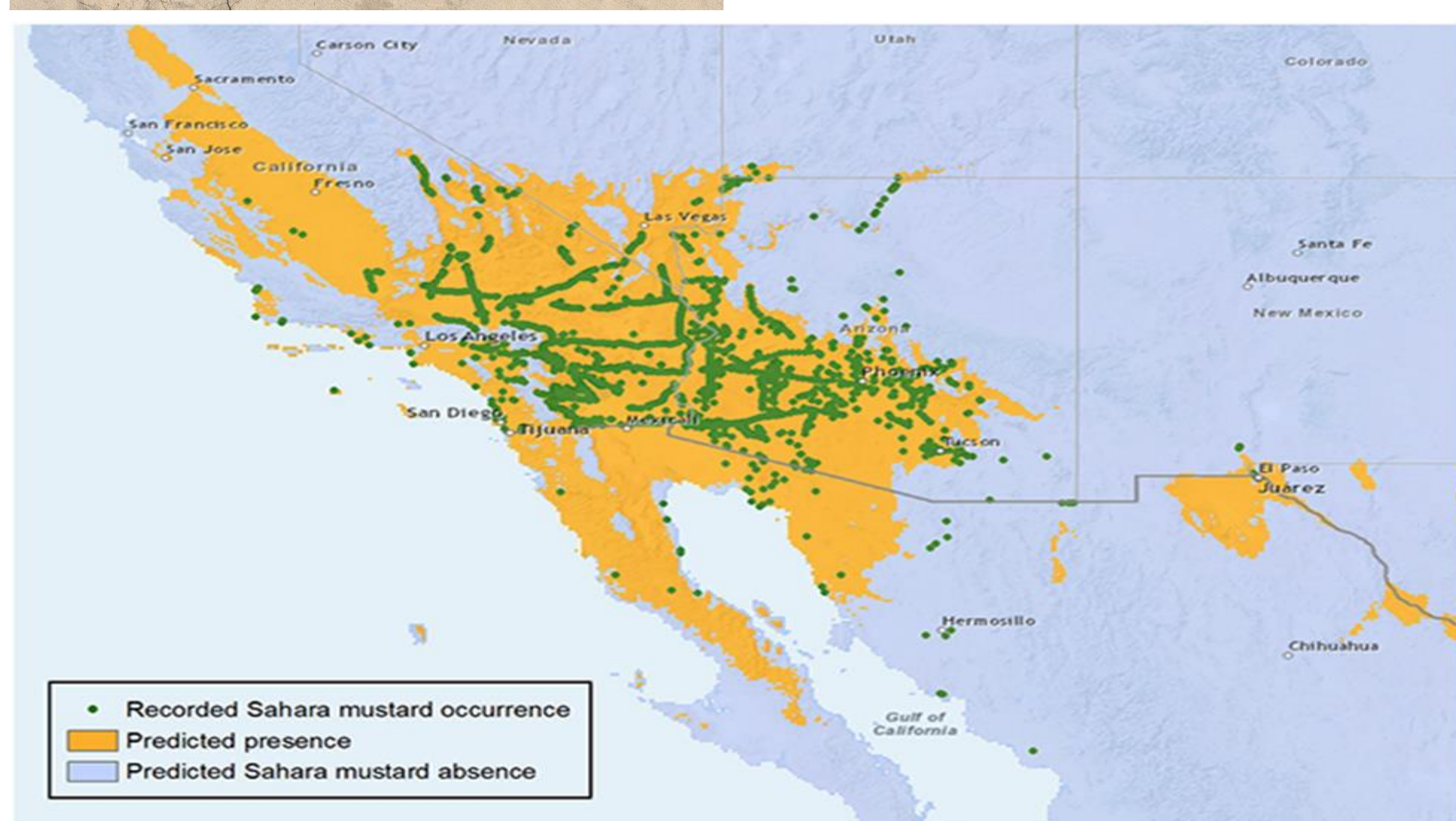
Figure 1. The left, x-axis, is the temperature of degrees Celsius, which measures climate sensitivity; a range between 2.5°C and 4°C of expected warming if carbon dioxide levels in the atmosphere were to double. The y-axis, is a timeline beginning in the 19th century, where the temperature ranged between 1.5°C and 4.5°C. Right of the graph are five scenarios called shared socioeconomic pathways (SSPs), which could possibly predict the future of rising carbon dioxide in the atmosphere

Future Implications and Directions

- Indigenous communities are greatly impacted, and livelihoods are more vulnerable to climate change, particularly due to increasing non-native species.
- For example, the Western Apache tribe holds invaluable cultural, medical, and dietary resources within the Emory oak ecosystem.
- Yellow bluestem and Sahara mustard are notoriously difficult to identify and readily occupy the Emory oak understory making them hard to control.
- SDM's can help Tribal land managers and practitioners focus their time and resources towards restoration efforts in specific regions.

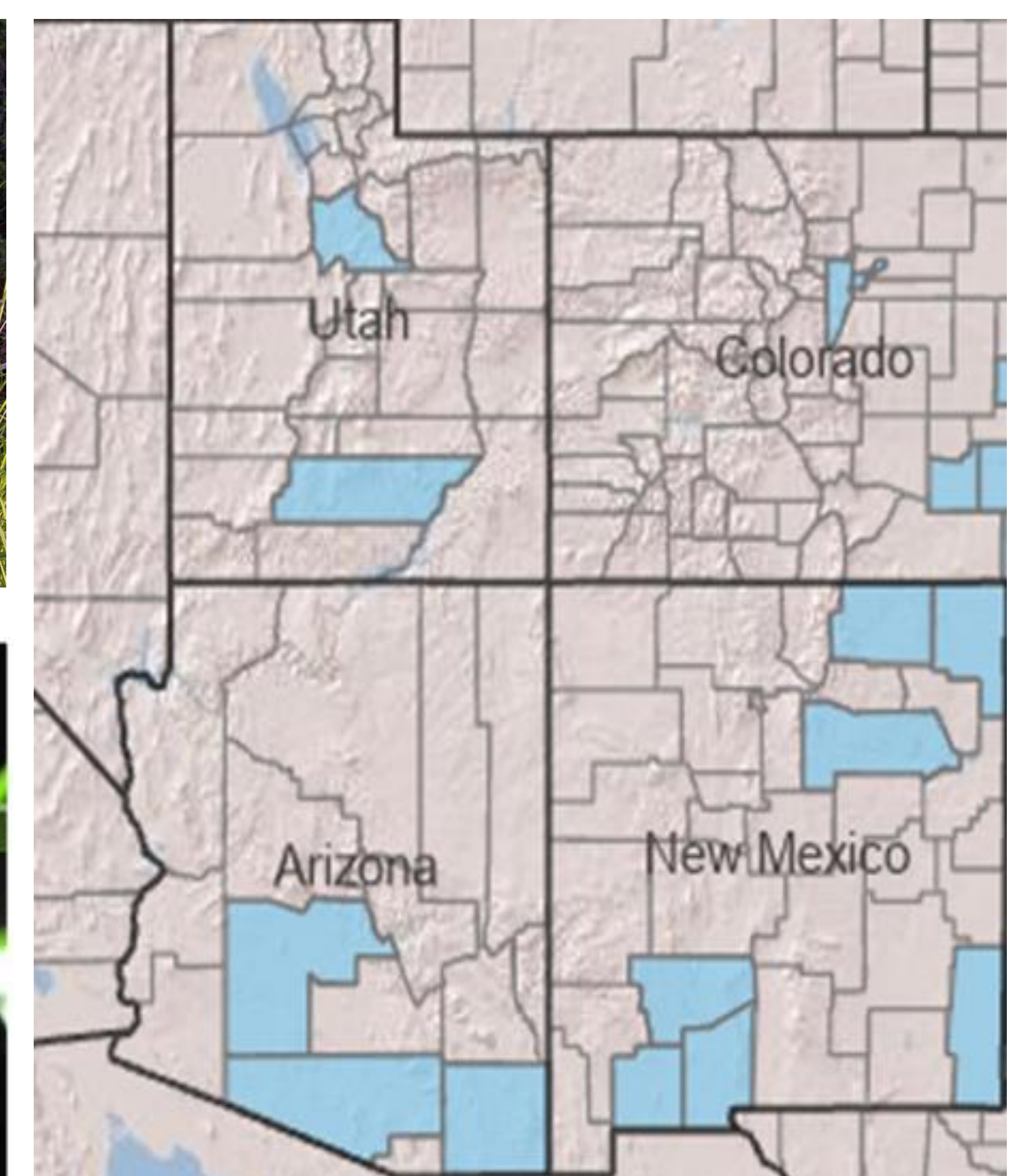


Sahara Mustard (*Brassica tournefortii*)



Figures 2-4. Sahara Mustard (*Brassica tournefortii*). A non-native species that propagates in warm deserts such as the southwest, and blooms in early December/January. Sahara Mustard will smother native species by stealing their water and nutrient resources and can also be toxic to desert tortoises due to its high levels of oxalic.

Yellow Bluestem (*Bothriochloa ischaemum*)



Figures 3-5. Yellow Bluestem (*Bothriochloa ischaemum*). This perennial grass species grows aggressive and is deleterious to pasturelands that can endanger other native species and their habitats by reducing plant and wildlife diversity. Animals become endangered by the plant shedding chemicals that make the soil inhospitable for other native plants. It forms monocultures that it extremely difficult to eradicate, which makes it fuel for wildfires.

Acknowledgments and References

National Conference on Ecosystem Restoration (NCER) Travel and Conference Award
Funding Opportunity National Science Foundation (NSF) 22-506

1. "Yellow Bluestem Grass." *Northern Arizona Invasive Plants*, University of Arizona, nauinvasiveplants.org/yellow-bluestem-grass. 2. Juan Arias. *Watch For, Report, or Control These Non-Native Invasive Species Threatening the San Carlos Apache Lands' Natural & Cultural Resources*. University of Arizona College of Agriculture and Life Sciences Cooperative Extension, Tucson, AZ. 3. Malusa, J., Rutman, S., & Winkler, D. (n.d.). *Sonoran Desert Cooperative Weed Management Area: Sahara Mustard - Brassica tournefortii*. <https://cwrma.org/species/saharamustard.php>. 4. Irwin, Umar. "What's The Worst That Could Happen?" *Vox*, Vox Media, 10 Sept. 2021. www.vox.com/22420706/climate-change-ipc-report-2021-ssp-scenario-future-warming. 5. Mike, Jesse, and Nora Talkington. "Wildlife Habitat and Invasive Plant Species Prioritization - NNDFW, Navajo Fish and Wildlife," Oct. 2020. www.nndfw.org/https://doi.org/10.21967/2020.09.01. 6. Grunich, Elise S, and Larry D Hovey. *Non-Native Invasive Plants of Arizona*. University of Arizona, Oct. 2019. extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1482-2019.pdf. 7. Natural Resources Conservation Service. (n.d.). *Bothriochloa ischaemum (L.) Keng*. USDA plants database. <https://plants.usda.gov/home/PlantProfile?symbol=bois>. 8. RStudio

Contact Information



Kayla.Yazzie@nau.edu, Northern Arizona University
RaMP Fellow, Center for Adaptable Western Landscapes, NAU
Incoming Master's student, Fall 2024, Department of Biological Sciences, NAU