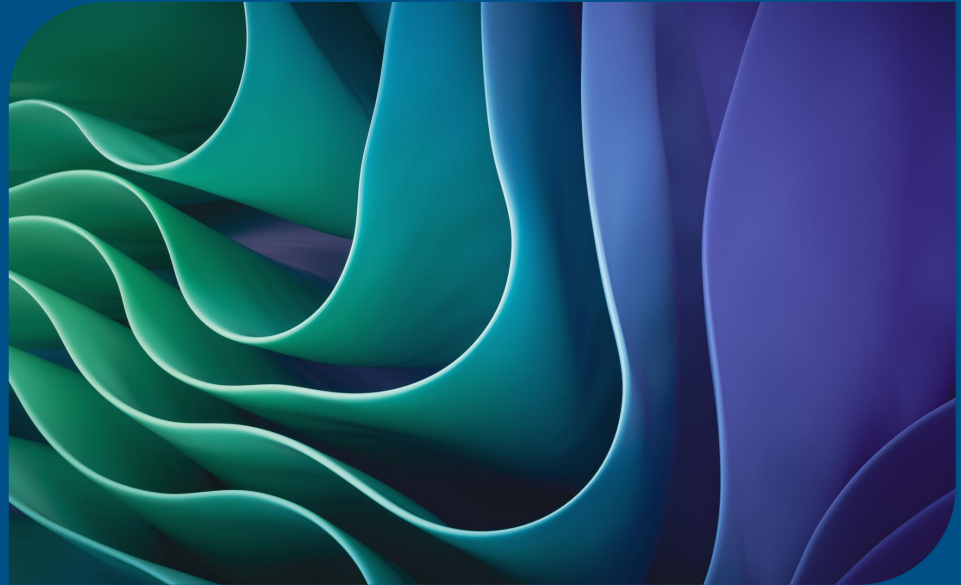


Using *ML* to Help Endangered Salamander Species

By Nick Garrone and Samuel
Veliveli



Background Information

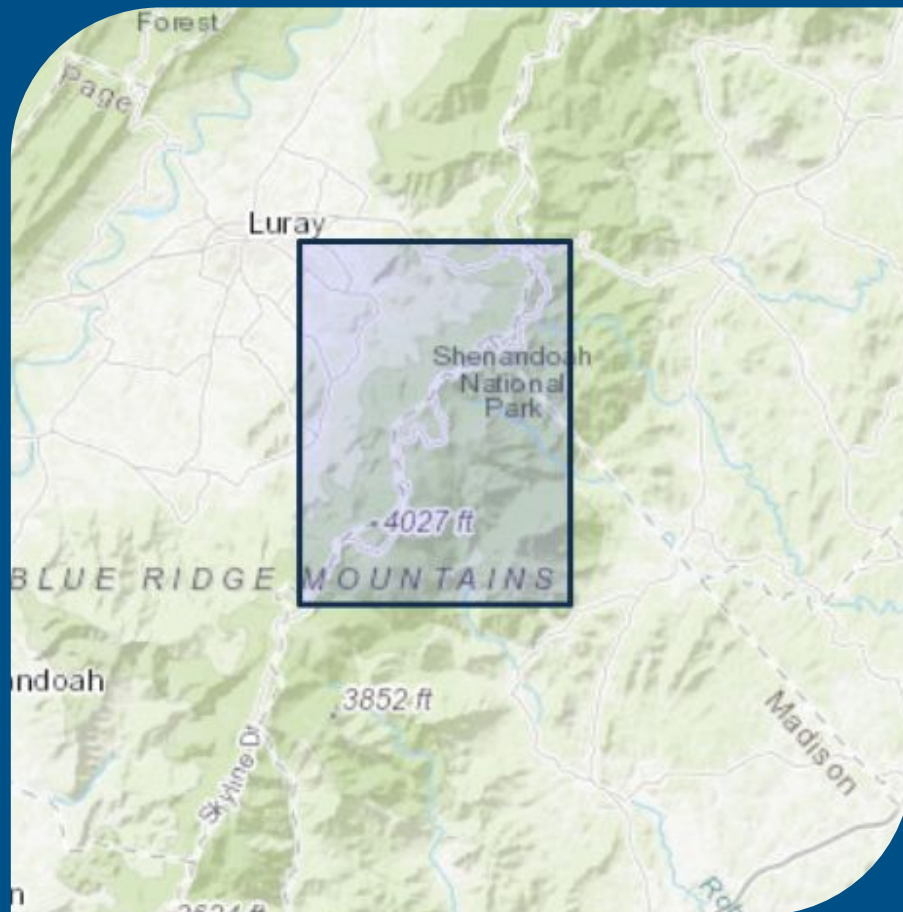
- The Shenandoah salamander (*Plethodon shenandoah*) is a small, terrestrial amphibian endemic to Shenandoah National Park in Virginia
- This species is exclusively found on the north-facing talus slopes of three mountain peaks within the park: Hawksbill, The Pinnacles, and Stony Man, all situated at elevations around 3,000 feet.
- Due to its restricted range and the threats it faces, the Shenandoah salamander was listed as an endangered species under the Endangered Species Act in 1989



Dataset

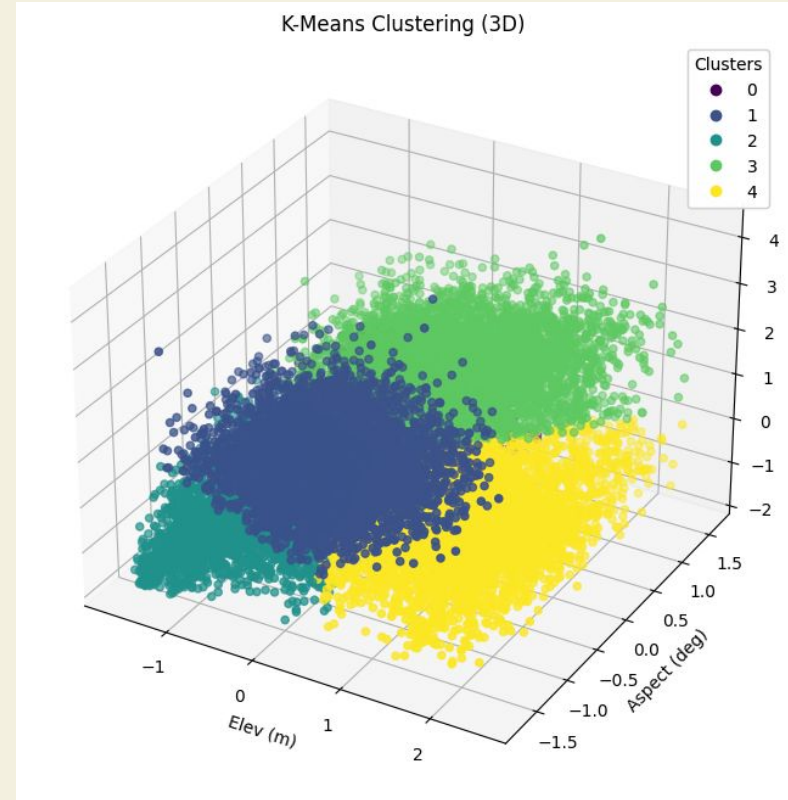
"Data to support an updated range map for *Plethodon shenandoah* and evaluating support for multiple models of species occurrence" by Evan H Grant, David A.W. Miller, Jo A Werba, Adrienne Brand

Contains a collection of survey tracts with salamander occurrence, temperature and precipitation data, and slope, elevation, and aspect data



Original Approach

- Using clustering to find common traits
- Clustered on physical features
 - Slope, aspect, elevation



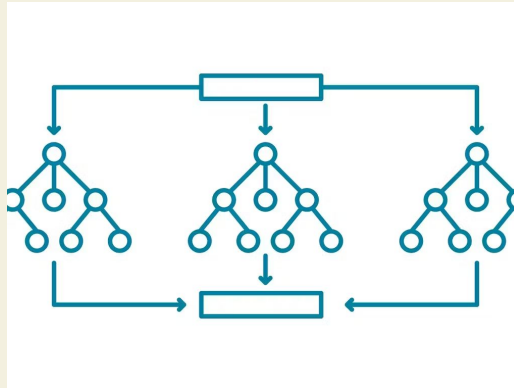
Transition of Topic

- We discover that a lot of clustering work had already been done with regards to the Salamanders' location
- Additionally, a lot of work was done on existing locations using ML Techniques
- We decided to see if we could predict locations in virginia where the salamander might be at.
- The value of this research could be to concentrate conservation efforts on areas that have not been explored to see if there are additional efforts in need of protection for the salamanders' habitat.



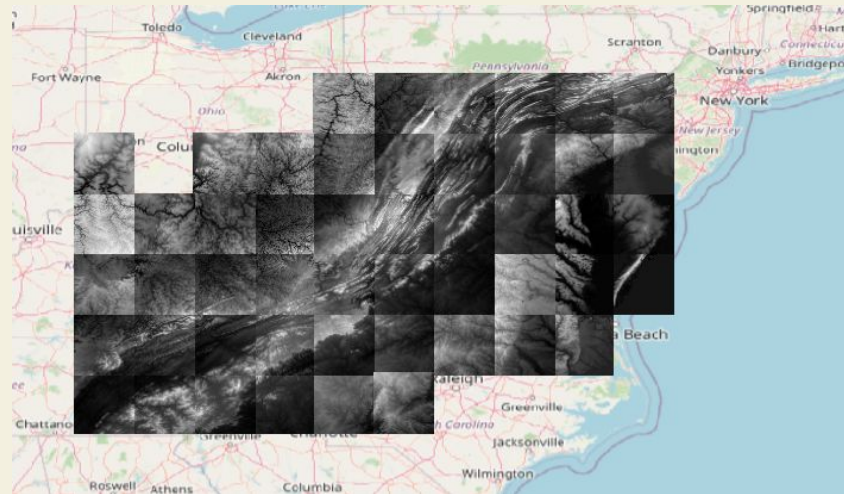
Predicting New Locations

- We decided to use classification algorithms for prediction. We were the most familiar with this method from class.
- Based on various factors we would predict the presence of Salamanders in the various regions in Virginia
- 1 if we predicted salamanders would be there, 0 if not
- Switched from regression to binary classification because presence of salamander is more important than exact number of salamanders



Data acquisition process

- Used QGIS to extract slope, elevation, aspect, temperature, and precipitation data for a survey area
- Extracted elevation data from 15m Digital Elevation model (DEM) from USGIS
- Extracted temperature and precipitation data from PRISM dataset
- Sampled grid of 10k points



Figuring out which algorithm to use

Model Performance Comparison:

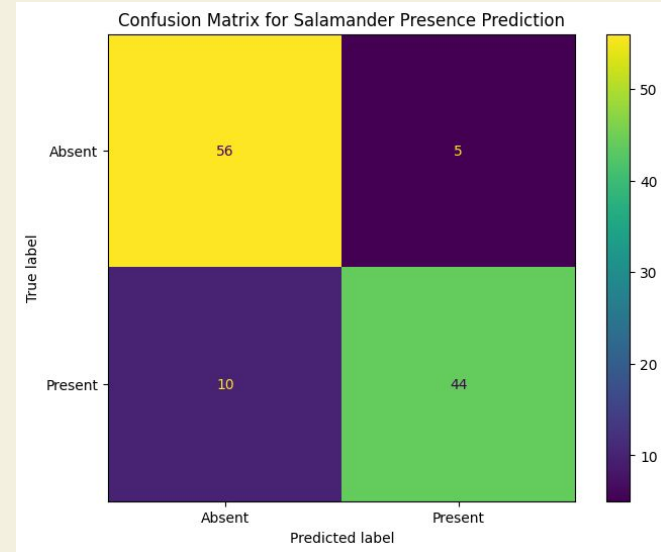
Random Forest: 0.87

Logistic Regression: 0.78

SVM (RBF Kernel): 0.82

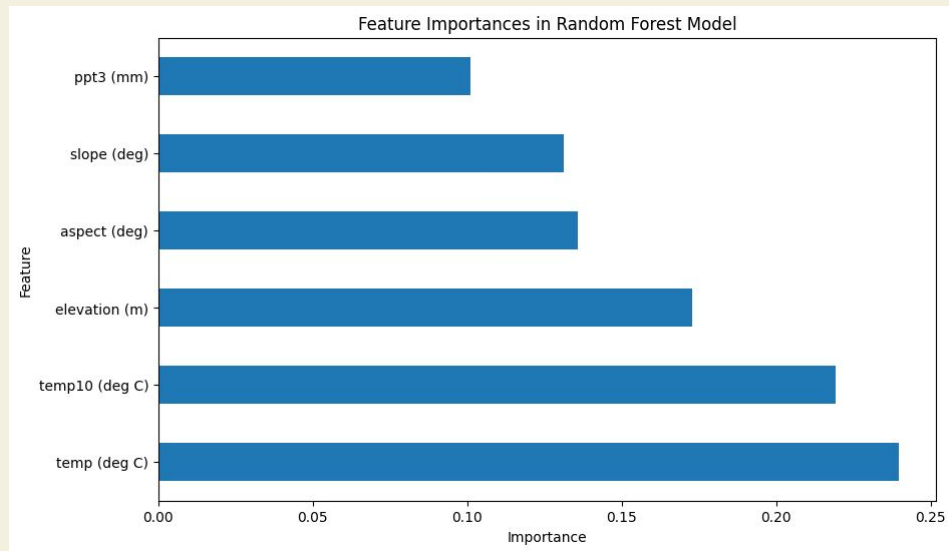
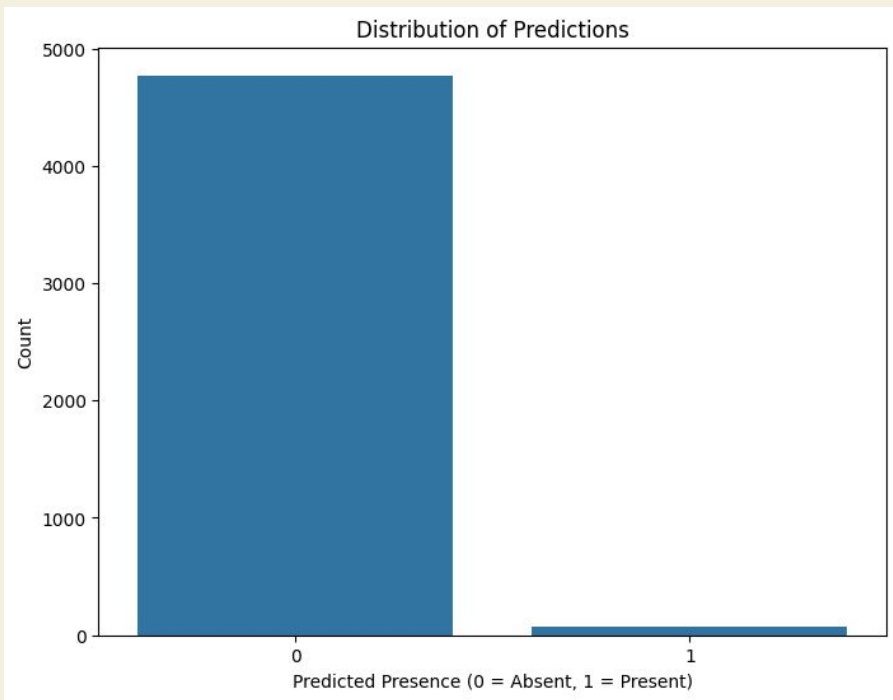
K-Nearest Neighbors: 0.80

Decision Tree: 0.78

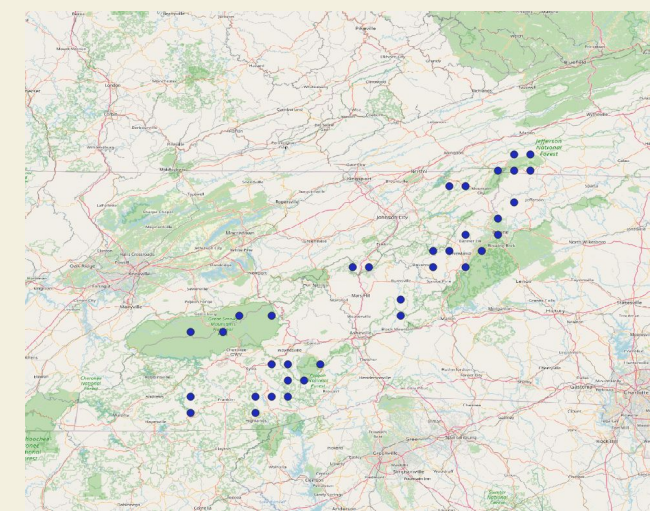
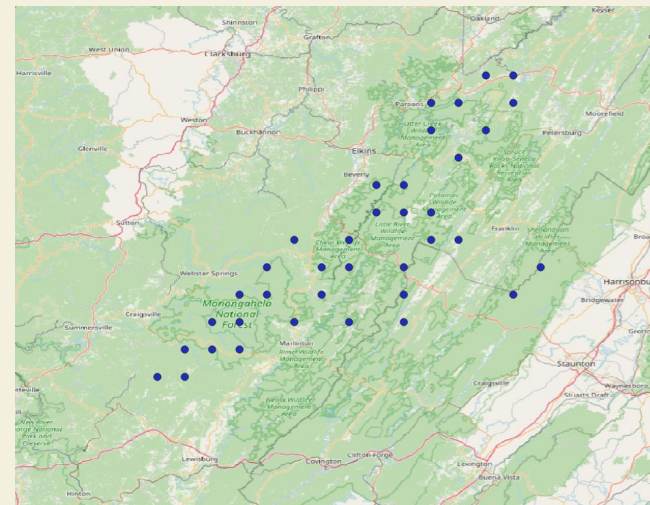
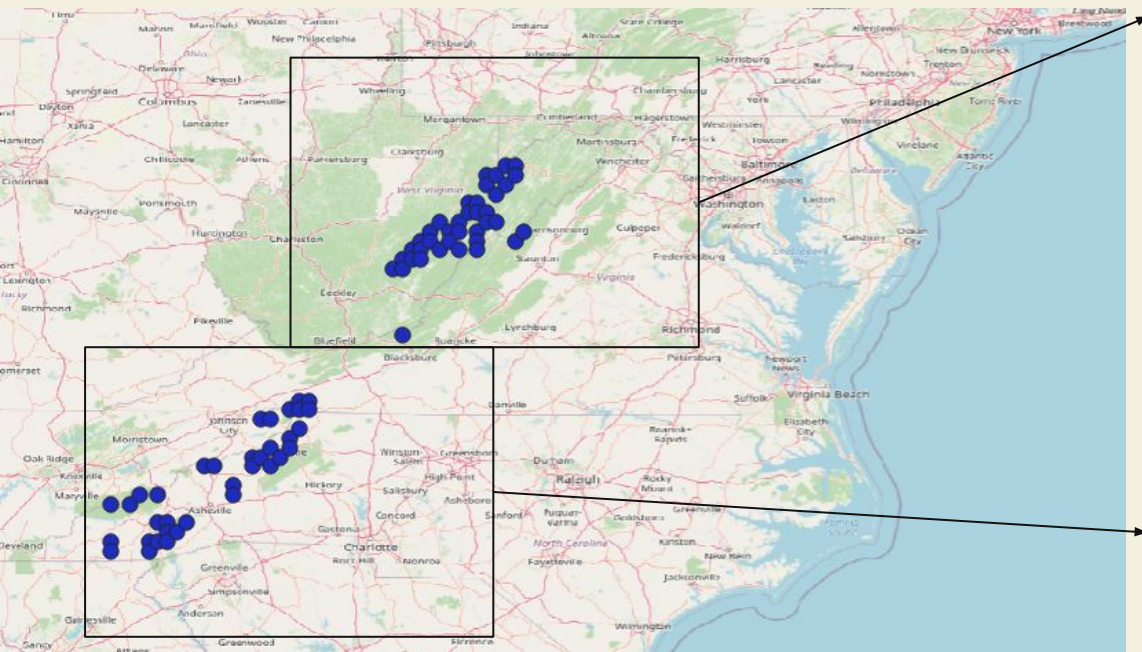


```
# Define feature columns and target based on the training dataset
feature_columns = ['elevation (m)', 'slope (deg)', 'aspect (deg)', 'ppt3 (mm)', 'temp10 (deg C)', 'temp (deg C)']
```


Results



New Locations

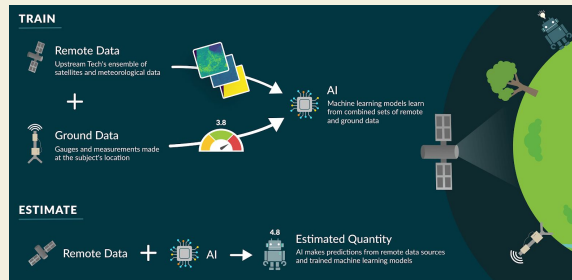


Analysis on New Locations

- The model predicted locations in the VA, WV, and NC Appalachian Mountains
 - Makes sense given correlation to elevation
- These locations are predicted to be habitable for Shenandoah Salamanders
- These locations are potential starting points for habitat expansion or additional surveying

Conclusions

- We were able to show the value of Machine Learning to conservation ecology
- Often times, researchers in conservation biology need to prioritize funding, resources, and time, and our project showed a proof of concept of a methodology that could aid resource conservation in which locations should be prioritized
- Next steps would be to see how our results translate to real life (if salamanders are there), and doing this with more species and data



References

National Park Service. (n.d.). *Shenandoah Salamander*. Retrieved from https://www.nps.gov/shen/learn/nature/shenandoah_salamander.htm

PRISM Climate Group. *PRISM Climate Data, Monthly*. Retrieved from <https://prism.oregonstate.edu/6month/>.

U.S. Geological Survey. Digital Elevation Model 1/3 Arc-second. Retrieved from <https://apps.nationalmap.gov/downloader/>.

U.S. Fish and Wildlife Service. (n.d.). *Shenandoah Salamander (Plethodon shenandoah)*. Retrieved from <https://www.fws.gov>
<https://www.usgs.gov/data/data-support-updated-range-map-plethodon-shenandoah-and-evaluating-support-multiple-models>

Images:

https://cdn.prod.website-files.com/6198248fab7fc465b00e696a/633da9a7a9d6ff4073f900ea_632b1dab1dd75c756dfb6981_ml-101-how-it-works.png

https://www.guideoftheworld.com/wp-content/uploads/map/color_map_of_virginia.jpg

https://images.prismic.io/turing/652ebf25fbd9a45bcec818a8_Random_Forest_Algorithm_a12b37363e.webp?auto=format,compress

https://www.nps.gov/shen/learn/nature/images/ShenSal_960x400.jpg