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Stream Surprises! The Impact of Environmental & Anthropogenic Factors on Salamander Populations

Background

Amphibians are facing major declines in abundance worldwide, with 33% of amphibian species considered globally threatened and 43% of species experiencing some level of population decline. To prevent the extinction of amphibians, it is important to understand how they are impacted by environmental conditions and human presence to inform effective conservation strategies. Salamanders are a particularly vulnerable order of amphibians and are historically understudied due to their cryptic nature.

3 adult northern dusky (*Desmognathus fuscus)* Busby, 2024

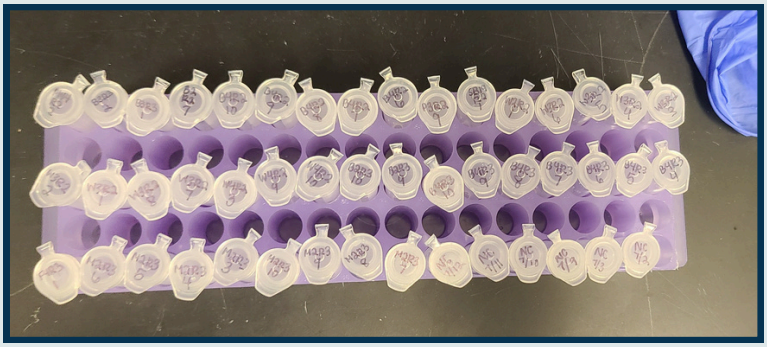
Over the past two years, I have collected data at small forest streams throughout Williamsburg. During my field sampling, I measured aquatic macroinvertebrates, habitat structure, water quality, dissolved oxygen, and conductivity to understand how these environmental factors impact salamander population size and diversity. To quantify salamander population size, I recorded salamander abundance along streams. Because young salamanders lack distinct morphological differences, it is difficult to identify their species. Therefore, I utilized DNA markers of species identity to quantify salamander diversity. While in the field, I swabbed each salamander to collect a skin cell sample for processing in the lab.

Summer 2024

Understanding Species Diversity

Alexa swabbing a salamander to collect skin cells for DNA extraction in the lab. Busby, 2024

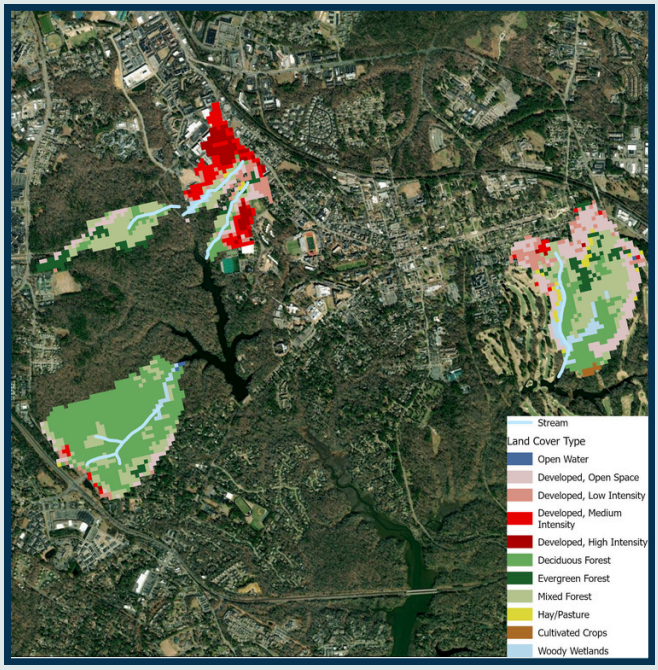
Through the support of the Liberson Summer Research Fellowship, I processed the skin cell samples I collected during my previous field sampling. I utilized molecular biology techniques to extract DNA from the skin cell swabs. I then sequenced the DNA samples and matched them to their corresponding salamander species.



Microcentrifuge tubes containing extracted salamander DNA. Busby, 2024

Understanding Human Influence

The support of the fellowship also allowed me to utilize geographic information systems (GIS) to quantify the degree of anthropogenic influence at my field sites. I utilized geospatial data on land cover to determine the percent of each field site composed of forest, developed land, and agriculture. I utilized geospatial data on impervious surface cover to determine the area of each field site covered in material impervious to water - which could affect stream flow and pollutant load in salamander habitats. This will allow me to understand how human disturbance of land affects salamander population size and diversity.



Map of 5 stream sites (4 on left on W&M campus, 1 on right in Colonial Williamsburg's Bassett Woods) and their corresponding land cover. Busby, 2024

Next Steps

Now, with all the data I have collected from my field, molecular, and geographic work, I can use statistical analysis to determine what factors are necessary to maintain healthy, stable salamander populations!

After I complete my statistical analysis, I will compile my results into a paper that I plan to publish in a scientific journal. The information in the paper will hopefully inform decision-making on the conservation strategies used to protect these imperiled species.

Acknowledgements

This fellowship allowed me to complete two crucial portions of my research project, 1) understanding salamander species diversity and 2) understanding human influence among my field sites. Over the summer, I learned more about DNA and improved my molecular biology and GIS skills. These skills will help me greatly when starting my applications to PhD programs this fall. Thank you to the generous donors who contribute to the Liberson Fellowship, the W&M ENSP department, and my faculty advisors Dr. Leu and Dr. Skelton for making this project possible!

Alexa surveying stream for salamander abundance in Colonial Williamsburg's Bassett Woods. Busby, 2024