Apr 14th, 1:00 PM - 3:00 PM

Assessing lichen diversity along the Lucayan Trail, San Salvador Island, Bahamas

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BACKGROUND

History

Lichens, two or three-way symbiotic organisms, occur nearly everywhere, with some species even documented in Antarctica (Selbmann et al.). Lichens occur on San Salvador Island, Bahamas, but they remain largely undocumented and unclassified. The north-eastern corner of the island includes the Lucayan trail (Fig. 1), and it is from this trail that lichen samples were collected.

Objectives

To encourage/enable lichenologists to utilize the Gerace Research Center (GRC), I will:

- Create color-accurate images of lichens present on San Salvador.
- Create a GIS map with locations of lichens (marked by GPS coordinates, with images embedded)
- Update the GRC's trail guide to include information on lichen genera, as well as their relative abundance and where to find them

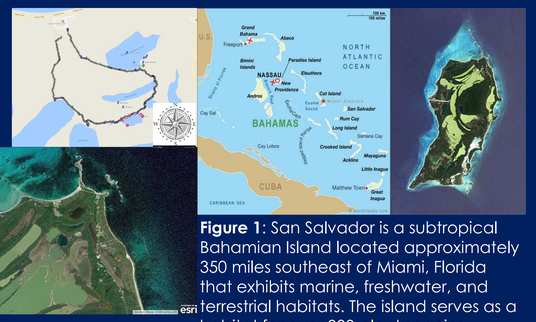

Figure 1: San Salvador is a subtropical Bahamian Island located approximately 350 miles southeast of Miami, Florida that exhibits marine, freshwater, and terrestrial habitats. The island serves as a habitat for over 800 plant species (Eshbaugh, 2014).

METHODS

Photography

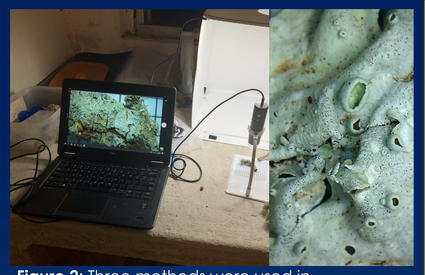

Figure 2: Three methods were used in photographing the lichens encountered: a USB microscope, an iPhone camera, and a DSLR camera supporting raw format. In the field, the iPhone camera was best, since it produced high quality images with accurate GPS location (Fig. 7). Of these, the USB microscope was the most efficient and produced relatively high-quality images of the lichens' fruiting structures in the lab.

Figure 3: A color-correcting card was included in each set of field photos. The same color card was photographed within a lightbox, allowing for any color variance caused by natural lighting to be corrected to the color it would be under optimal lighting conditions.

Figure 4: Specific attention was paid to sustainable sampling methods. Here, only a small piece of the organism is removed to be photographed in lab. Other times, the whole organism was able to be collected along with its substrate and later replaced.

Chemical Testing

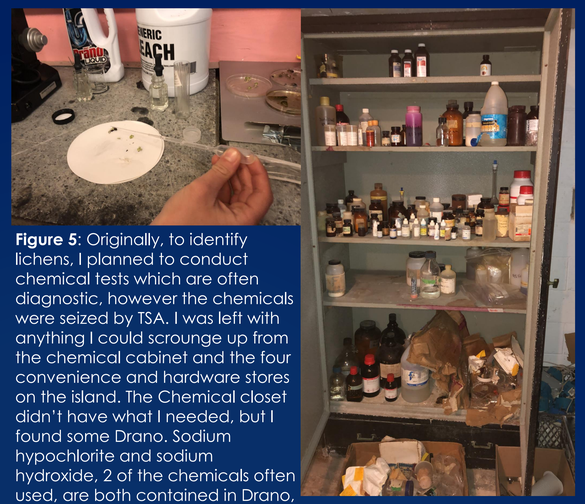

Figure 5: Originally, to identify lichens, I planned to conduct chemical tests which are often diagnostic, however the chemicals were seized by TSA. I was left with anything I could scrounge up from the chemical cabinet and the four convenience and hardware stores on the island. The Chemical closet didn't have what I needed, but I found some Drano. Sodium hypochlorite and sodium hydroxide, 2 of the chemicals often used, are both contained in Drano, but could not be separated or independently extracted, which prevented chemical testing.

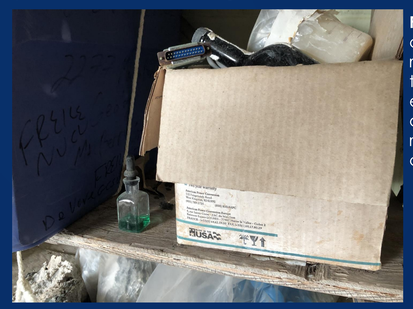

Figure 6: An unlabeled chemical, representing one of the major issues encountered in organizing and ransacking the chemical cabinet.

ACKNOWLEDGEMENTS

Thanks to Dr. Dawn Ford, who supervised the research component while abroad. Laurel Jobe contributed as a research assistant in San Salvador, and this work could not have been done without her. Finally, Zachary Cross deserves recognition for his photography work.

REFERENCES

Eshbaugh, W. H. (2014). The flora of the Bahamas, Donovan Correll, and the Miami University connection. *The Botanical Review*, *80*(3), 184-203.

Selbmann, L., Grube, M., Onofri, S., Isola, D., & Zucconi, L. (2013). Antarctic epilithic lichens as niches for black meristematic fungi. *Biology*, 2(2), 784–797. https://doi.org/10.3390/biology2020784

PRELIMINARY RESULTS

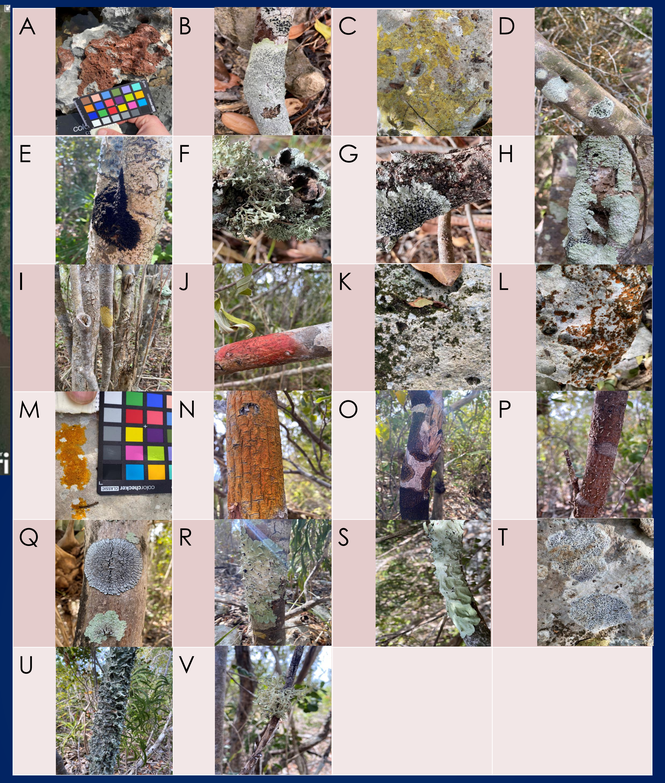

Figure 7: A preliminary GIS map and a table displaying the photos associated with each point.

Figure 8: Category I contains crustose and foliose lichens.

Preliminary Species List

With the help of two research assistants, I took 957 photos in-situ and 283 more in the lab. At this time, I am confident that I have identified 21 distinct species, and I will continue to update this number as I continue the work of classification. individual genera have not been conclusively classified, but have been identified as distinct. Each is referred to by a Roman numeral followed by an Arabic numeral allowing the species to be distinguished during the process of classification.
*Grid size on gridded images is 5x5mm

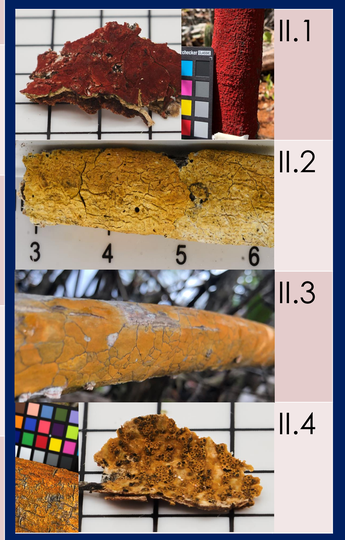

Figure 9: Category II contains crustose lichens.

FUTURE DIRECTIONS

Going forward, our focus will be on classification work. In the future, more research should be done into the lichens' chemical properties in order to definitively identify to the level of species, however this is beyond the scale of this project. More research into the diversity of lichens inland and in more exposed coastal areas will contribute to a knowledge of the lichens of San Salvador, the Bahamas, and the Caribbean in general.

Figure 10: Lichens in category III are all visually similar, highlighting one of the difficulties of classification without chemical test results.
The category III lichens pictured are characterized by a thallus composed of freestanding, branching tubes (papillae), though they display variety in the frequency with which they branch, and in the roundness or flatness of their papillae. In classifying the lichens of any category, a list is first generated of visually similar genera which have been found in North and South America. The current list of species visually similar includes *Cladina, Cladiuna, Cladonia, Everniastrum, Heterodermia, Ramalina,* and *Usnea.*