Analyzing Physical and Chemical Characteristics of Antarctic Moss Species: How Does the Environment Influence Microorganism Diversity and Abundance?

Avery Swanton, Daniela Figueroa, Becky Ball

New College of Interdisciplinary Arts & Sciences, Arizona State University – West Campus, Phoenix, AZ 85069

1. Research Questions and Hypotheses:

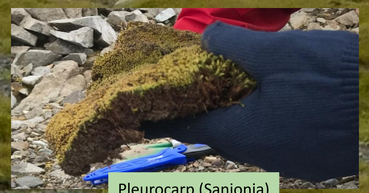
- How do different Antarctic moss and soil characteristics influence species and species abundance within the Antarctic biota?
- Physical and chemical properties of Antarctic moss and soil affect the species and abundance of microorganisms present within the moss.

2. Introduction:

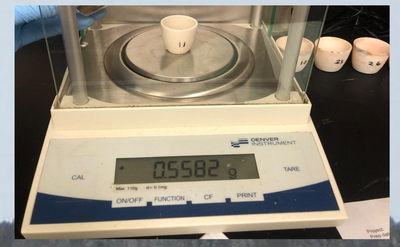
- Antarctica is at the forefront of major climate change impacts proposing new challenges as to what the changing environment may bring (Câmara 2020). As temperatures rise the ice caps recede exposing more landmass harboring the perfect conditions for Antarctic moss to move from the maritime to continental ecosystems (Prather 2019).
- Moss is the most abundant plant on Antarctica, serving as large nitrogen and carbon sinks (Lindo 2010).
- The Bryosphere is a home for important invertebrates in the soil (Lindo 2010). Invertebrates include tardigrades, mites, rotifers, nematodes, and springtails. These invertebrates are the most present as they can survive the harsh conditions, and important for protecting the biodiversity of Antarctica (Shaw 2018).

We must examine the physical and chemical properties of Antarctic soil and moss species in order to understand how they may affect species diversity and abundance of microorganisms present within moss canopies.

Acrocarp (other)

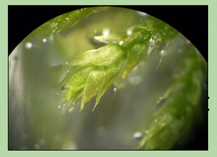


Pleurocarp (Sanionia)



3. Methods:

- Moss samples were identified by growth form in order to localize our research to Antarctica. Chemical properties of 130 samples were extracted through a process of chemical digestion in order to compare nutrient abundance of samples all throughout maritime Antarctica.
- **Physical properties** of the 130 moss samples were identified.
  - Using a 1.2 cm diameter core, moss density was measured.
  - Genus Sanionia was determined and compared against non Sanionia moss.
  - Using calipers gametophyte and rhizoid (cm) were recorded for each sample.



- **Chemical properties** for the moss and soil samples were identified.
  - %C and %N were measured on an elemental analyzer.
  - %P, K, Ca, Mg were measured using an ashed-acid digest on an ICP-OES.

4. Results:

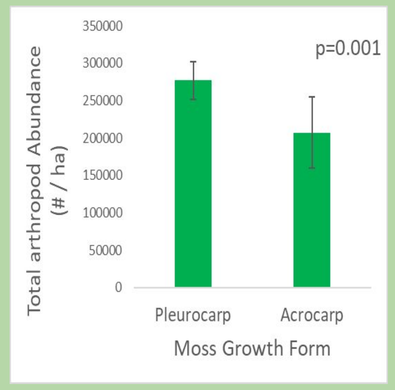


Figure 1. Data shows significant r^2 between pleurocarp and acrocarp Vs. total abundance.

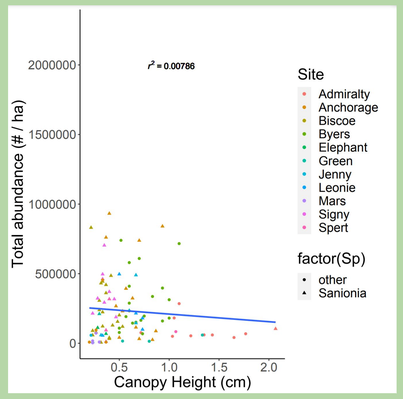


Figure 2. Insignificant correlation between canopy height and total abundance of invertebrates.

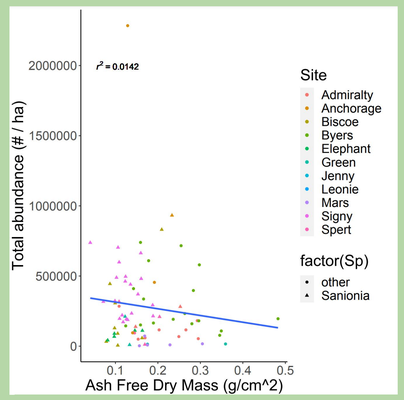


Figure 3. Ash free dry mass calculated the density within a 2.5 cm core. The data did not show a significant correlation.

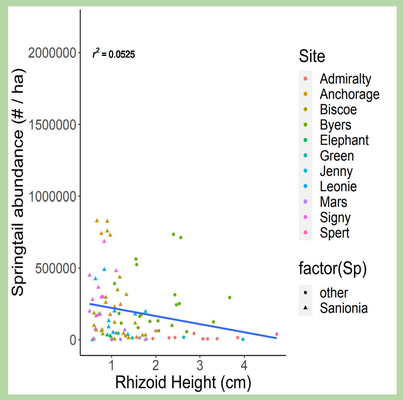


Figure 4. when looking at rhizoid height and springtail abundance there was a significant r^2. This significance was not replicated with mites, etc.

5. Discussion:

- Major statistical importance when looking at pleurocarp (Sanionia) compared to acrocarp (other), in which invertebrate abundance is higher within Sanionia.
- No noticeable statistical significance between physical properties our team measured and total abundance of invertebrates present within the moss.
- Minor statistical importance when looking at rhizoid height and springtail abundance, and preferred shorter rhizoid height.
- Regression analysis on species compared to bacterial abundance, it was found that bacterial abundance is higher within Sanionia.

6. Continued Research:

- Research on our hypothesis will be continued throughout the 2022-2023 year. All moss samples will be identified to genus with the help of an Antarctic bryologist. Nutrient content will be measured in the future to determine if chemical properties may be relevant.
- More samples are on their way from Antarctica in order for our team to conduct physical and chemical, in order for our sample size to be larger and more consistent. Our team will have conducted and collected the chemical data that was run using the elemental analyzer. We will also begin to look into bacterial differences, as well as moisture content.