



# Freezing! Thawing! Waves! Talk About Stress...

Exploring The Effects of Biological Filters On Lichen Populations in the BWCAW

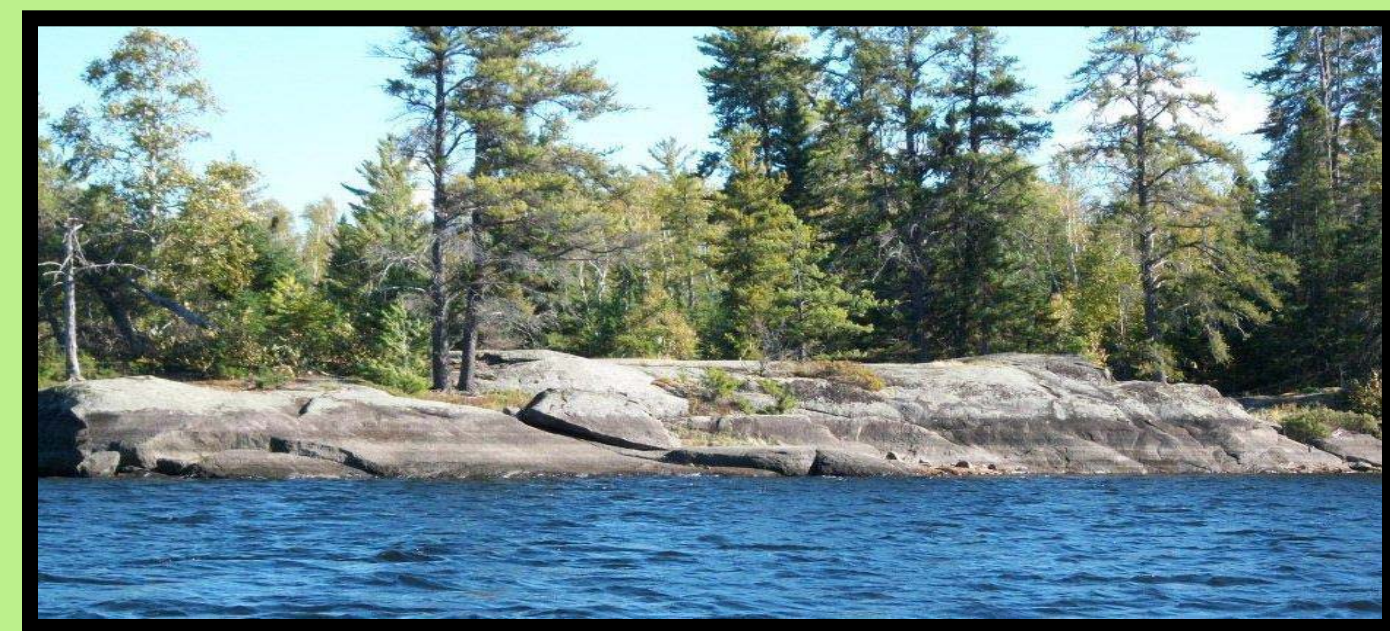
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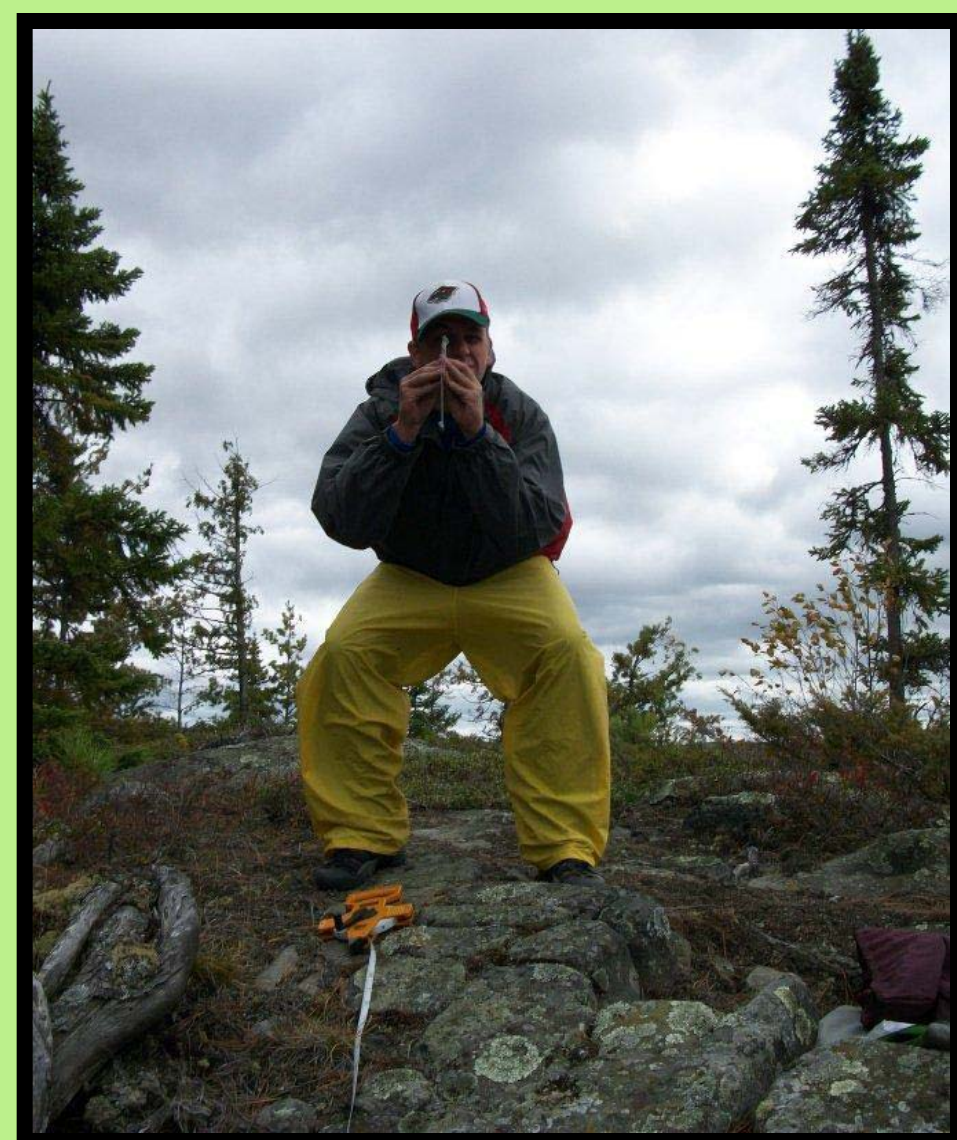
**Introduction:** Lichens are ubiquitous in the Boundary Waters Canoe Area Wilderness (BWCAW), and near lakes, are often found on exposed rock faces. Lichens require a relatively undisturbed environment to persist (Wetmore, 1987). On rock slopes near the water, both waves, and the freezing and thawing of ice, create a high stress environment. As distance from waterline increases, these stresses decrease, creating a gradient.

**Hypothesis:** According to Chase (2007), in areas of high stress (high stress filter) we should expect to see low lichen species diversity, as well as similar lichen communities. By contrast, in areas of low stress (low stress filter) we should expect to see greater lichen species diversity, and less similar lichen communities.

## Methods:



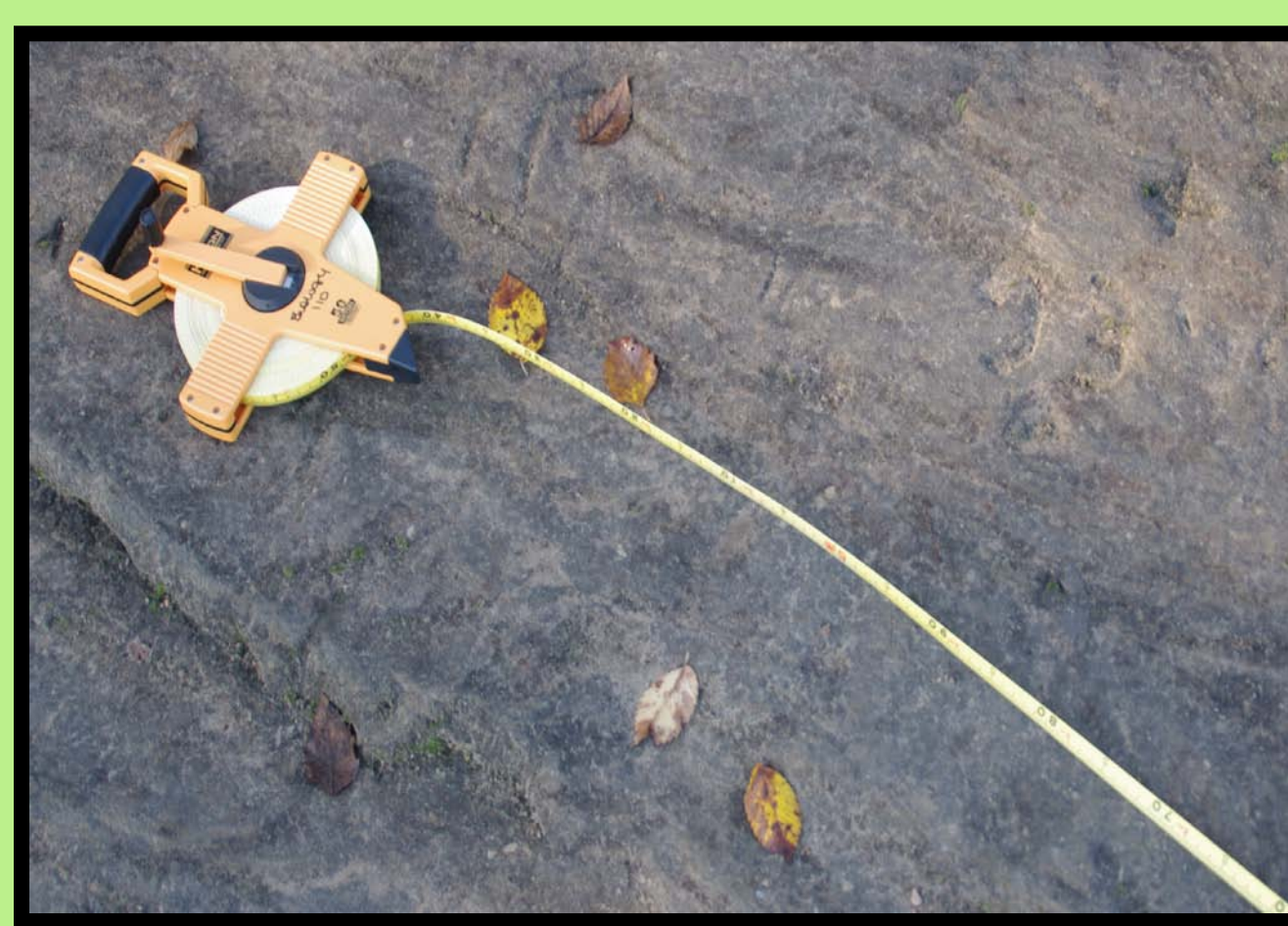
1. Locate exposed rock face extending into water, slope < 45°, with visible high water line.



2. Measure slope angle and aspect.



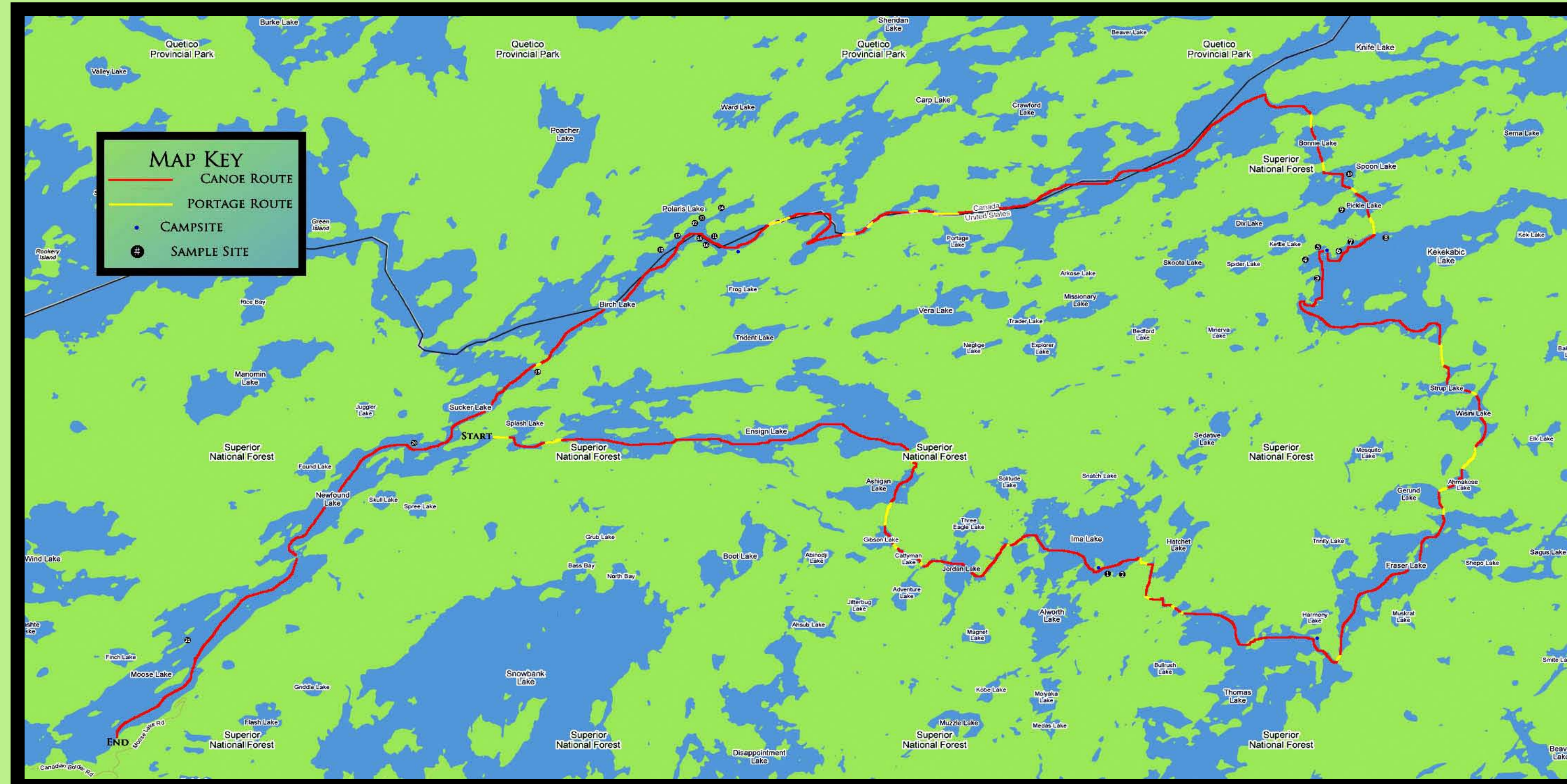
3. Start transect at high water line, continue length of rock face, sampling with quadrat every meter.



4. Each student logs lichen species abundance within quadrat.



5. Compare, contrast, and average abundance findings between findings. Record totals.



Map of Boundary Waters Canoe Area Wilderness in Northern Minnesota

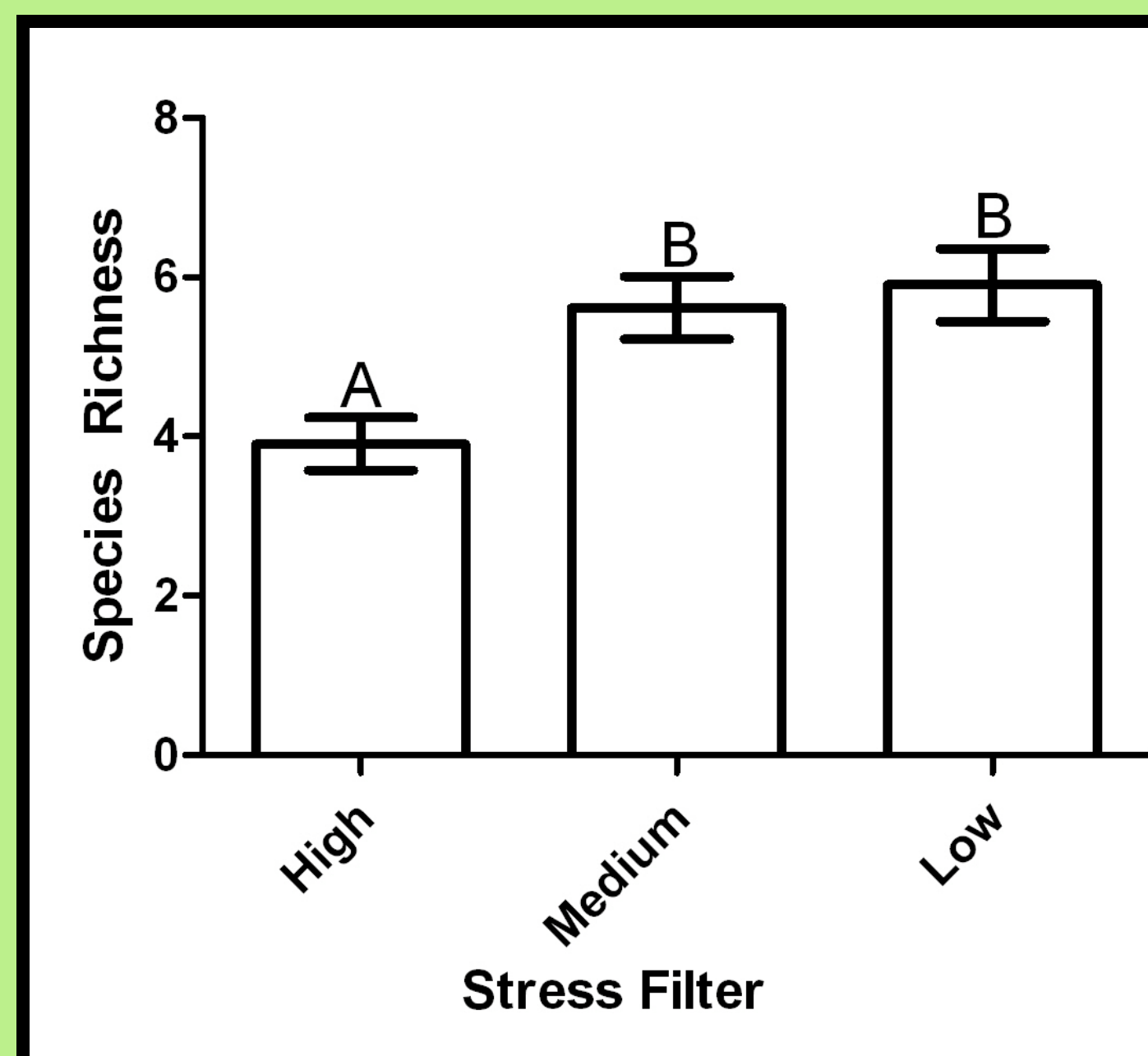


Fig. 1: Species richness as a function of stress filter.

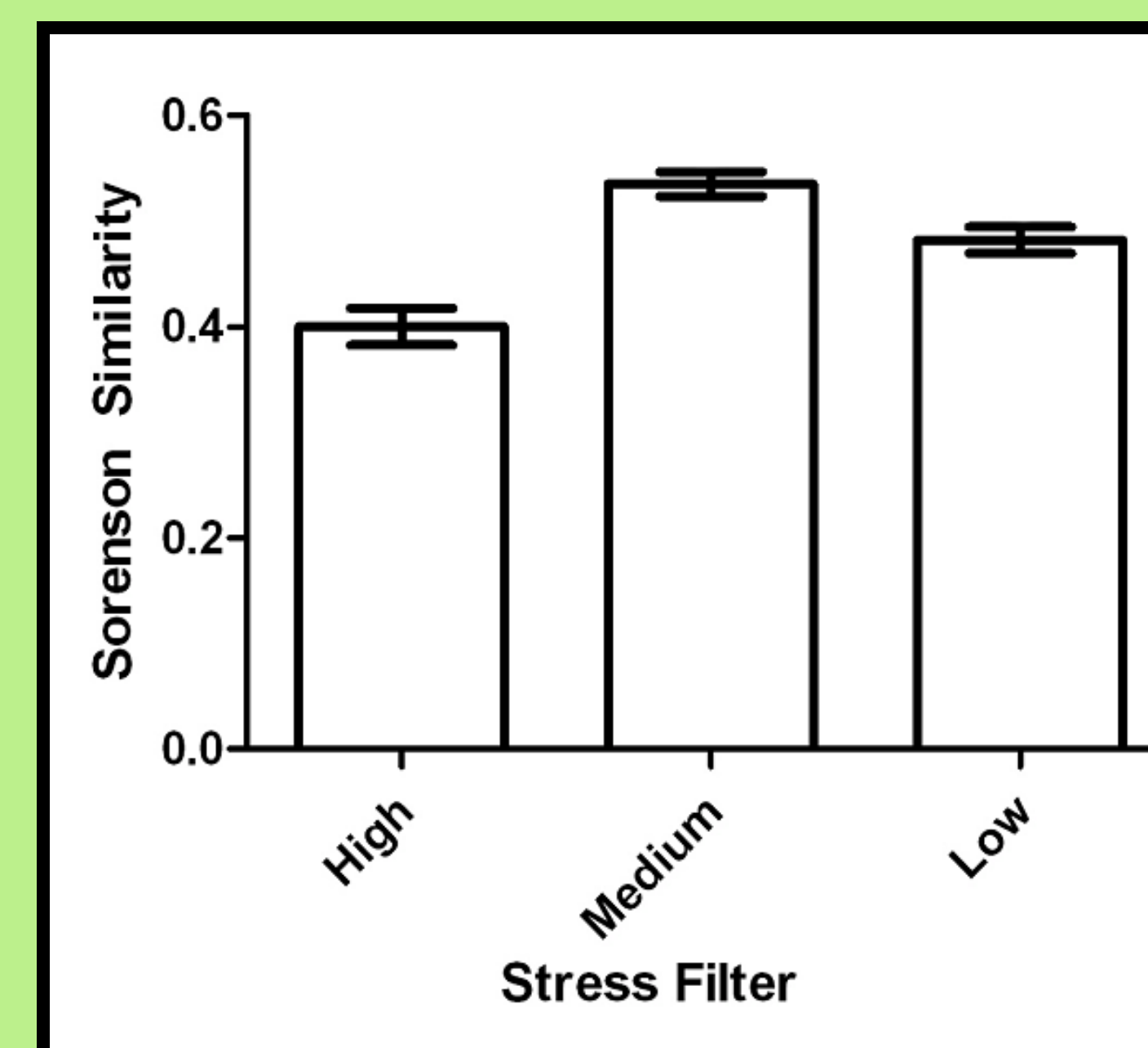


Fig. 2: Sorenson similarity of sample sites for given stress level.

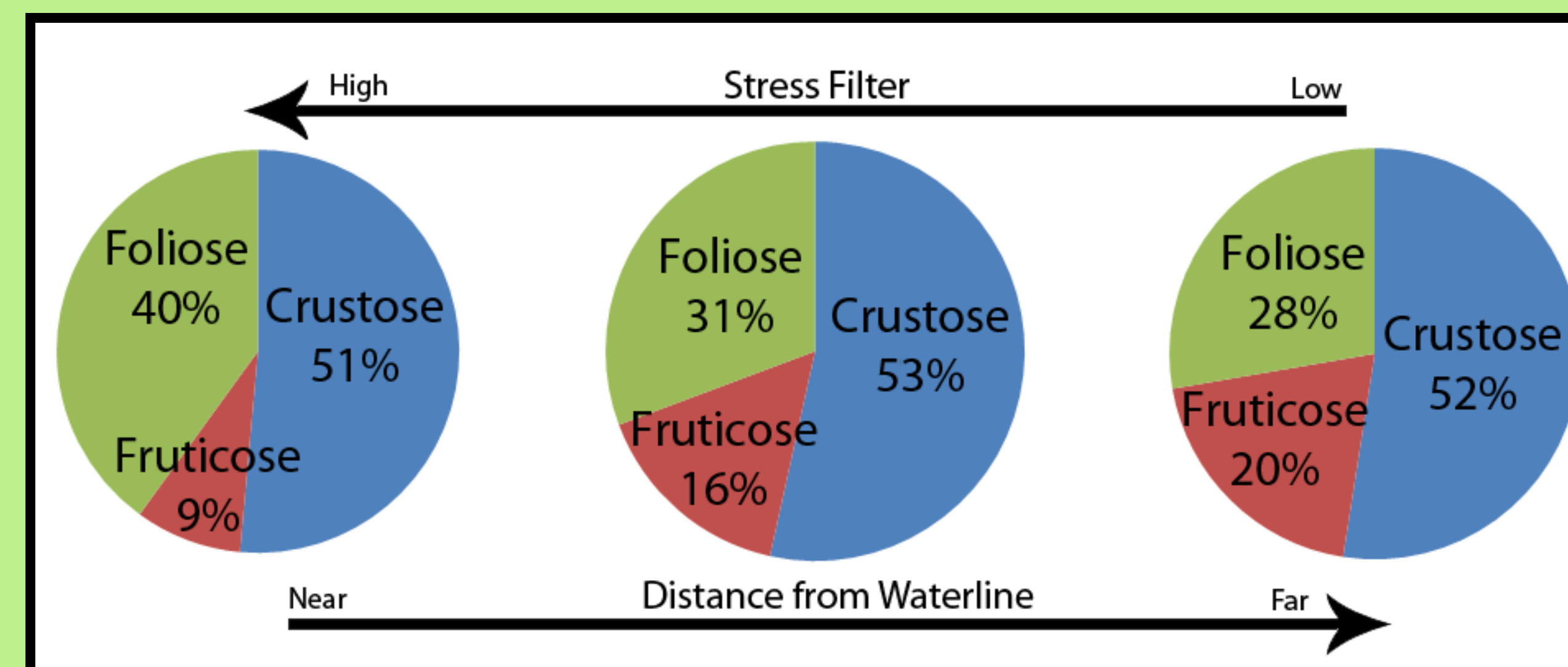


Fig. 3: Relationship between percent composition of lichen morphotypes and high, medium, and low stress sample sites.

## Lichen Morphotypes



**Crustose:** Species blend in with the rock substrate, attach at many points, strongest bond.



**Foliose:** Species attach at several points to the rock substrate, but majority of body is above rock surface.



**Fruticose:** Species attach to rock substrate at single point, weakest bond with surface.

## Results:

- Species richness was significantly lower in a high stress environment, compared to medium ( $p=0.0018$ ) and low stress ( $p=0.001$ ).
- Species richness was not significantly different between medium and low stress environments.
- Sorenson Similarity index (a measure of overall similarity between all sample sites of a given type) showed:
  - Significantly less similarity in high stress sites than medium stress sites ( $p=<0.0001$ ), and high stress sites than low stress sites ( $p=0.0002$ ).
  - No significant difference in Sorenson similarity between medium stress compared to low stress sites.

## Discussion:

Our data does not support Chase's hypothesis.

Species richness (an indicator of overall species diversity) increases with distance from stress (Fig. 1). This relationship is similar to Chase's hypothesis, which predicted low diversity in areas of high stress, and high diversity in areas of low stress.

We expected high stress sites to exhibit more similar species composition, than medium and low stress sites. However, our results indicate the opposite, with high stress sites having less similar species composition than medium and low stress sites (Fig. 2).

Overall, distance from water appears to function as a biological filter, as a determinant of what types of species can inhabit certain areas. Percent composition of fruticose lichen increased with distance from waterline, however foliose lichen decreased. Crustose lichen was least affected by distance (Fig. 3).



## Acknowledgements:

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## References:

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