Fig 1. Atqasuk is located in Northern Alaska.

Arctic Plant Response to Abiotic Factors in Northern Alaska

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Fig 2. Working at an experimental plot at the study site.

Abstract

Arctic plants play critical roles in ecological interactions, nutrient cycling, and energy balance. Given the pronounced documented warming in the Arctic it is important to anticipate the effects of climate change on such systems. Therefore the relationship between arctic plant growth and abiotic factors was examined using findings from a long-term warming experiment in Atqasuk, Alaska. We found plant growth responded differently to warming depending on the species. These data suggest that plant communities are dynamic and may respond differently to climate change.

Study Area

Atqasuk, Alaska is in located in a low Arctic tundra region in Northern Alaska (**Fig. 1**). The Atqasuk Dry (AD) study site is seated on an elevated ridge, with well-drained soils, and high occurrences of bare ground and dead plant matter. The vegetation occurring at the AD site consists mainly of forbs, graminoids, and evergreen shrubs (Gregory, 2014).

Methods:

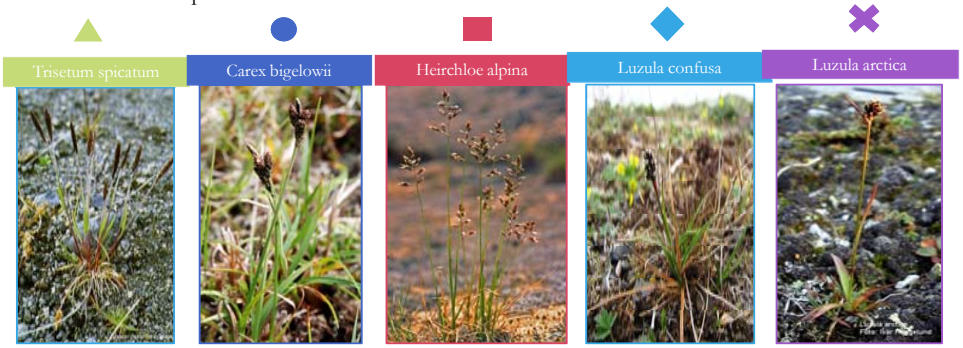
The data used in this study includes leaf length measurements on five graminoids taken from 48 vegetation plots (**Fig. 2**) in the AD site from 1997 to 2016. The thaw depth measurements were taken with a thaw depth probe in each plot. Snowmelt date was defined as the average date at which each plot was free of snow or the day average soil surface temperatures rose above 0° C. Temperatures were recorded hourly with sensors, and thawing degree day was calculated by subtracting a base temperature from an average daily temperature, then summing positive values over the period of interest (Barrett, 2015). Access and Excel were used for data analysis.

Literature Cited

Barrett, R. T., Hollister, R. D., Oberbauer, S. F., & Tweedie, C. E. (2015). Arctic plant responses to changing abiotic factors in northern Alaska. *American journal of botany*, *102*(12), 2020-2031.

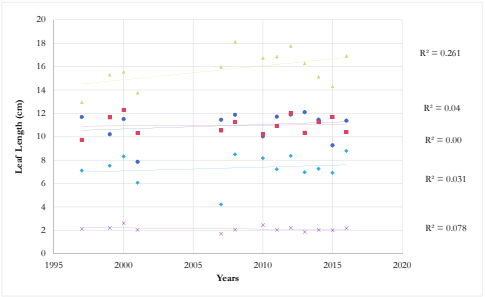
Gregory, J. L. (2014). Structural comparison of arctic plant communities across the landscape and with experimental warming in Northern Alaska (Master's thesis, Grand Valley State University, 2014)(pp. 22-23). Allendale: Grand Valley State University.

A. Vascular Plant Species

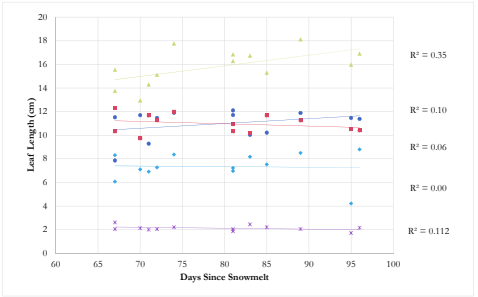


Results:

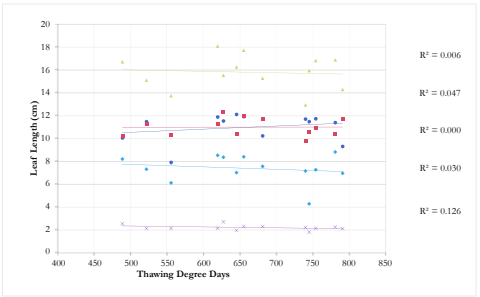
B. Year



C. Days Since Snowmelt



D. Thawing Degree Day



E. Thaw Depth

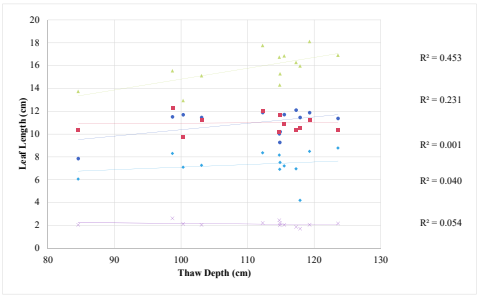


Fig. 3. Average leaf length at the end of the season of five plant species (A) in relation to year (B), days since snowmelt (C), thawing degree days (D), and thaw depth (E).

Conclusions:

- Plants respond differently to abiotic factors depending on the species.
- Some plant species may respond more significantly to increasing thaw depth.
- Plant communities are dynamic and may respond differently to climate change.

Abiotic factors such as thaw depth, snowmelt, and thawing degree day have varying impacts on the growth of graminoids in Northern Alaska. In **Fig. 3**, part **E** shows thaw depth and leaf length are positively correlated in *Trisetum spicatum, Carex bigelowii,* and *Luzula confusa,*, with *Trisetum spicatum* having the most significant positive correlation. *Luzula arctica,* and *Heirchloe alpina* did not have the same correlation, Conversely, graph **D** shows that thawing degree day and leaf length display no positive correlation with any of the graminoids excluding *Carex bigelowii,* in which there is a slight positive correlation. The other graminoid species have a either a slightly negative correlation, or a relatively constant relationship with thawing degree day. Graph **C** shows a positive correlation between *Tristetum spicatum, Carex bigelowii,* and days since snowmelt, while the other three species show more constant correlation. We conclude from this that plants respond differently to abiotic factors depending on the species.

Further information

For more information on Dr. Robert Hollister's ecological research in Northern Alaska, visit

http://faculty.gvsu.edu/hollistr/