A Comparison of Growth Patterns of *Carex aquatilis-stans* Between Two Sites in Northern Alaska

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Introduction

High latitude regions are expected to show impacts from global climate change the fastest and of the greatest magnitude. Air temperatures in the arctic have been increasing at faster rates than the rest of the world (IPCC 2007). Arctic plants are adapted to severe conditions in this region and a small change in climate could alter communities significantly. These changes could impact plant productivity and community composition in Arctic regions. The International Tundra Experiment (ITEX) uses experimental warming to examine how plants respond to changing temperatures. Generally, previous studies have indicated that arctic plants respond to warming by increasing growth and reproduction (Hollister et al 2005). This study looks at the response of the Arctic sedge *Carex aquatilis-stans* (Figure 1) to warming between two sites in Northern Alaska.

Methods

Sites were established at Barrow in 1995 and Atqasuk in 1996. Atqasuk is located approximately 60 miles south of Barrow (Figure 2). Atqasuk is generally 4°C warmer than Barrow during the summer. Each site contains 24 experimental plots and 24 control plots. The experimental plots (1m^2) were warmed 1°C to 3°C using fiberglass open-top chambers (Figure 3). Data on *Carex aquatilis-stans* was collected in each control and experimental plot containing the species over various years, during the growing season that year, which is from mid June to late August. Data for this study was from total season measurements (inflorescence height and leaf length) which were collected in early to mid August.

Statistics used for data analysis involved a 2 tailed sample unequal variance t-test to compare means of average leaf length and inflorescence height per plot for each site and year (Table 1).

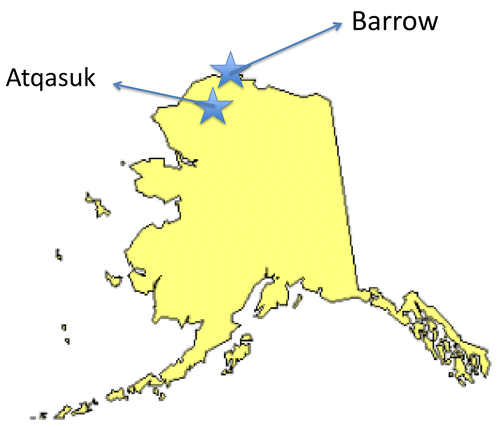

Figure 2. Location of study sites in Barrow and Atqasuk, Alaska.

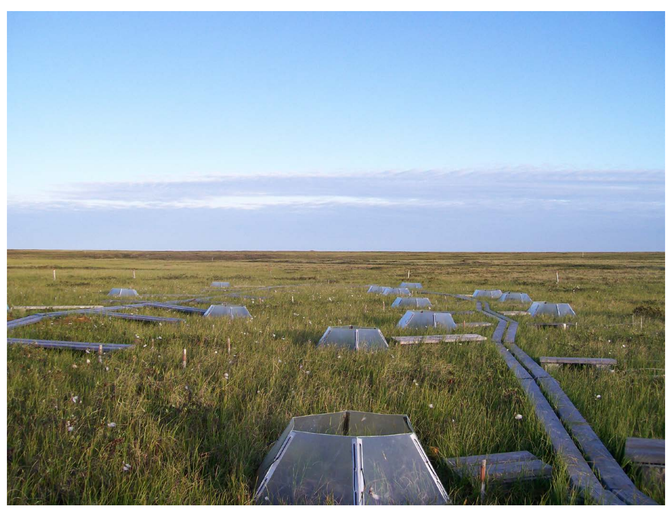

Figure 3. Fiberglass Open Top Chambers used to passively warm plots. at the Atqasuk wet site.

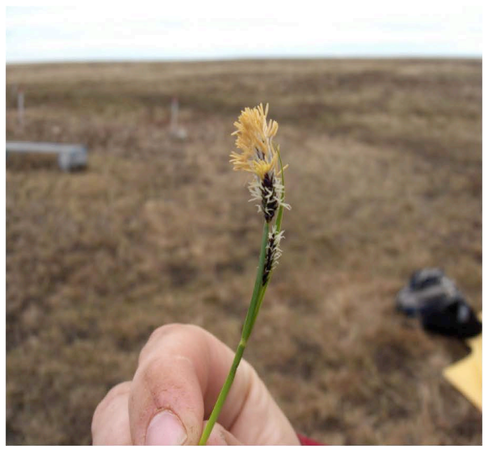

Figure 1. Photographs of *Carex aquatilis-stans* inflorescences taken in Atqasuk, Alaska.

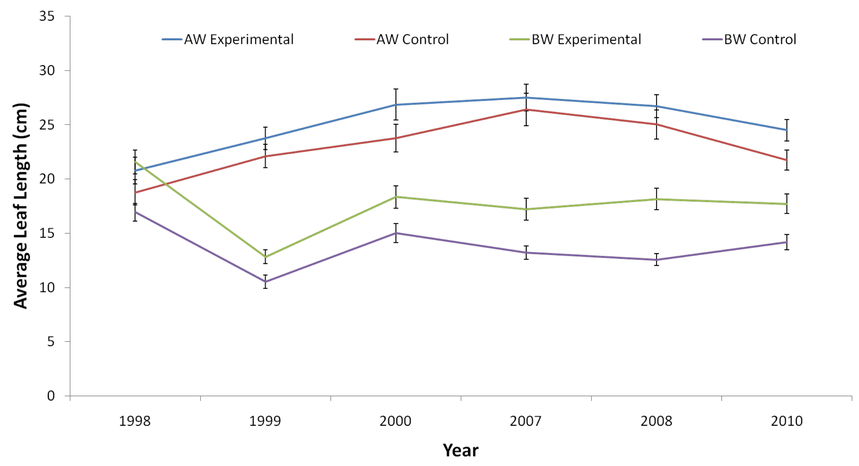

Figure 4. Average leaf length of *Carex aquatilis-stans* by year at each site. Standard error of the mean was calculated for each site and year.

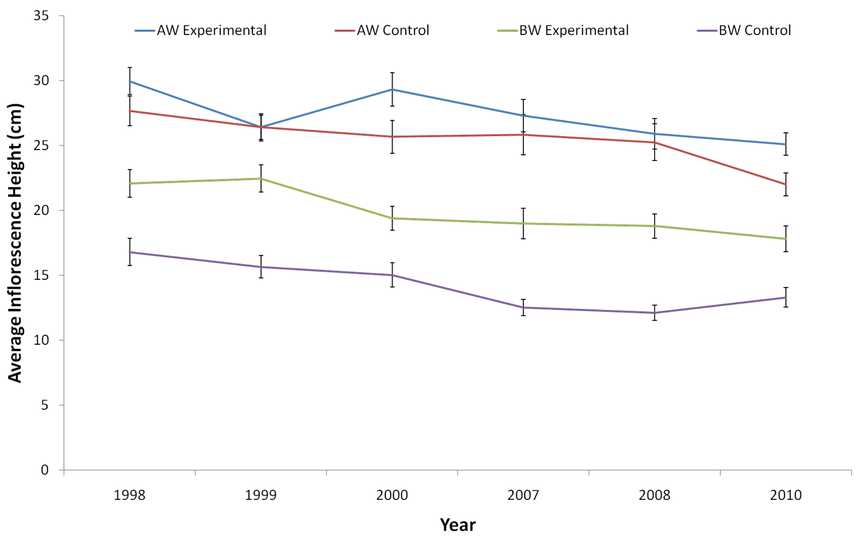

Figure 5. Average inflorescence height of *Carex aquatilis-stans* by year at each site. Standard error of the mean was calculated for each site and year.

Trait	Year	Barrow	Atqasuk
Inflorescence Height	1998	**	**
	1999	**	*
	2000	**	**
	2007	**	
	2008	**	*
	2010	**	**
Leaf Length	1998	**	*
	1999	**	
	2000	**	**
	2007	**	
	2008	**	
	2010	**	**

Table 1. Statistical analysis of average leaf length and inflorescence height of *Carex aquatilis-stans*. Values less than 0.05 were denoted with an *, values less than 0.01 were denoted with **.

Figure 6. Timothy F. Botting and Jeremy, L. May investigate Arctic plants in Barrow, Alaska.

Results

Yearly patterns showed a general increase in average leaf length but a decrease in average inflorescence height. The Atqasuk wet site also had longer average leaf lengths than the Barrow wet site in all years except 1998 (Figure 5). Average inflorescence heights were taller in the Atqasuk wet site compared to the Barrow wet site most years (Figure 4). Experimental plots had taller average inflorescence heights compared to control plots each year and had longer average leaf lengths than control plots. The Barrow wet site data was statistically significant each year of this study while the Atqasuk data showed varied significance by year.

Discussion

A general decline in average inflorescence height over time was unexpected, and could be attributed to increased competition as the total number of individuals increased during this time period. In 1998, average leaf lengths were longer in Barrow than Atqasuk. A possible explanation is that Barrow may have experienced unseasonably warm temperatures that summer. Results of this study generally show that *Carex aquatilis-stans* leaves grow longer and inflorescence heights are taller each year in Atqasuk compared to Barrow due to the warmer Arctic climate in Atqasuk. Likewise, experimental plots showed greater *Carex aquatilis-stans* growth than control plots each year as synthetic warming likely led to greater growth. These results suggest that *Carex aquatilis-stans* will become an even more dominant sedge in the Arctic community as warming will likely lead to increased growth of this species.

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References

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