

# The Effects of Climate Change on *Carex aquatilis* and *Eriophorum angustifolium* in Atqasuk, Alaska

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## Introduction

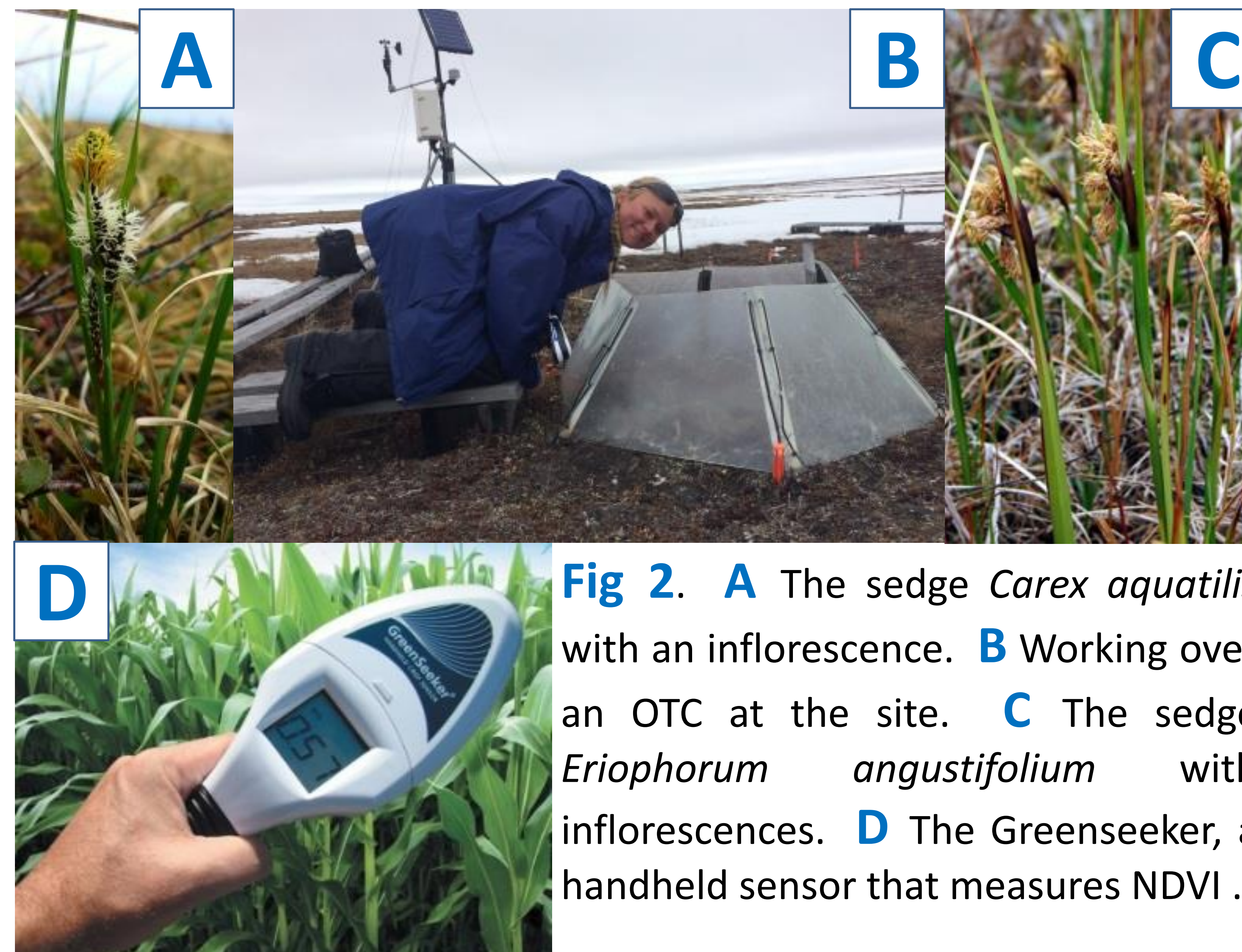
The observation of the effects of climate change on the Arctic are of global significance (Hollister *et al.* 2005). Since 1996, students have been monitoring plots of tundra under normal conditions along with a warming experiment that provides insights on growth and flowering in response to temperature in northern Alaska (Fig 1). In the summer of 2018, experiments were conducted to focus on the sedge species *Carex aquatilis* (Fig 2A) and *Eriophorum angustifolium* (Fig 2C). Measurements were taken on leaf length, inflorescence length, temperature, and the overall greenness of the plot. The results show that plants respond to warming with increased growth which corresponds with an increased greening at the plot level. These observations suggest that the greening trend observed across the Arctic may be explained by increased growth of graminoids during warm periods.

## Methods

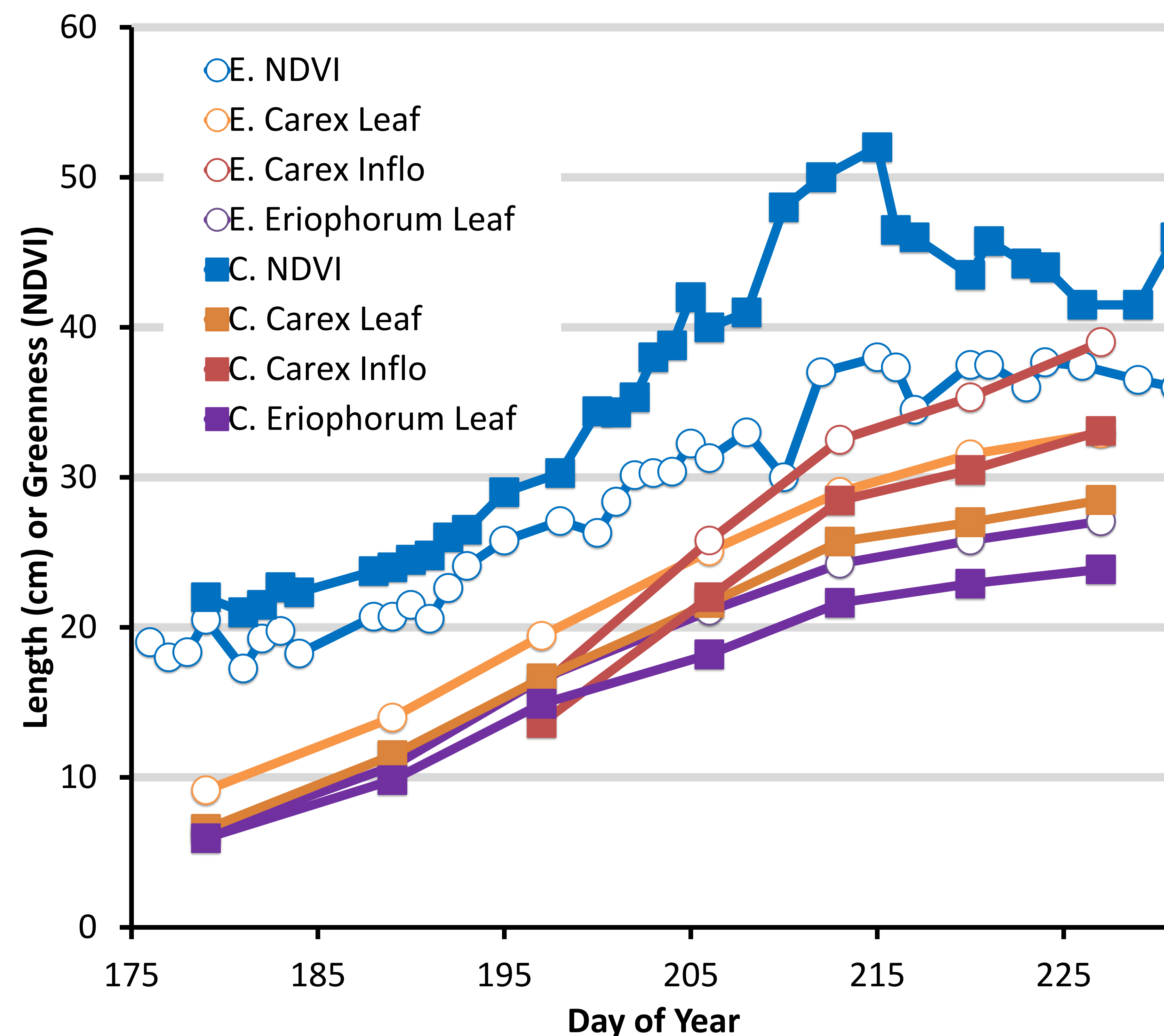
The study site was in wet tundra dominated by the species *Carex aquatilis* and *Eriophorum angustifolium*. The site was established in 1996 and consists of 24 control plots, and 24 experimental plots which were covered by open top chambers (OTC) to simulate regional warming (Fig 2B). Leaf and Inflorescence lengths were measured every one to two weeks. Normalized Difference Vegetation Index (NDVI) was measured every one to two days using a Greenseeker (Fig 2D). NDVI measures how green the plot is by sending light towards the plants, and then measuring the ratio of wavelengths reflected back (Pattison *et al.* 2015).

	NDVI Control	NDVI Combined	Sample Size
Day of Year (DOY)	0.75	0.72	31
Thawing Degree Days (TDD)	0.85	0.74	31
Carex Leaf	0.87	0.65	7
Carex Inflorescence	0.81	0.49	6
Eriophorum Leaf	0.86	0.67	7

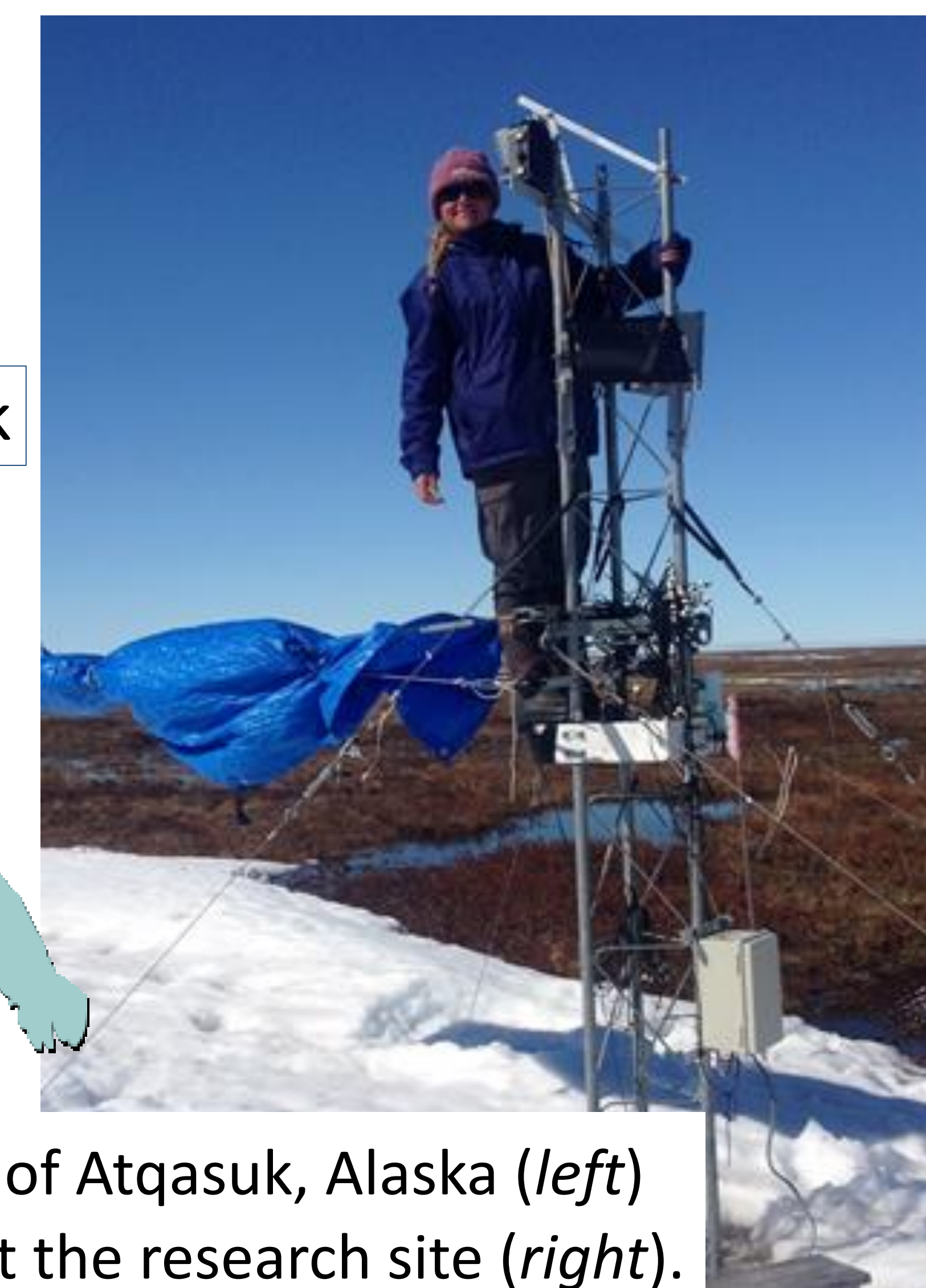
**Table 1.** R<sup>2</sup> values for correlations of NDVI for control plots and combined (control and experimental plots) with TDD, DOY, *Carex* Leaf, *Carex* Inflorescence, *Eriophorum* Leaf.



**Fig 2.** A The sedge *Carex aquatilis* with an inflorescence. B Working over an OTC at the site. C The sedge *Eriophorum angustifolium* with inflorescences. D The Greenseeker, a handheld sensor that measures NDVI.



**Fig 3.** The progression overtime of NDVI and leaf and inflorescence lengths of *Carex aquatilis* and *Eriophorum angustifolium* measured in control (C) and experimental (E) plots.



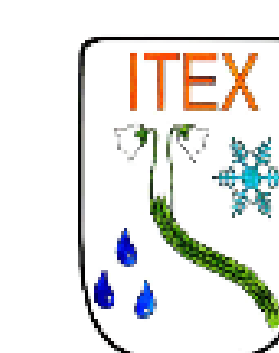
**Fig 1.** The location of Atqasuk, Alaska (left) and a photograph at the research site (right).

## Results and Discussion

Greening and growth progress over time and this corresponds with an increase in thawing degree days (which integrate time and temperature)(Fig 3). All measurements were found to be positively correlated with NDVI. None were found to be a significantly better predictor than the others (Table 1). When comparing the correlations, the combined correlations were significantly less than just the control plots. The control plots ended up having higher NDVI values (Fig 3). This likely due to the accumulation of standing dead in the warmed plots. By having extra dead leaves present, it reduces the overall reflectance of the plot when measured by the Greenseeker. Further research will examine these patterns over multiple years and at other sites. The ultimate goal is to understand how plants and consequently communities will respond to climate change.

## Acknowledgments

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## References

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