

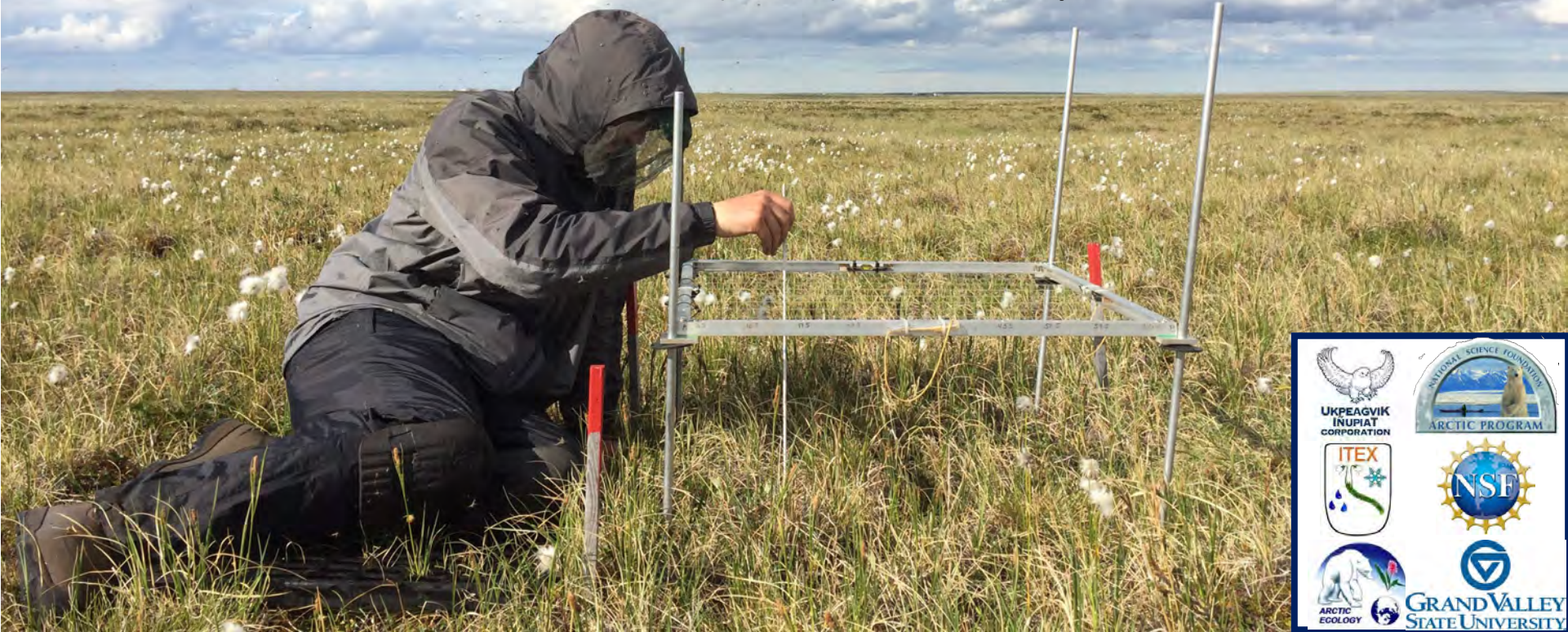
# Drivers of decadal vegetation change in Northern Alaska

Thesis Defense – Biology Master's Candidate

Jacob Harris

Grand Valley State University, Biology Department

Committee: Robert Hollister (Chair), Priscilla Nyamai, James Dunn

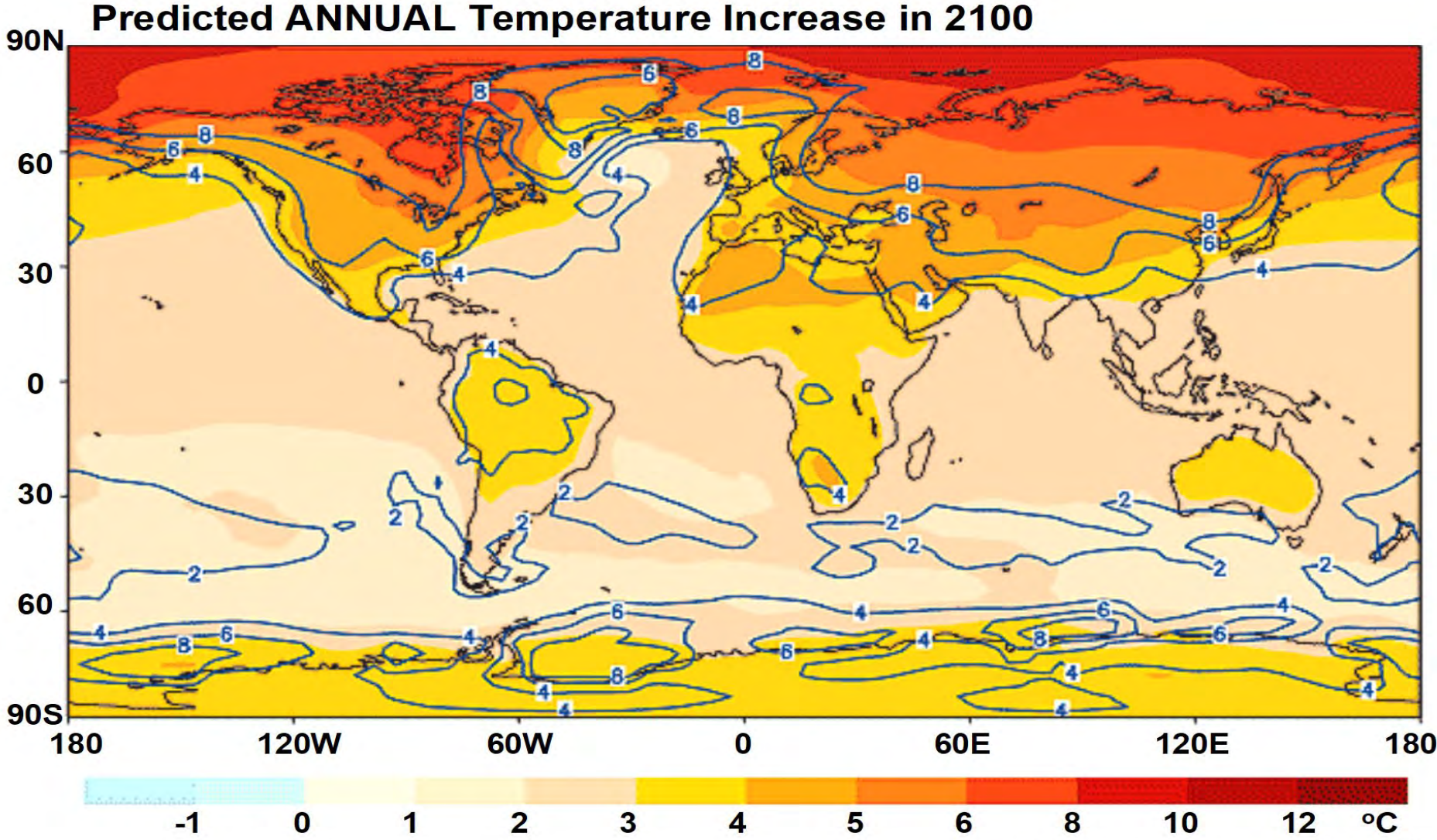


# Presentation Outline

- 1) Title
- 2) Introduction
- 3) Research Questions
- 4) Methods
  - Study sites
  - Climate monitoring
  - Vegetation sampling
  - Data analysis
- 5) Results
  - Abiotic factors
  - Vegetation cover
  - Diversity
  - Vegetation height
- 6) Conclusions
- 7) Question period

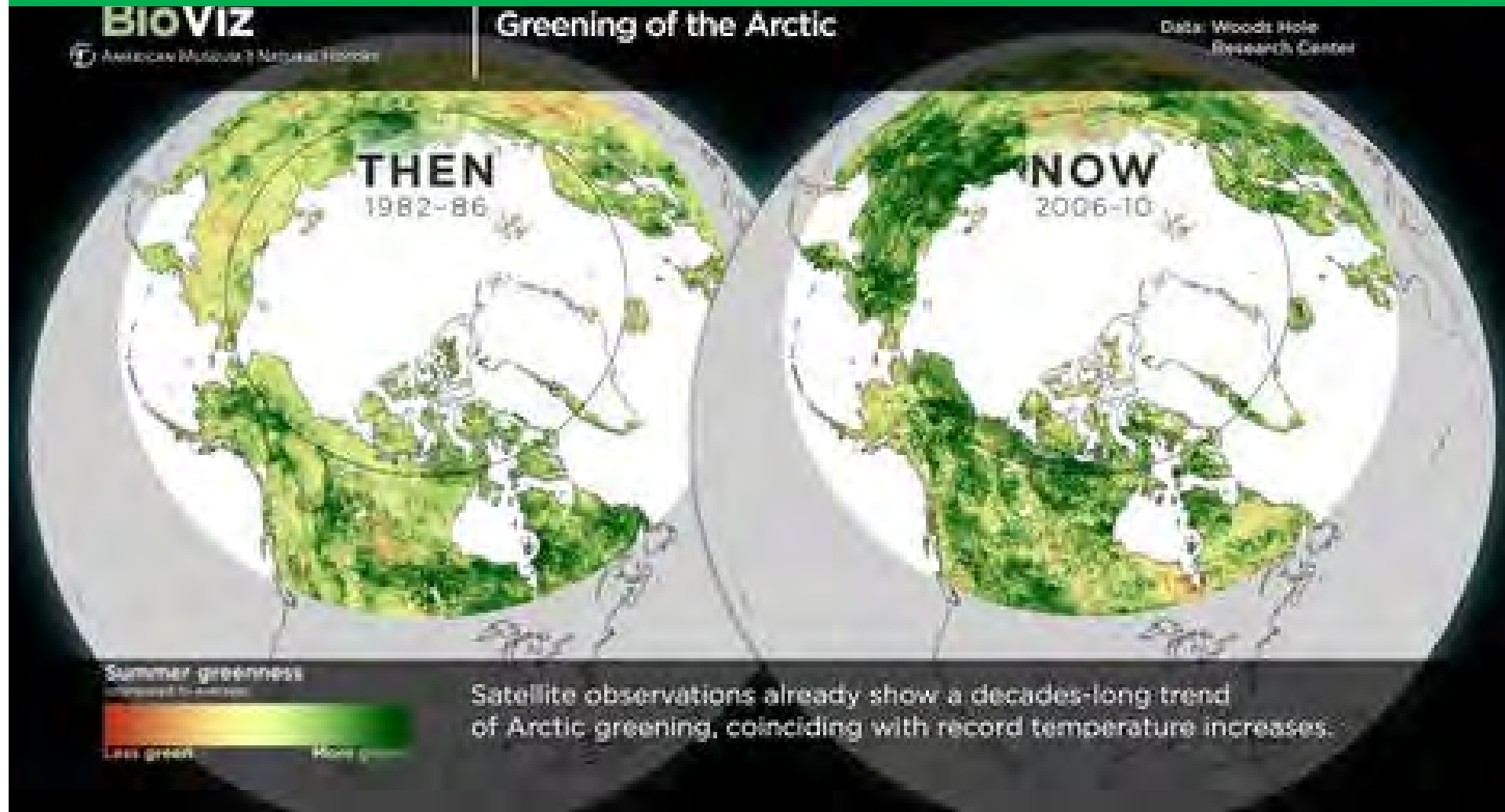
# Why?

Warming



IPCC (Intergovernmental Panel on Climate Change) 2001.  
Climate Change 2001: The Scientific Basis

# Observed change



Greenness (NDVI) increasing (Woods Hole, MA)

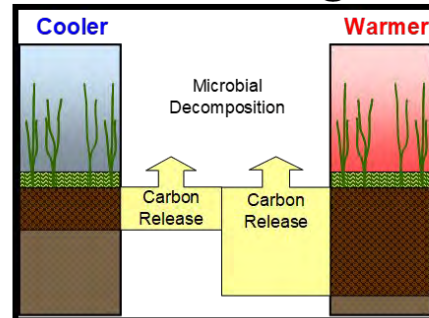
$$\text{NDVI} = (\text{NIR} - \text{Red}) / (\text{NIR} + \text{Red})$$

# Role of Plants

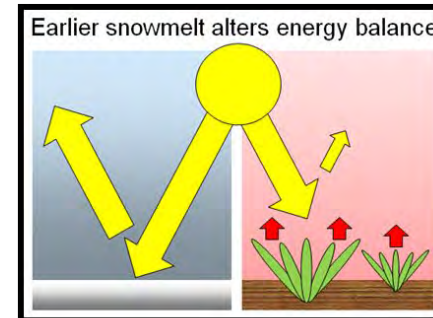
- Net primary producers
- Influence herbivory, animal community
- Species level effects on nutrient cycling, resource partitioning, and soil nutrient dynamics



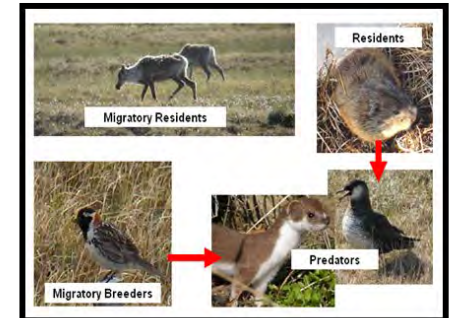
Carbon Budget



Energy Balance



Trophic Interactions



# Functional Groups

- Incorporate various plant species into useable groups, based on growth forms
- Saves time while sampling
- Allows for simplistic modeling and large datasets
- Used in climate studies

# Cover and Height

- Competition
- Albedo
- Habitat structure

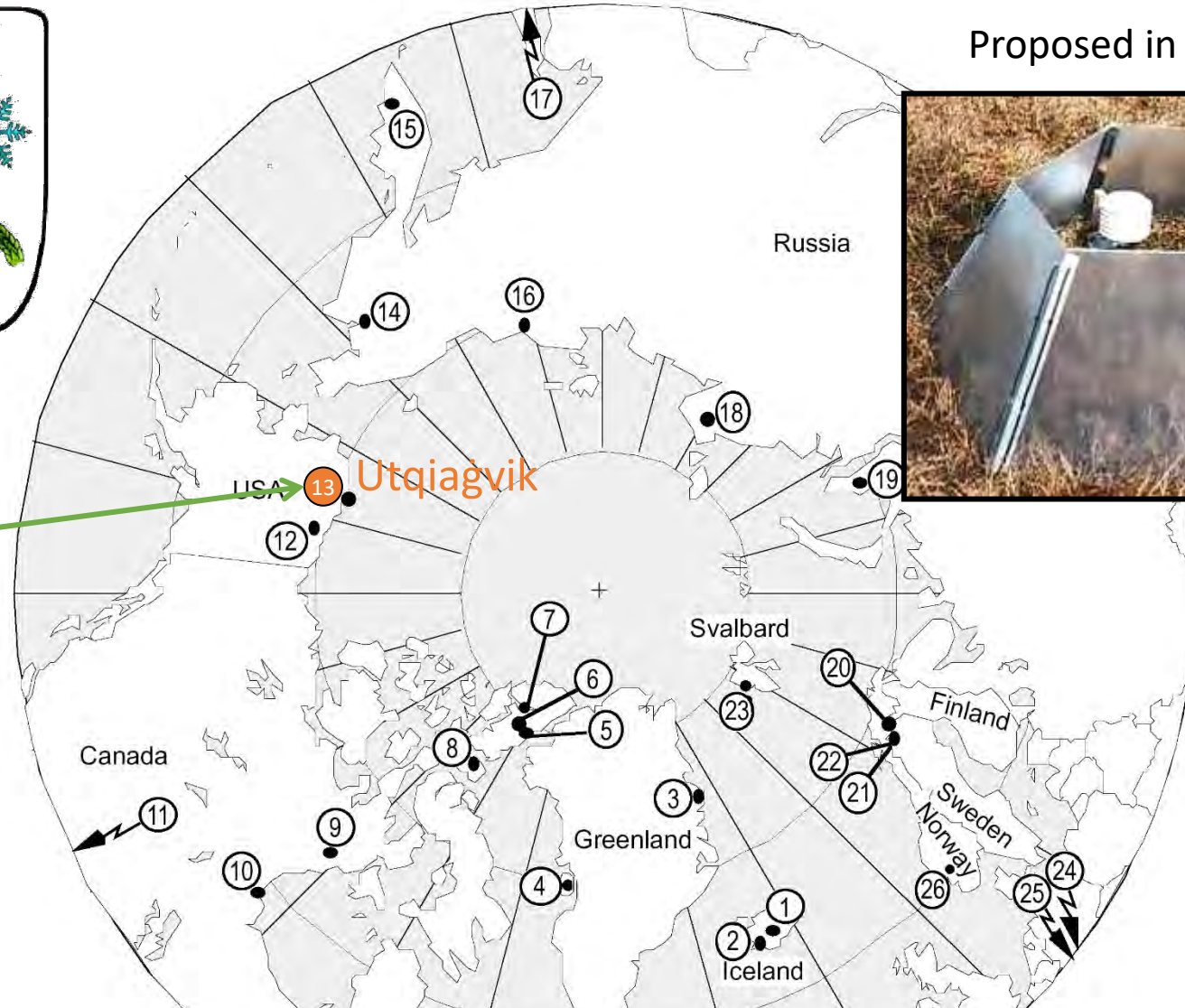
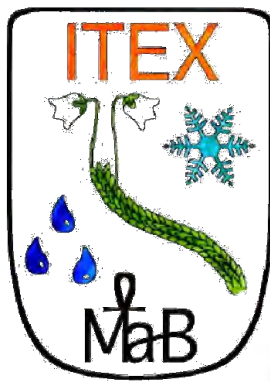
# Diversity

- Productivity
- Stability
- Ecosystem function
- Predictions

Sphagnum moss, a bryophyte, growing amongst sedges and willows







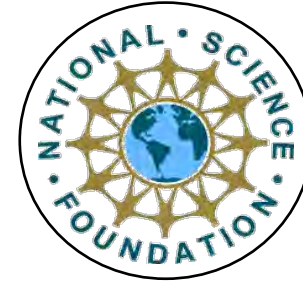
Proposed in 1990



The original **I**nternational **T**undra **E**xperiment sites  
*agreed on a common warming manipulation  
to simulate climate change*

# Part of the

Beginning in 2009



## Arctic Observatory Network

**Collaborative Research: Sustaining and amplifying the ITEX AON through automation and increased interdisciplinarity of observations**

***Funding:*** National Science Foundation

***Collaborators:*** FIU, Florida International University  
UTEP, University of Texas at El Paso  
UAA, University of Alaska at Anchorage

# Research Questions

1. Has change occurred over the sampling period of nine years for the functional groups and the selected species at either Atqasuk or Utqiagvik?

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2. Which, if any, abiotic factors are driving change at either site?

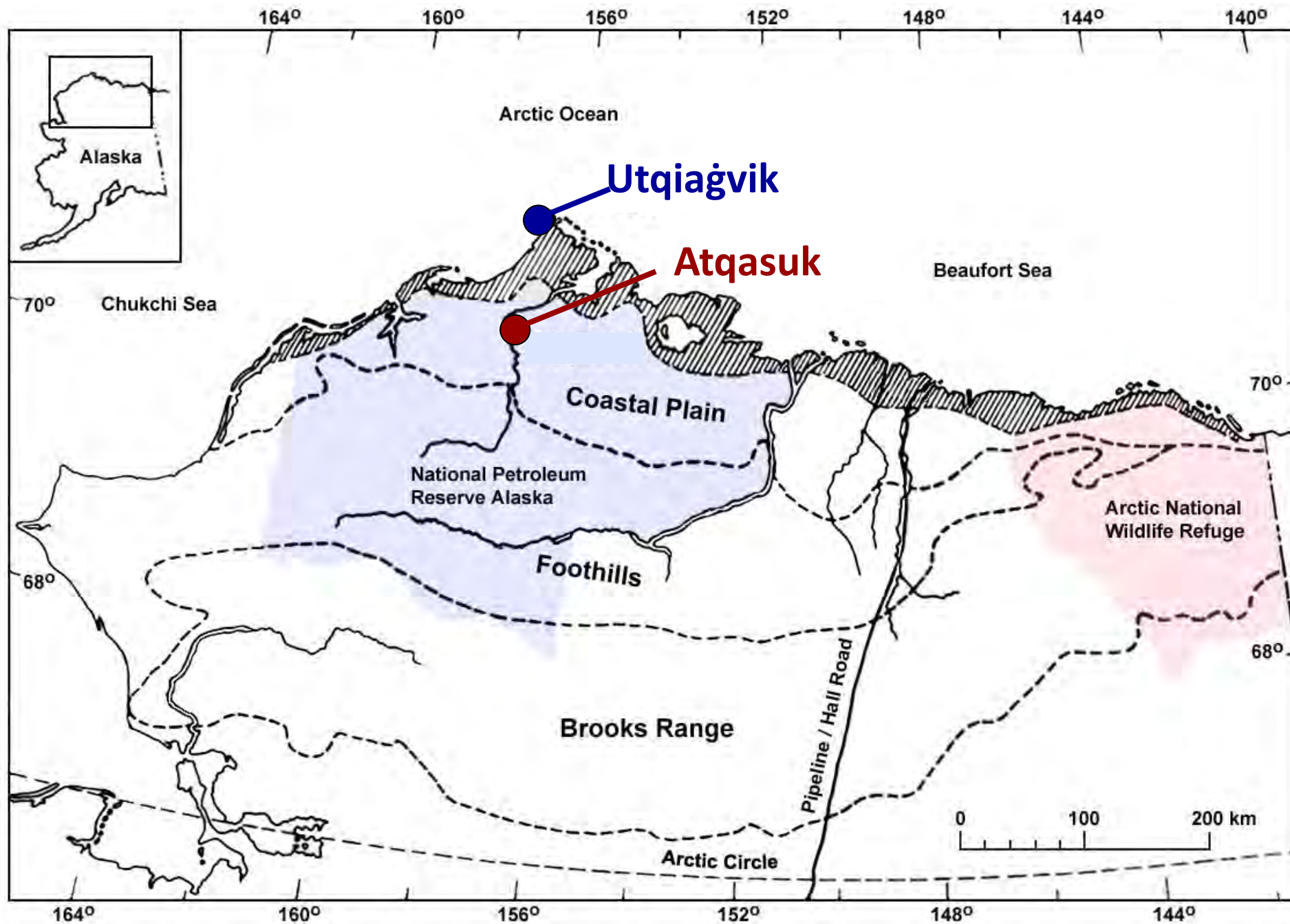
# Research Questions

1. Has change occurred over the sampling period of nine years for the functional groups and the selected species at either Atqasuk or Utqiagvik?
2. Which, if any, abiotic factors are driving change at either site?
3. If changes are present, are they similar between sites?

# Methods

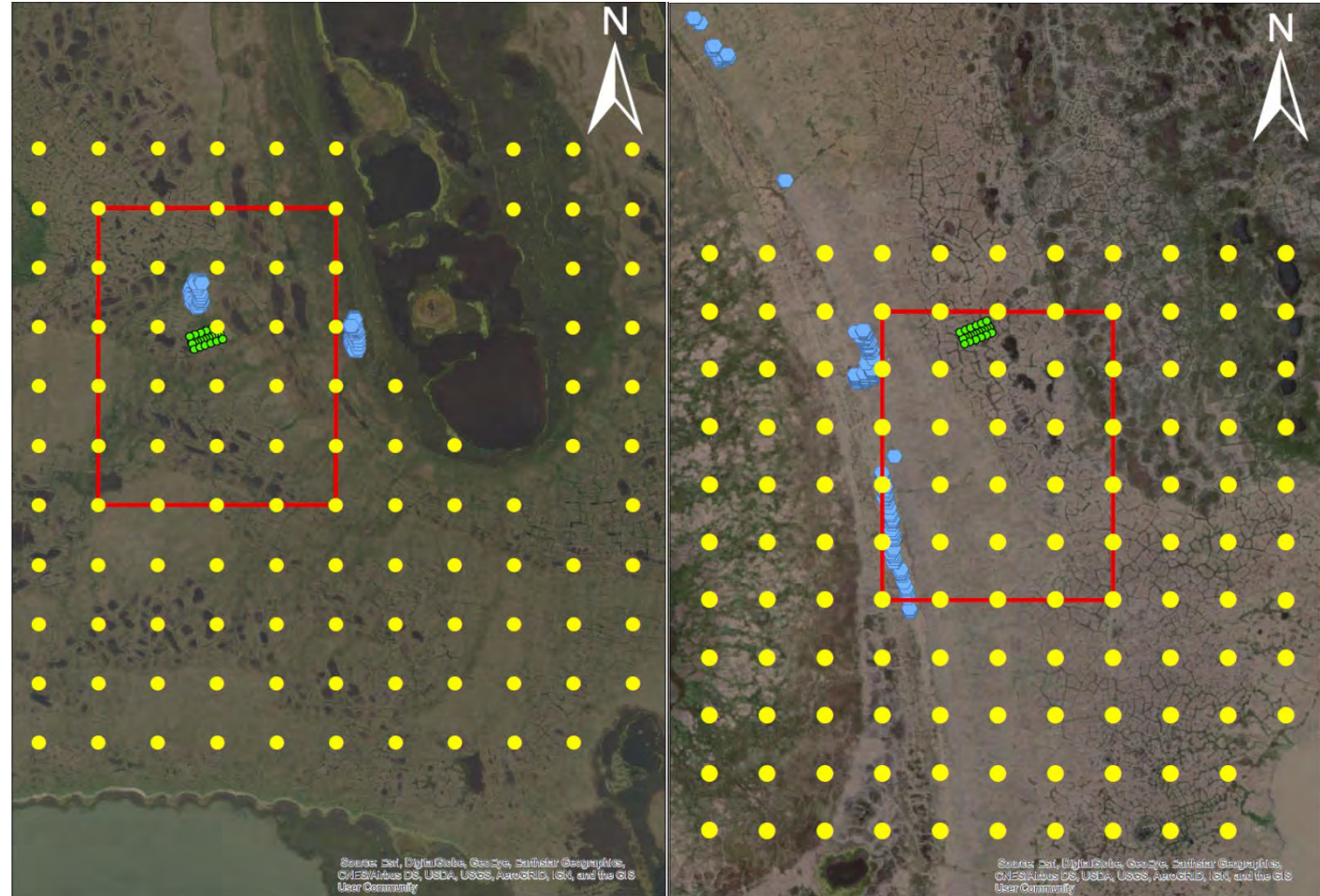
*Eriophorum vaginatum*, a common graminoid. Known for forming tussocks.





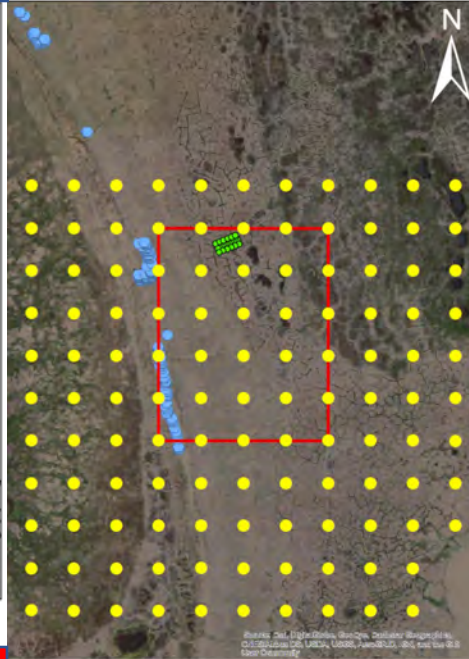
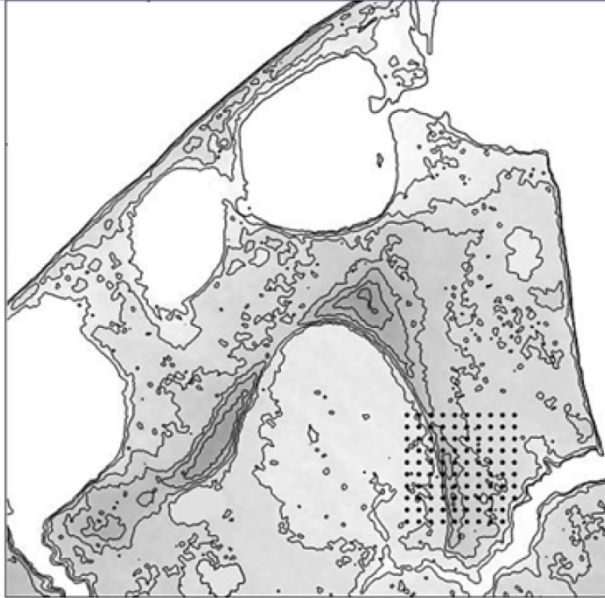
# Long Term Research Initiatives

- Arctic System Science (ARCSS) grid
  - Established in the early 1990s
  - Facilitate interdisciplinary research
  - Landscape level
  - Long-term
  - Spread across regions

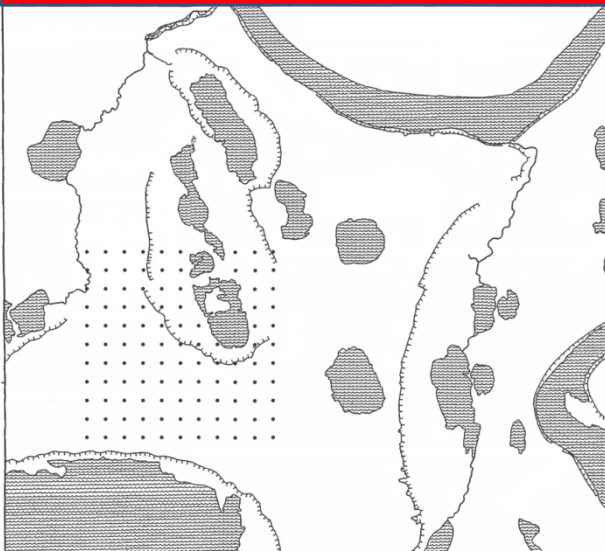




## Utqiagvik



## Atqasuk



Red rectangle represents the 30 plot subset of the grid (annually sampled)

# Vegetation Sampling

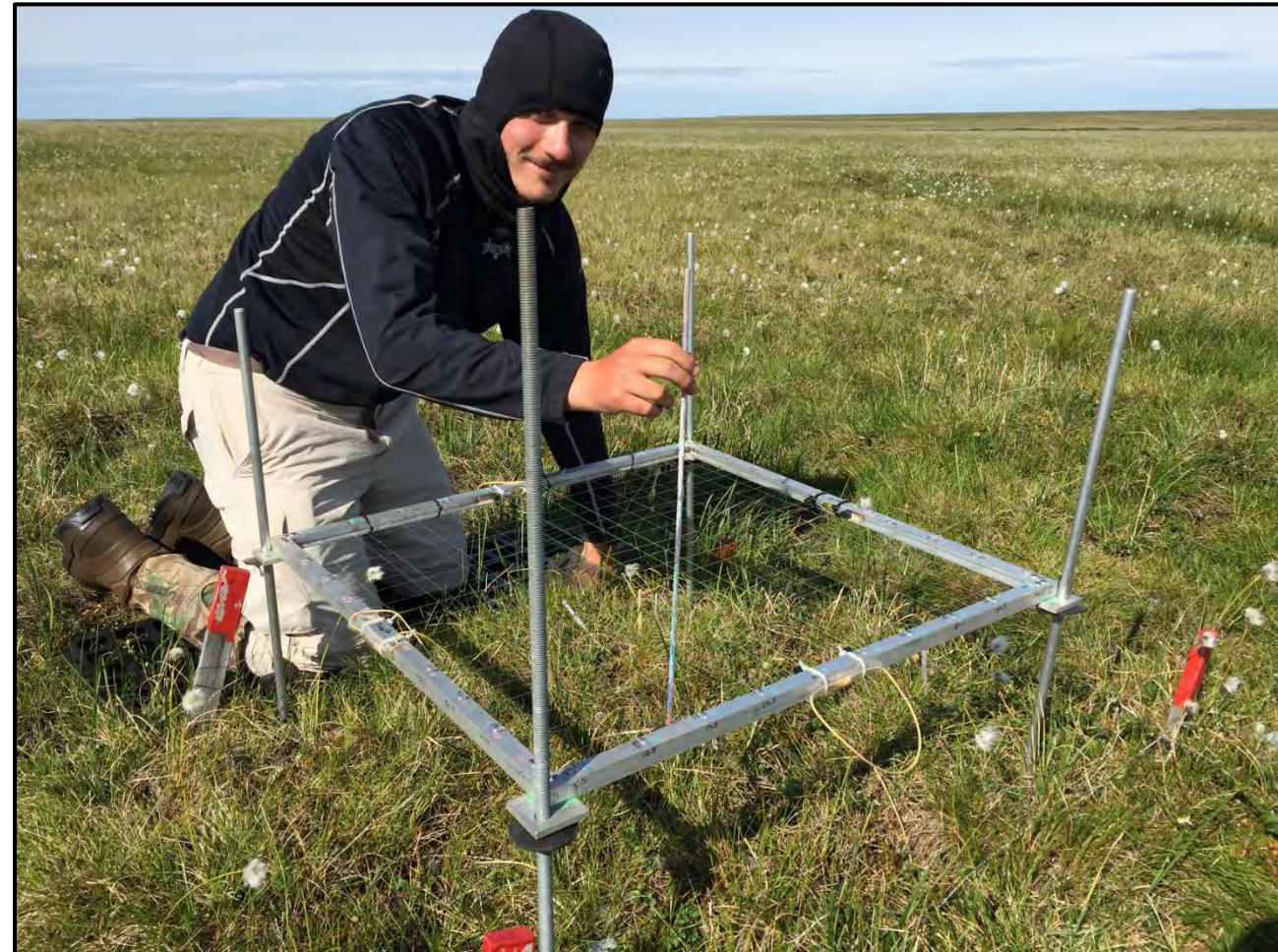


*Cassiope tetragona*, a woody evergreen shrub

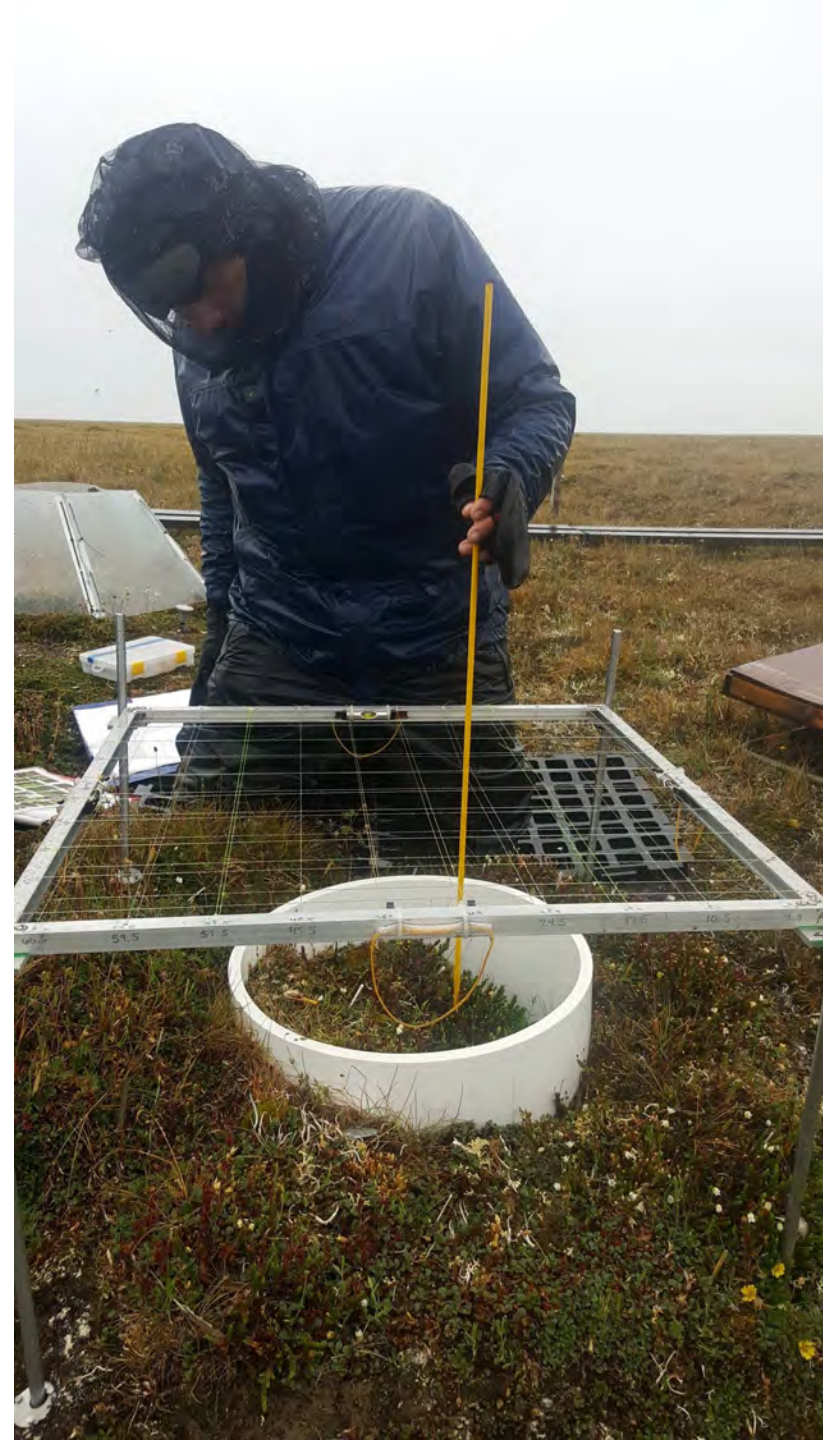


*Papaver hultenii*, an example of a forb

- 100 coordinate point frame placed over each plot and aligned with permanently placed markers



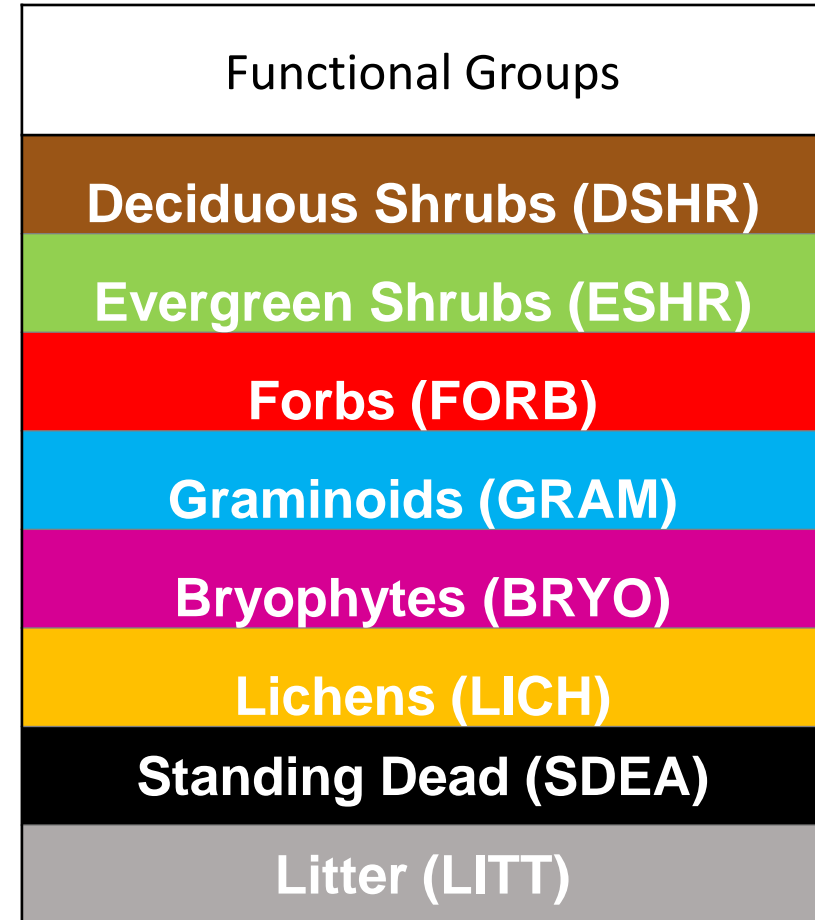
- 100 coordinate point frame placed over each plot and aligned with permanently placed markers
- All plant hits recorded



- 100 coordinate point frame placed over each plot and aligned with permanently placed markers
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- Sampling was done within a two week window, relative to the very first ever date of sampling



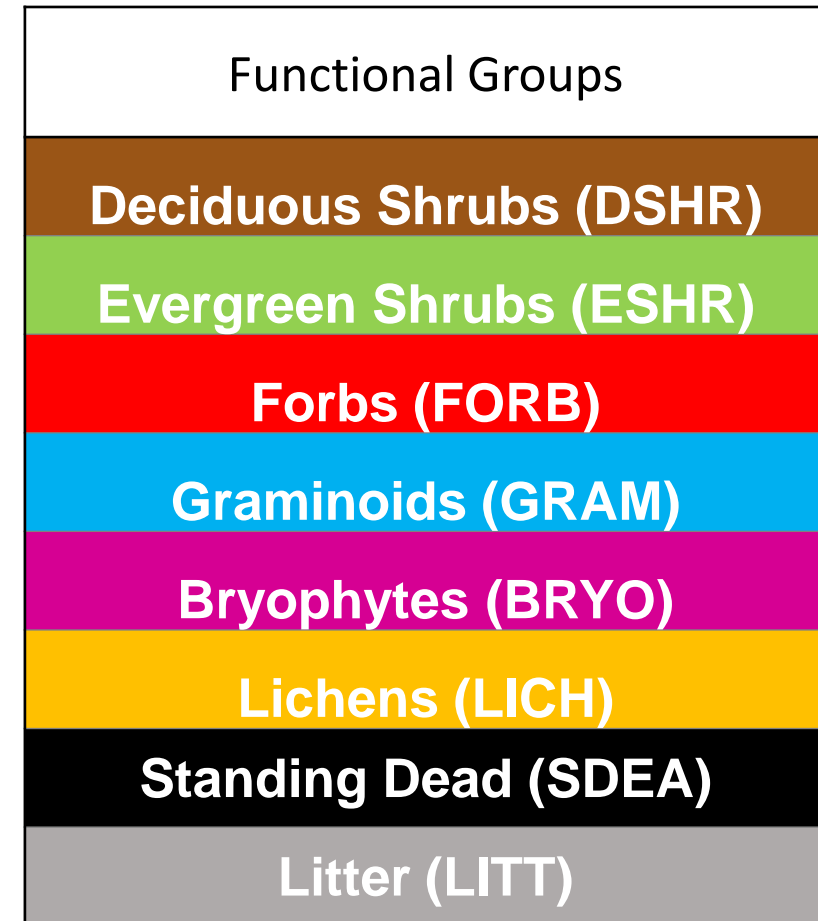
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- Vascular plants identified to species and also lumped by growth form



- Functional Groups are as shown
- Vascular plants identified to species and also lumped by growth form
- Standing dead and litter counted as separate groupings





# Environmental Data

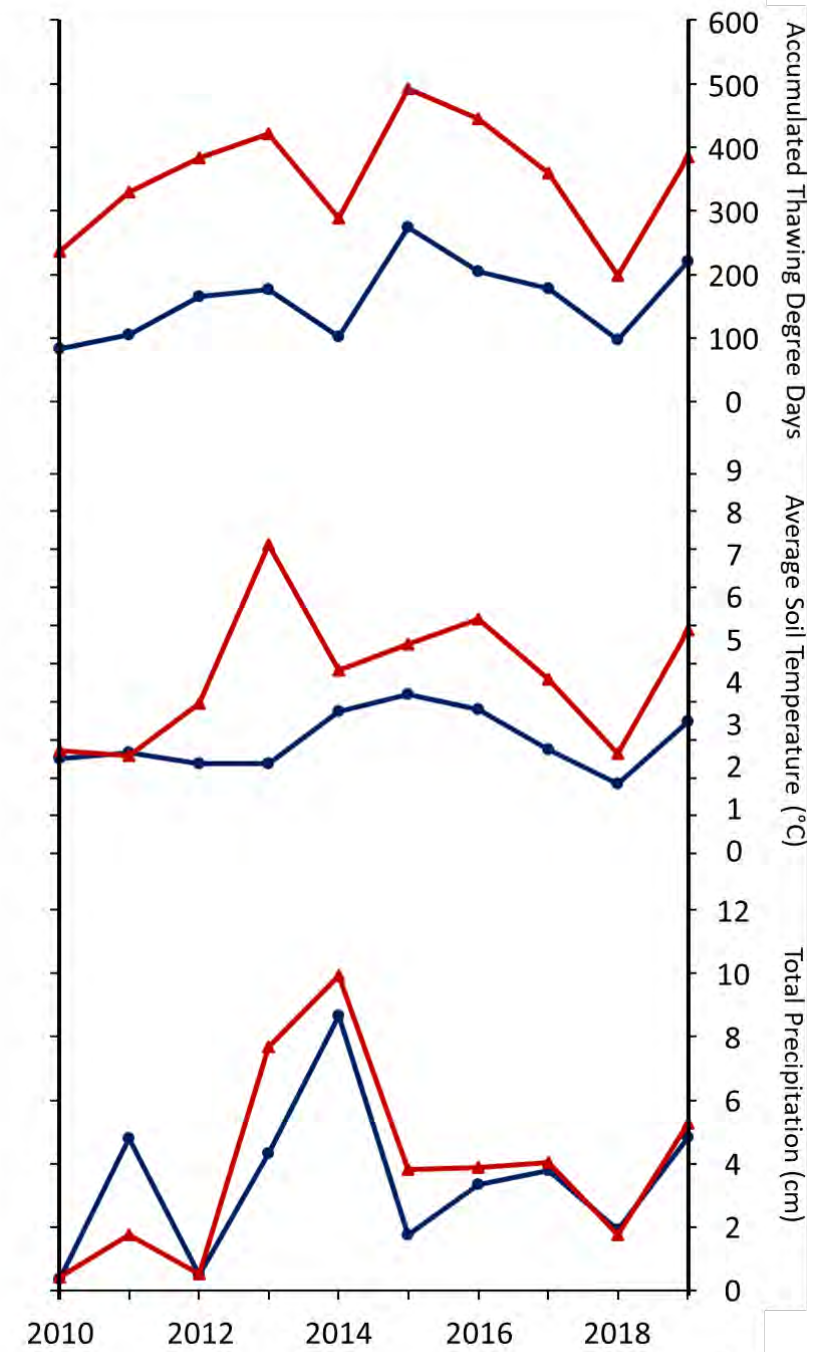
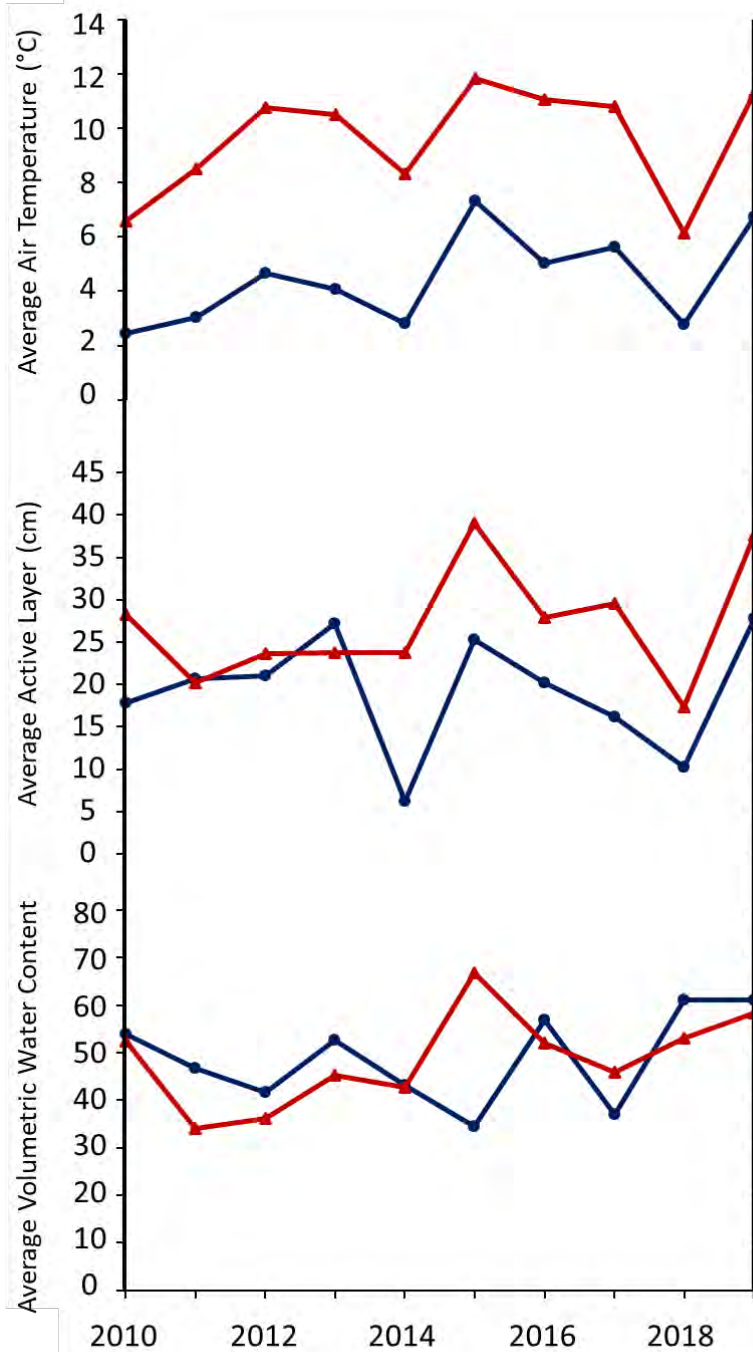


Dr. Hollister next to the  
Utqiagvik dry site  
weather station nested  
within the ARCSS grid

# Environmental Data at both Sites

• June 15<sup>th</sup> to July 15<sup>th</sup>

- Red = Atqasuk
  - Blue = Utqiagvik
- ▲ = ATQ  
● = UTQ



# Environmental Data at both Sites

• All significant except:

- UTQ active layer
- UTQ avg soil temperature

• Red = Atqasuk

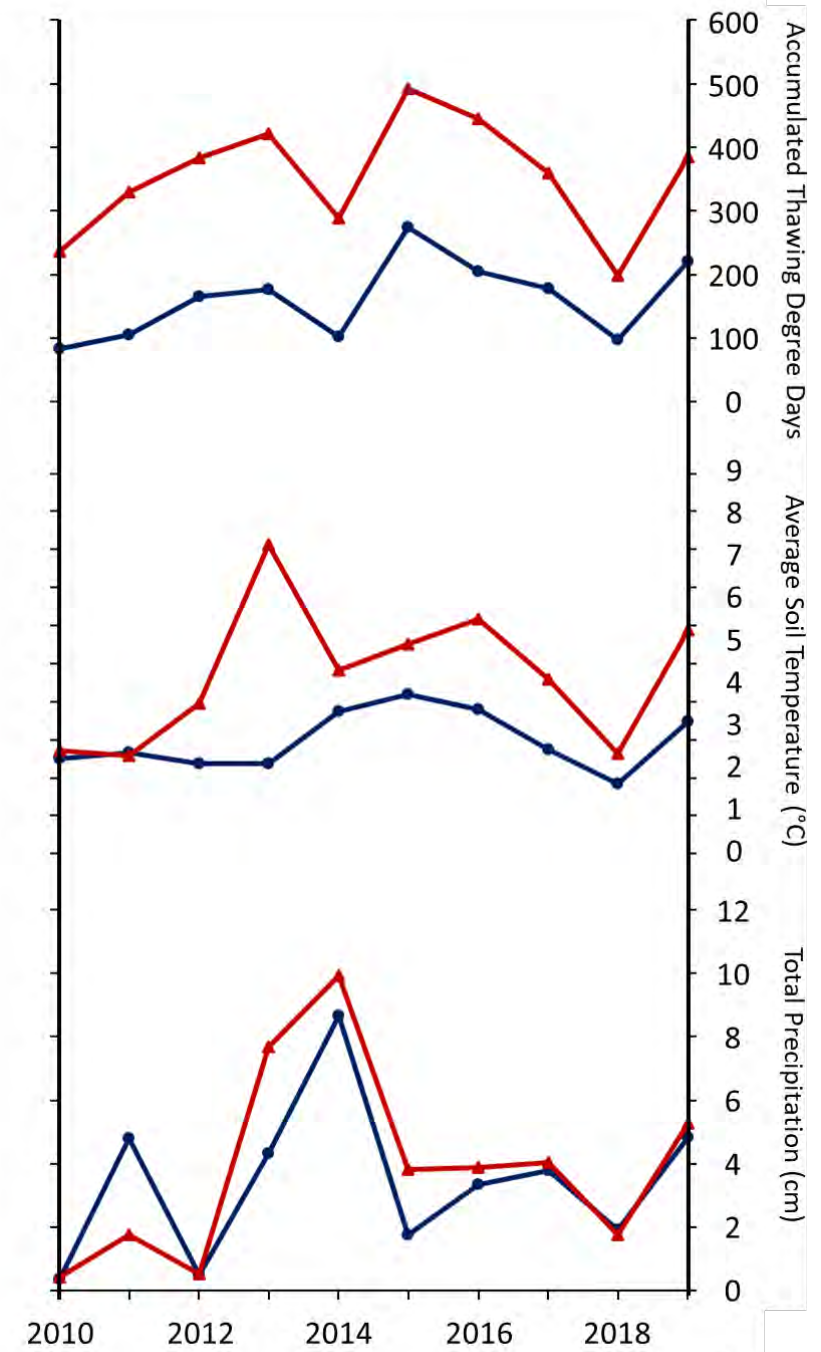
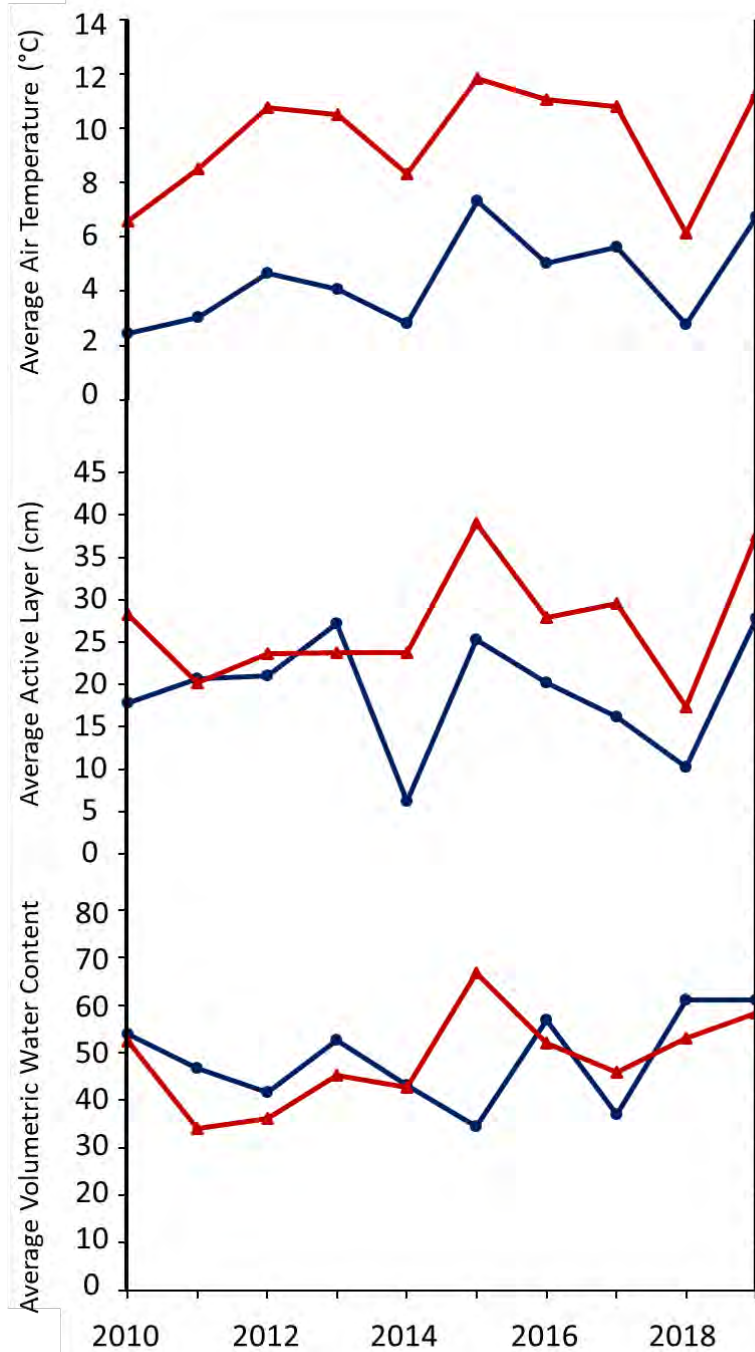


= ATQ

• Blue = Utqiagvik



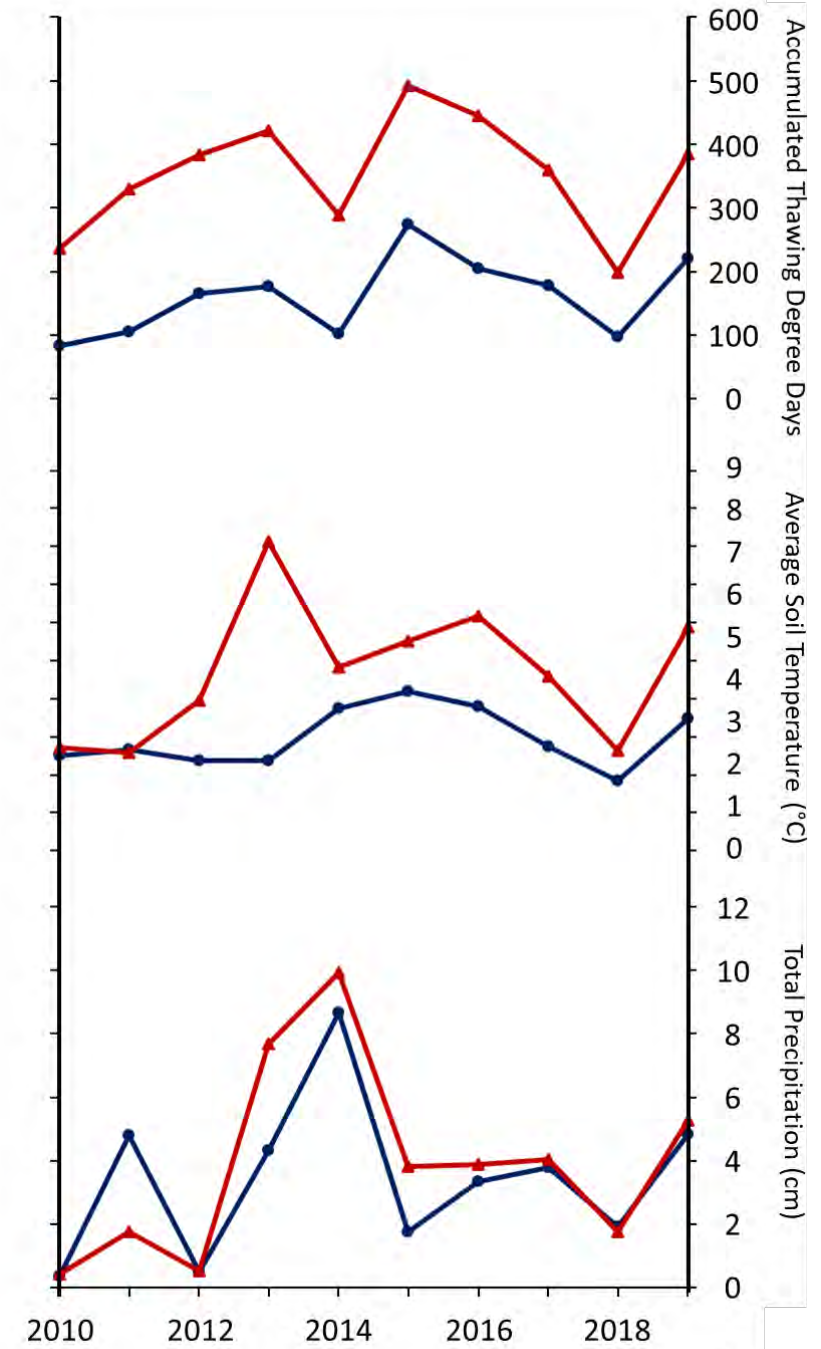
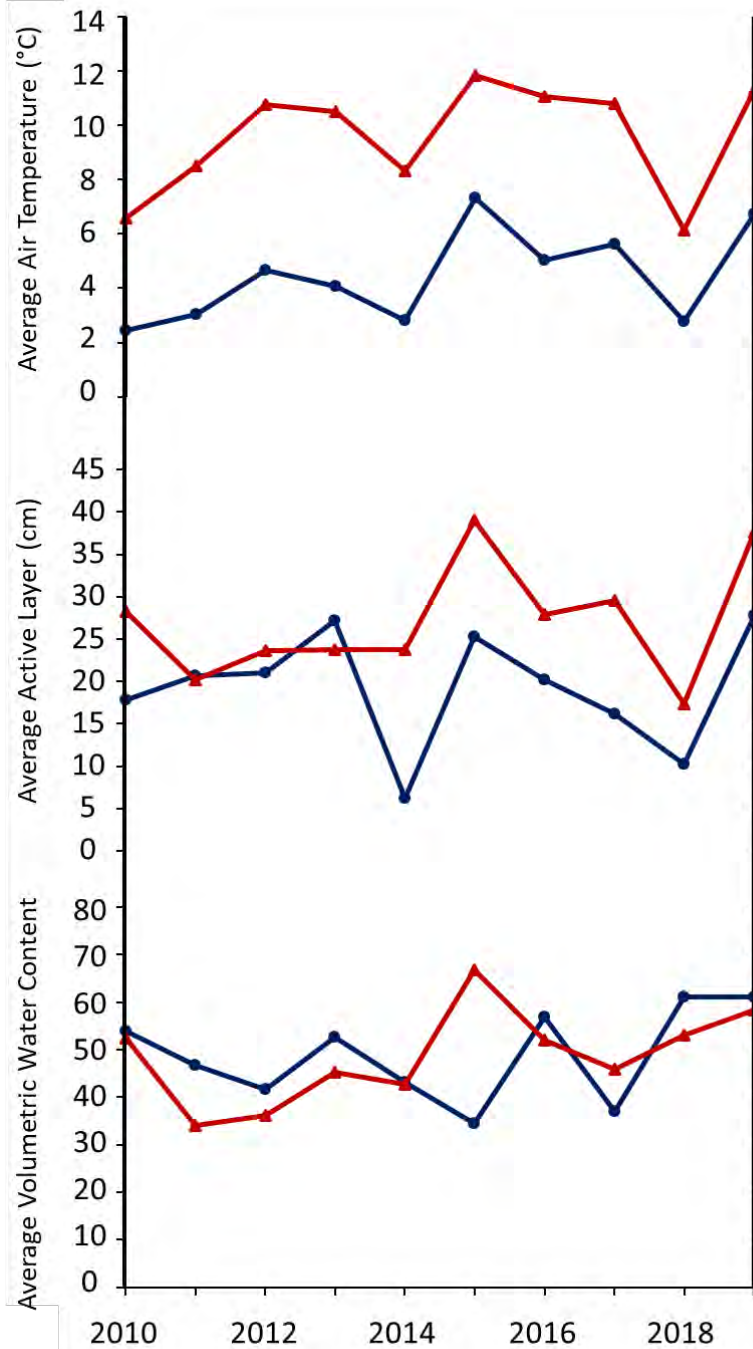
= UTQ



# Environmental Data at both Sites

- Not shown
  - Max air temperature
  - Max soil temperature

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  - $Y = X\beta + Zu + \varepsilon$
  - Plot and year treated as sources of random effects; abiotic factors treated as fixed effects
  - Marginal r squared values reported; associated with fixed effects only

# Statistical Analysis

- Diversity
  - *Alpha, beta, and gamma*, Shannon' index and Pielou's evenness reported
  - Only vascular species which occurred in five or more plots for a single year were used
  - All data fit normal distributions, so simple linear models used

# Results



*Betula nana* a common woody deciduous shrub, growing over some bryophytes.

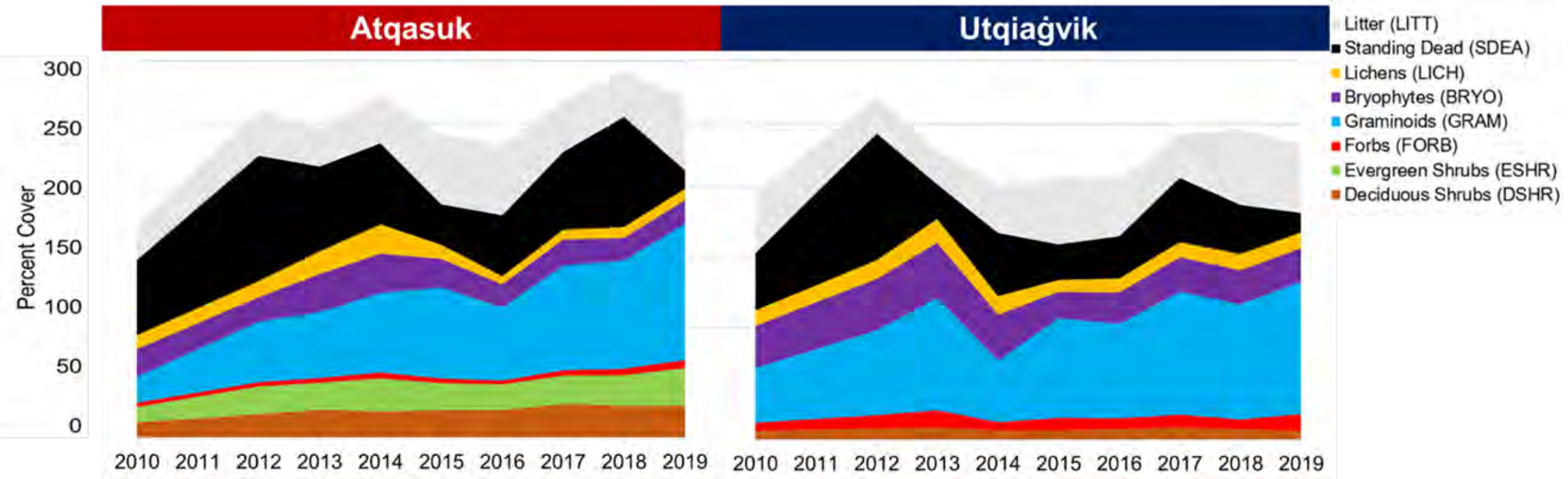
# Cover Difference Between Years



*Thamnolia subuliformis*, a typical tundra lichen growing out of a wooded board.

## Atqasuk

## Utqiagvik





### Atqasuk

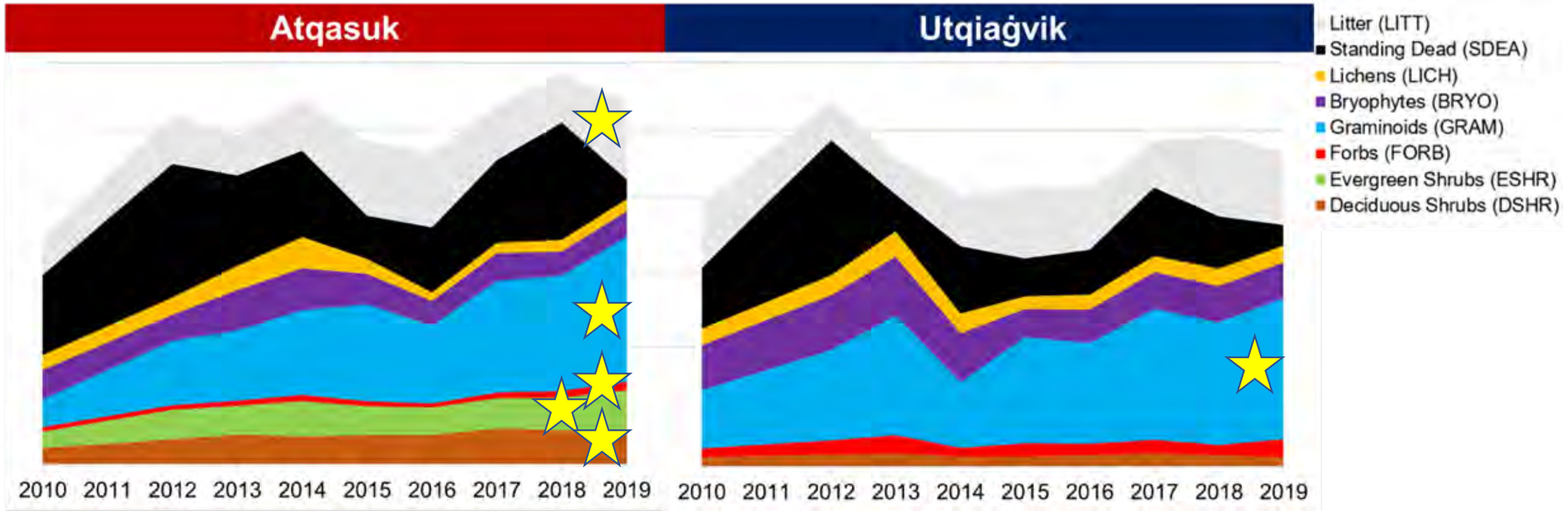
### Utqiaġvik

- Litter (LITT)
- Standing Dead (SDEA)
- Lichens (LICH)
- Bryophytes (BRYO)
- Graminoids (GRAM)
- Forbs (FORB)
- Evergreen Shrubs (ESHR)
- Deciduous Shrubs (DSHR)

Percent Cover

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019



# Atqasuk Cover

## Atqasuk Grid

### Woody deciduous

*Betula nana*

*Salix pulchra*

### Woody evergreen

*Cassiope tetragona*

*Ledum palustre*

*V. vitis-idaea*

### Forb

*R. chamaemorus*

### Graminoid

*Carex aquatilis*

*Carex bigelowii*

*E. angustifolium*

*E. russeolum*

*E. vaginatum*

*Trisetum spicatum*

### Bryophyte

Acrocarpous moss

Pleurocarpous moss

### Lichen

Crustose

Foliose

Fruticose

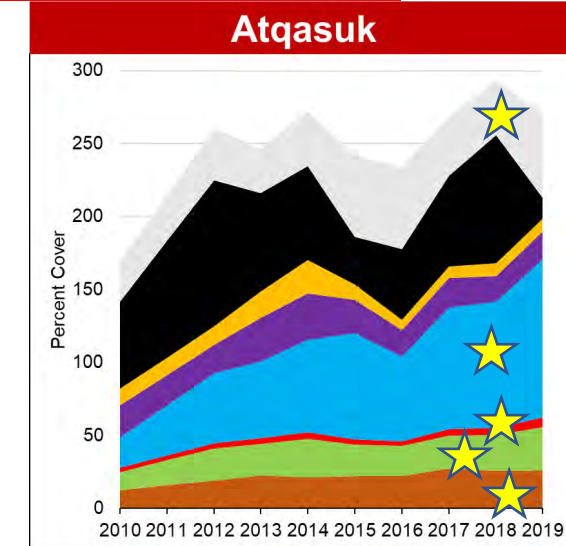
### Standing dead plants

### Leaf litter

Bare ground

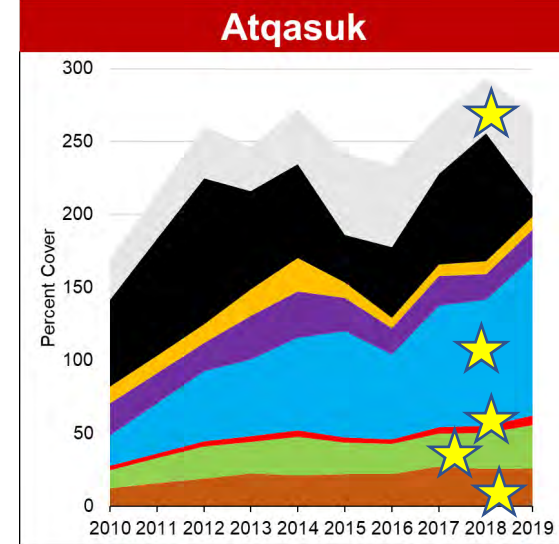
# Atqasuk Cover

	2010	2012	2013	2014	2015	2016	2017	2018	2019
<b>Atqasuk Grid</b>									
<b>Woody deciduous</b>	<b>11.5 (17.5)</b>	<b>17.1 (23.3)</b>	<b>20.1 (28.6)</b>	<b>18.7 (27.0)</b>	<b>19.2 (26.4)</b>	<b>19.8 (28.6)</b>	<b>24.9 (34.4)</b>	<b>23.3 (33.6)</b>	<b>26.1 (38.0)</b>
<i>Betula nana</i>	8.0 (15.8)	12.8 (22.4)	15.0 (26.8)	14.1 (25.4)	13.0 (22.9)	14.2 (27.0)	16.6 (30.2)	14.8 (25.9)	16.1 (27.9)
<i>Salix pulchra</i>	3.5 (10.0)	4.3 (11.6)	5.1 (13.8)	4.6 (13.0)	6.2 (17.0)	5.7 (14.2)	8.3 (22.0)	8.5 (26.4)	10.0 (30.5)
<b>Woody evergreen</b>	<b>12.2 (11.2)</b>	<b>22.0 (19.8)</b>	<b>21.6 (19.3)</b>	<b>26.4 (24.2)</b>	<b>21.5 (19.9)</b>	<b>20.7 (19.2)</b>	<b>22.5 (20.9)</b>	<b>24.5 (23.5)</b>	<b>29.6 (30.5)</b>
<i>Cassiope tetragona</i>	3.0 (6.5)	3.9 (9.5)	4.3 (10.8)	4.0 (9.2)	4.0 (8.9)	3.6 (8.1)	3.0 (7.0)	3.9 (9.9)	4.7 (11.9)
<i>Ledum palustre</i>	3.9 (4.4)	9.3 (9.9)	8.2 (8.5)	9.2 (10.3)	7.5 (7.9)	7.9 (8.8)	8.4 (8.8)	8.1 (9.1)	10.7 (12.7)
<i>V. vitis-idaea</i>	5.3 (6.2)	8.8 (9.1)	9.1 (9.7)	13.3 (13.2)	10.0 (10.9)	9.1 (10.0)	11.0 (12.4)	12.4 (13.0)	14.2 (16.0)
<b>Forb</b>	<b>3.2 (4.2)</b>	<b>3.4 (5.0)</b>	<b>3.7 (4.9)</b>	<b>4.6 (6.2)</b>	<b>3.8 (5.5)</b>	<b>3.2 (5.1)</b>	<b>4.3 (6.4)</b>	<b>5.1 (7.5)</b>	<b>6.4 (9.4)</b>
<i>R. chamaemorus</i>	1.9 (3.6)	2.3 (4.6)	2.0 (4.0)	2.5 (4.4)	2.8 (5.3)	2.5 (4.8)	2.9 (5.6)	3.4 (6.0)	4.6 (8.4)
<b>Graminoid</b>	<b>20.7 (11.5)</b>	<b>48.1 (28.2)</b>	<b>52.4 (27.8)</b>	<b>63.3 (28.1)</b>	<b>72.6 (35.4)</b>	<b>58.1 (35.9)</b>	<b>83.4 (39.5)</b>	<b>86.1 (45.0)</b>	<b>108.4 (46.0)</b>
<i>Carex aquatilis</i>	6.7 (8.2)	12.0 (13.2)	16.7 (18.6)	18.4 (20.7)	22.4 (25.5)	20.7 (26.4)	29.0 (32.6)	28.5 (33.5)	38.6 (44.5)
<i>Carex bigelowii</i>	2.5 (4.6)	4.7 (9.3)	6.3 (12.1)	7.0 (14.1)	7.7 (14.9)	5.0 (9.9)	10.1 (18.8)	8.5 (15.8)	11.2 (21.7)
<i>E. angustifolium</i>	0.4 (1.5)	1.6 (5.0)	1.7 (4.6)	2.0 (5.5)	3.4 (8.7)	2.1 (6.4)	4.8 (11.3)	5.0 (13.5)	7.1 (17.3)
<i>E. russeolum</i>	1.2 (2.7)	4.3 (8.6)	6.5 (13.6)	9.5 (17.8)	9.5 (17.3)	6.4 (11.8)	8.4 (14.8)	6.9 (13.4)	12.3 (24.5)
<i>E. vaginatum</i>	6.5 (9.6)	21.2 (29.7)	18.0 (25.1)	22.1 (29.8)	23.5 (33.2)	21.6 (32.8)	27.5 (38.4)	32.8 (44.3)	33.0 (42.2)
<i>Trisetum spicatum</i>	0.9 (2.4)	2.5 (7.1)	1.6 (4.6)	2.3 (5.5)	2.7 (6.2)	1.2 (4.3)	2.2 (5.2)	3.3 (8.5)	4.6 (12.3)
<b>Bryophyte</b>	<b>12.4 (11.3)</b>	<b>12.2 (12.3)</b>	<b>29.7 (22.6)</b>	<b>31.4 (21.0)</b>	<b>22.4 (18.0)</b>	<b>18.1 (16.8)</b>	<b>20.2 (17.7)</b>	<b>17.9 (18.1)</b>	<b>18.9 (18.4)</b>
Acrocarpus moss	7.7 (9.7)	8.2 (7.8)	15.5 (15.5)	16.3 (13.0)	9.4 (9.2)	6.5 (7.5)	9.5 (10.6)	7.4 (9.1)	8.0 (9.7)
Pleurocarpus moss	1.8 (4.4)	2.8 (7.4)	2.4 (6.6)	4.4 (9.6)	3.9 (7.9)	4.8 (11.7)	1.9 (5.7)	2.7 (6.9)	3.2 (6.8)
<b>Lichen</b>	<b>9.3 (10.5)</b>	<b>12.5 (12.1)</b>	<b>17.4 (17.4)</b>	<b>22.3 (21.9)</b>	<b>10.1 (12.8)</b>	<b>6.4 (7.8)</b>	<b>7.9 (9.7)</b>	<b>8.6 (9.7)</b>	<b>8.9 (11.0)</b>
Crustose	0.0 (0.0)	0.1 (0.5)	3.2 (6.4)	1.2 (2.8)	1.0 (2.8)	0.6 (2.0)	0.3 (1.3)	0.4 (1.7)	0.5 (1.4)
Foliose	3.9 (4.9)	4.1 (4.4)	5.0 (5.0)	6.2 (6.8)	3.1 (3.7)	1.6 (2.0)	2.9 (3.8)	3.2 (3.5)	3.1 (3.8)
Fruticose	5.4 (6.5)	8.3 (8.5)	9.3 (9.5)	14.9 (14.4)	6.1 (7.3)	4.3 (5.0)	4.7 (5.5)	5.0 (5.7)	5.2 (6.9)
<b>Standing dead plants</b>	<b>59.7 (36.3)</b>	<b>100.1 (45.3)</b>	<b>67.4 (34.0)</b>	<b>64.2 (28.0)</b>	<b>32.4 (18.0)</b>	<b>48.5 (29.2)</b>	<b>62.1 (37.9)</b>	<b>87.6 (41.3)</b>	<b>35.8 (17.3)</b>
<b>Leaf litter</b>	<b>27.7 (12.0)</b>	<b>35.5 (15.1)</b>	<b>30.2 (14.9)</b>	<b>37.9 (18.4)</b>	<b>56.2 (19.8)</b>	<b>56.0 (23.1)</b>	<b>40.4 (17.6)</b>	<b>37.2 (13.9)</b>	<b>67.2 (34.4)</b>
Bare ground	0.0	0.6	0.1	0.4	0.1	0.3	2.0	4.5	0.0



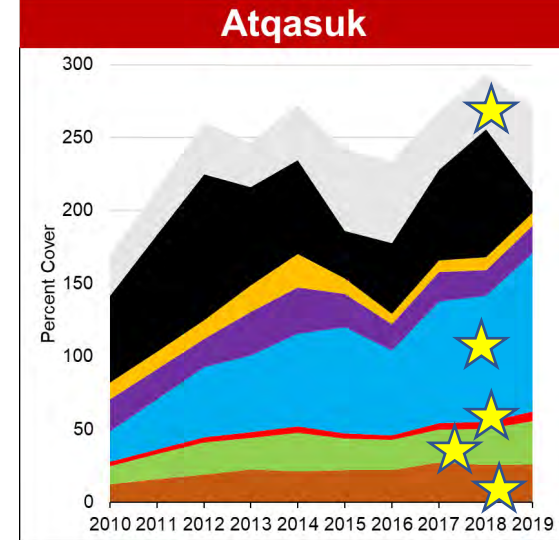
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<b>Atqasuk Grid</b>										
<b>Woody deciduous</b>	11.5 (17.5)	17.1 (23.3)	20.1 (28.6)	18.7 (27.0)	19.2 (26.4)	19.8 (28.6)	24.9 (34.4)	23.3 (33.6)	26.1 (38.0)	↑
<i>Betula nana</i>	8.0 (15.8)	12.8 (22.4)	15.0 (26.8)	14.1 (25.4)	13.0 (22.9)	14.2 (27.0)	16.6 (30.2)	14.8 (25.9)	16.1 (27.9)	↑
<i>Salix pulchra</i>	3.5 (10.0)	4.3 (11.6)	5.1 (13.8)	4.6 (13.0)	6.2 (17.0)	5.7 (14.2)	8.3 (22.0)	8.5 (26.4)	10.0 (30.5)	↑
<b>Woody evergreen</b>	12.2 (11.2)	22.0 (19.8)	21.6 (19.3)	26.4 (24.2)	21.5 (19.9)	20.7 (19.2)	22.5 (20.9)	24.5 (23.5)	29.6 (30.5)	↑
<i>Cassiope tetragona</i>	3.0 (6.5)	3.9 (9.5)	4.3 (10.8)	4.0 (9.2)	4.0 (8.9)	3.6 (8.1)	3.0 (7.0)	3.9 (9.9)	4.7 (11.9)	-
<i>Ledum palustre</i>	3.9 (4.4)	9.3 (9.9)	8.2 (8.5)	9.2 (10.3)	7.5 (7.9)	7.9 (8.8)	8.4 (8.8)	8.1 (9.1)	10.7 (12.7)	-
<i>V. vitis-idaea</i>	5.3 (6.2)	8.8 (9.1)	9.1 (9.7)	13.3 (13.2)	10.0 (10.9)	9.1 (10.0)	11.0 (12.4)	12.4 (13.0)	14.2 (16.0)	↑
<b>Forb</b>	3.2 (4.2)	3.4 (5.0)	3.7 (4.9)	4.6 (6.2)	3.8 (5.5)	3.2 (5.1)	4.3 (6.4)	5.1 (7.5)	6.4 (9.4)	↑
<i>R. chamaemorus</i>	1.9 (3.6)	2.3 (4.6)	2.0 (4.0)	2.5 (4.4)	2.8 (5.3)	2.5 (4.8)	2.9 (5.6)	3.4 (6.0)	4.6 (8.4)	↓
<b>Graminoid</b>	20.7 (11.5)	48.1 (28.2)	52.4 (27.8)	63.3 (28.1)	72.6 (35.4)	58.1 (35.9)	83.4 (39.5)	86.1 (45.0)	108.4 (46.0)	↑
<i>Carex aquatilis</i>	6.7 (8.2)	12.0 (13.2)	16.7 (18.6)	18.4 (20.7)	22.4 (25.5)	20.7 (26.4)	29.0 (32.6)	28.5 (33.5)	38.6 (44.5)	↑
<i>Carex bigelowii</i>	2.5 (4.6)	4.7 (9.3)	6.3 (12.1)	7.0 (14.1)	7.7 (14.9)	5.0 (9.9)	10.1 (18.8)	8.5 (15.8)	11.2 (21.7)	↑
<i>E. angustifolium</i>	0.4 (1.5)	1.6 (5.0)	1.7 (4.6)	2.0 (5.5)	3.4 (8.7)	2.1 (6.4)	4.8 (11.3)	5.0 (13.5)	7.1 (17.3)	↑
<i>E. russeolum</i>	1.2 (2.7)	4.3 (8.6)	6.5 (13.6)	9.5 (17.8)	9.5 (17.3)	6.4 (11.8)	8.4 (14.8)	6.9 (13.4)	12.3 (24.5)	↑
<i>E. vaginatum</i>	6.5 (9.6)	21.2 (29.7)	18.0 (25.1)	22.1 (29.8)	23.5 (33.2)	21.6 (32.8)	27.5 (38.4)	32.8 (44.3)	33.0 (42.2)	↑
<i>Trisetum spicatum</i>	0.9 (2.4)	2.5 (7.1)	1.6 (4.6)	2.3 (5.5)	2.7 (6.2)	1.2 (4.3)	2.2 (5.2)	3.3 (8.5)	4.6 (12.3)	↑
<b>Bryophyte</b>	12.4 (11.3)	12.2 (12.3)	29.7 (22.6)	31.4 (21.0)	22.4 (18.0)	18.1 (16.8)	20.2 (17.7)	17.9 (18.1)	18.9 (18.4)	-
Acrocarpus moss	7.7 (9.7)	8.2 (7.8)	15.5 (15.5)	16.3 (13.0)	9.4 (9.2)	6.5 (7.5)	9.5 (10.6)	7.4 (9.1)	8.0 (9.7)	-
Pleurocarpus moss	1.8 (4.4)	2.8 (7.4)	2.4 (6.6)	4.4 (9.6)	3.9 (7.9)	4.8 (11.7)	1.9 (5.7)	2.7 (6.9)	3.2 (6.8)	-
<b>Lichen</b>	9.3 (10.5)	12.5 (12.1)	17.4 (17.4)	22.3 (21.9)	10.1 (12.8)	6.4 (7.8)	7.9 (9.7)	8.6 (9.7)	8.9 (11.0)	-
Crustose	0.0 (0.0)	0.1 (0.5)	3.2 (6.4)	1.2 (2.8)	1.0 (2.8)	0.6 (2.0)	0.3 (1.3)	0.4 (1.7)	0.5 (1.4)	-
Foliose	3.9 (4.9)	4.1 (4.4)	5.0 (5.0)	6.2 (6.8)	3.1 (3.7)	1.6 (2.0)	2.9 (3.8)	3.2 (3.5)	3.1 (3.8)	-
Fruticose	5.4 (6.5)	8.3 (8.5)	9.3 (9.5)	14.9 (14.4)	6.1 (7.3)	4.3 (5.0)	4.7 (5.5)	5.0 (5.7)	5.2 (6.9)	-
<b>Standing dead plants</b>	59.7 (36.3)	100.1 (45.3)	67.4 (34.0)	64.2 (28.0)	32.4 (18.0)	48.5 (29.2)	62.1 (37.9)	87.6 (41.3)	35.8 (17.3)	-
<b>Leaf litter</b>	27.7 (12.0)	35.5 (15.1)	30.2 (14.9)	37.9 (18.4)	56.2 (19.8)	56.0 (23.1)	40.4 (17.6)	37.2 (13.9)	67.2 (34.4)	↑
<b>Bare ground</b>	0.0	0.0	0.6	0.1	0.4	0.1	0.3	2.0	4.5	0.0



# Atqasuk Cover

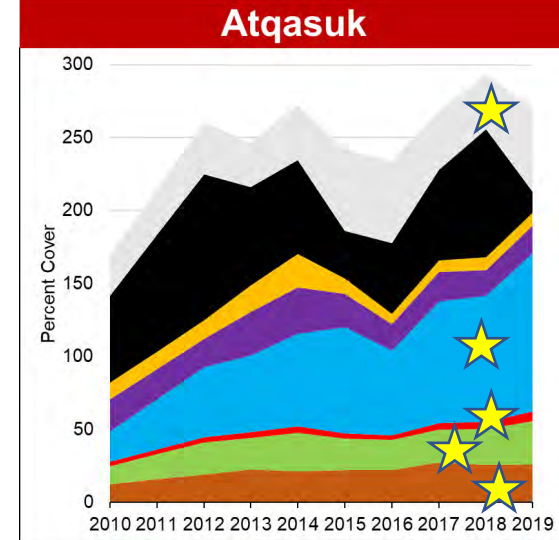
	2010	2012	2013	2014	2015	2016	2017	2018	2019	Ch
<b>Atqasuk Grid</b>										
★ <b>Woody deciduous</b>	11.5 (17.5)	17.1 (23.3)	20.1 (28.6)	18.7 (27.0)	19.2 (26.4)	19.8 (28.6)	24.9 (34.4)	23.3 (33.6)	26.1 (38.0)	↑
<i>Betula nana</i>	8.0 (15.8)	12.8 (22.4)	15.0 (26.8)	14.1 (25.4)	13.0 (22.9)	14.2 (27.0)	16.6 (30.2)	14.8 (25.9)	16.1 (27.9)	↑
<i>Salix pulchra</i>	3.5 (10.0)	4.3 (11.6)	5.1 (13.8)	4.6 (13.0)	6.2 (17.0)	5.7 (14.2)	8.3 (22.0)	8.5 (26.4)	10.0 (30.5)	↑
★ <b>Woody evergreen</b>	12.2 (11.2)	22.0 (19.8)	21.6 (19.3)	26.4 (24.2)	21.5 (19.9)	20.7 (19.2)	22.5 (20.9)	24.5 (23.5)	29.6 (30.5)	↑
<i>Cassiope tetragona</i>	3.0 (6.5)	3.9 (9.5)	4.3 (10.8)	4.0 (9.2)	4.0 (8.9)	3.6 (8.1)	3.0 (7.0)	3.9 (9.9)	4.7 (11.9)	-
<i>Ledum palustre</i>	3.9 (4.4)	9.3 (9.9)	8.2 (8.5)	9.2 (10.3)	7.5 (7.9)	7.9 (8.8)	8.4 (8.8)	8.1 (9.1)	10.7 (12.7)	-
<i>V. vitis-idaea</i>	5.3 (6.2)	8.8 (9.1)	9.1 (9.7)	13.3 (13.2)	10.0 (10.9)	9.1 (10.0)	11.0 (12.4)	12.4 (13.0)	14.2 (16.0)	↑
★ <b>Forb</b>	3.2 (4.2)	3.4 (5.0)	3.7 (4.9)	4.6 (6.2)	3.8 (5.5)	3.2 (5.1)	4.3 (6.4)	5.1 (7.5)	6.4 (9.4)	↑
<i>R. chamaemorus</i>	1.9 (3.6)	2.3 (4.6)	2.0 (4.0)	2.5 (4.4)	2.8 (5.3)	2.5 (4.8)	2.9 (5.6)	3.4 (6.0)	4.6 (8.4)	↓
★ <b>Graminoid</b>	20.7 (11.5)	48.1 (28.2)	52.4 (27.8)	63.3 (28.1)	72.6 (35.4)	58.1 (35.9)	83.4 (39.5)	86.1 (45.0)	108.4 (46.0)	↑
<i>Carex aquatilis</i>	6.7 (8.2)	12.0 (13.2)	16.7 (18.6)	18.4 (20.7)	22.4 (25.5)	20.7 (26.4)	29.0 (32.6)	28.5 (33.5)	38.6 (44.5)	↑
<i>Carex bigelowii</i>	2.5 (4.6)	4.7 (9.3)	6.3 (12.1)	7.0 (14.1)	7.7 (14.9)	5.0 (9.9)	10.1 (18.8)	8.5 (15.8)	11.2 (21.7)	↑
<i>E. angustifolium</i>	0.4 (1.5)	1.6 (5.0)	1.7 (4.6)	2.0 (5.5)	3.4 (8.7)	2.1 (6.4)	4.8 (11.3)	5.0 (13.5)	7.1 (17.3)	↑
<i>E. russeolum</i>	1.2 (2.7)	4.3 (8.6)	6.5 (13.6)	9.5 (17.8)	9.5 (17.3)	6.4 (11.8)	8.4 (14.8)	6.9 (13.4)	12.3 (24.5)	↑
<i>E. vaginatum</i>	6.5 (9.6)	21.2 (29.7)	18.0 (25.1)	22.1 (29.8)	23.5 (33.2)	21.6 (32.8)	27.5 (38.4)	32.8 (44.3)	33.0 (42.2)	↑
<i>Trisetum spicatum</i>	0.9 (2.4)	2.5 (7.1)	1.6 (4.6)	2.3 (5.5)	2.7 (6.2)	1.2 (4.3)	2.2 (5.2)	3.3 (8.5)	4.6 (12.3)	↑
<b>Bryophyte</b>	12.4 (11.3)	12.2 (12.3)	29.7 (22.6)	31.4 (21.0)	22.4 (18.0)	18.1 (16.8)	20.2 (17.7)	17.9 (18.1)	18.9 (18.4)	-
Acrocarpus moss	7.7 (9.7)	8.2 (7.8)	15.5 (15.5)	16.3 (13.0)	9.4 (9.2)	6.5 (7.5)	9.5 (10.6)	7.4 (9.1)	8.0 (9.7)	-
Pleurocarpus moss	1.8 (4.4)	2.8 (7.4)	2.4 (6.6)	4.4 (9.6)	3.9 (7.9)	4.8 (11.7)	1.9 (5.7)	2.7 (6.9)	3.2 (6.8)	-
<b>Lichen</b>	9.3 (10.5)	12.5 (12.1)	17.4 (17.4)	22.3 (21.9)	10.1 (12.8)	6.4 (7.8)	7.9 (9.7)	8.6 (9.7)	8.9 (11.0)	-
Crustose	0.0 (0.0)	0.1 (0.5)	3.2 (6.4)	1.2 (2.8)	1.0 (2.8)	0.6 (2.0)	0.3 (1.3)	0.4 (1.7)	0.5 (1.4)	-
Foliose	3.9 (4.9)	4.1 (4.4)	5.0 (5.0)	6.2 (6.8)	3.1 (3.7)	1.6 (2.0)	2.9 (3.8)	3.2 (3.5)	3.1 (3.8)	-
Fruticose	5.4 (6.5)	8.3 (8.5)	9.3 (9.5)	14.9 (14.4)	6.1 (7.3)	4.3 (5.0)	4.7 (5.5)	5.0 (5.7)	5.2 (6.9)	-
★ <b>Standing dead plants</b>	59.7 (36.3)	100.1 (45.3)	67.4 (34.0)	64.2 (28.0)	32.4 (18.0)	48.5 (29.2)	62.1 (37.9)	87.6 (41.3)	35.8 (17.3)	-
★ <b>Leaf litter</b>	27.7 (12.0)	35.5 (15.1)	30.2 (14.9)	37.9 (18.4)	56.2 (19.8)	56.0 (23.1)	40.4 (17.6)	37.2 (13.9)	67.2 (34.4)	↑
Bare ground	0.0	0.0	0.6	0.1	0.4	0.1	0.3	2.0	4.5	0.0



The cover of five of the functional groups changed significantly with time

# Atqasuk Cover

	2010	2012	2013	2014	2015	2016	2017	2018	2019	Ch
<b>Atqasuk Grid</b>										
<b>Woody deciduous</b>	11.5 (17.5)	17.1 (23.3)	20.1 (28.6)	18.7 (27.0)	19.2 (26.4)	19.8 (28.6)	24.9 (34.4)	23.3 (33.6)	26.1 (38.0)	↑
<i>Betula nana</i>	8.0 (15.8)	12.8 (22.4)	15.0 (26.8)	14.1 (25.4)	13.0 (22.9)	14.2 (27.0)	16.6 (30.2)	14.8 (25.9)	16.1 (27.9)	↑
<i>Salix pulchra</i>	3.5 (10.0)	4.3 (11.6)	5.1 (13.8)	4.6 (13.0)	6.2 (17.0)	5.7 (14.2)	8.3 (22.0)	8.5 (26.4)	10.0 (30.5)	↑
<b>Woody evergreen</b>	12.2 (11.2)	22.0 (19.8)	21.6 (19.3)	26.4 (24.2)	21.5 (19.9)	20.7 (19.2)	22.5 (20.9)	24.5 (23.5)	29.6 (30.5)	↑
<i>Cassiope tetragona</i>	3.0 (6.5)	3.9 (9.5)	4.3 (10.8)	4.0 (9.2)	4.0 (8.9)	3.6 (8.1)	3.0 (7.0)	3.9 (9.9)	4.7 (11.9)	-
<i>Ledum palustre</i>	3.9 (4.4)	9.3 (9.9)	8.2 (8.5)	9.2 (10.3)	7.5 (7.9)	7.9 (8.8)	8.4 (8.8)	8.1 (9.1)	10.7 (12.7)	-
<i>V. vitis-idaea</i>	5.3 (6.2)	8.8 (9.1)	9.1 (9.7)	13.3 (13.2)	10.0 (10.9)	9.1 (10.0)	11.0 (12.4)	12.4 (13.0)	14.2 (16.0)	↑
<b>Forb</b>	3.2 (4.2)	3.4 (5.0)	3.7 (4.9)	4.6 (6.2)	3.8 (5.5)	3.2 (5.1)	4.3 (6.4)	5.1 (7.5)	6.4 (9.4)	↑
<i>R. chamaemorus</i>	1.9 (3.6)	2.3 (4.6)	2.0 (4.0)	2.5 (4.4)	2.8 (5.3)	2.5 (4.8)	2.9 (5.6)	3.4 (6.0)	4.6 (8.4)	↓
<b>Graminoid</b>	20.7 (11.5)	48.1 (28.2)	52.4 (27.8)	63.3 (28.1)	72.6 (35.4)	58.1 (35.9)	83.4 (39.5)	86.1 (45.0)	108.4 (46.0)	↑
<i>Carex aquatilis</i>	6.7 (8.2)	12.0 (13.2)	16.7 (18.6)	18.4 (20.7)	22.4 (25.5)	20.7 (26.4)	29.0 (32.6)	28.5 (33.5)	38.6 (44.5)	↑
<i>Carex bigelowii</i>	2.5 (4.6)	4.7 (9.3)	6.3 (12.1)	7.0 (14.1)	7.7 (14.9)	5.0 (9.9)	10.1 (18.8)	8.5 (15.8)	11.2 (21.7)	↑
<i>E. angustifolium</i>	0.4 (1.5)	1.6 (5.0)	1.7 (4.6)	2.0 (5.5)	3.4 (8.7)	2.1 (6.4)	4.8 (11.3)	5.0 (13.5)	7.1 (17.3)	↑
<i>E. russeolum</i>	1.2 (2.7)	4.3 (8.6)	6.5 (13.6)	9.5 (17.8)	9.5 (17.3)	6.4 (11.8)	8.4 (14.8)	6.9 (13.4)	12.3 (24.5)	↑
<i>E. vaginatum</i>	6.5 (9.6)	21.2 (29.7)	18.0 (25.1)	22.1 (29.8)	23.5 (33.2)	21.6 (32.8)	27.5 (38.4)	32.8 (44.3)	33.0 (42.2)	↑
<i>Trisetum spicatum</i>	0.9 (2.4)	2.5 (7.1)	1.6 (4.6)	2.3 (5.5)	2.7 (6.2)	1.2 (4.3)	2.2 (5.2)	3.3 (8.5)	4.6 (12.3)	↑
<b>Bryophyte</b>	12.4 (11.3)	12.2 (12.3)	29.7 (22.6)	31.4 (21.0)	22.4 (18.0)	18.1 (16.8)	20.2 (17.7)	17.9 (18.1)	18.9 (18.4)	-
Acrocarpus moss	7.7 (9.7)	8.2 (7.8)	15.5 (15.5)	16.3 (13.0)	9.4 (9.2)	6.5 (7.5)	9.5 (10.6)	7.4 (9.1)	8.0 (9.7)	-
Pleurocarpus moss	1.8 (4.4)	2.8 (7.4)	2.4 (6.6)	4.4 (9.6)	3.9 (7.9)	4.8 (11.7)	1.9 (5.7)	2.7 (6.9)	3.2 (6.8)	-
<b>Lichen</b>	9.3 (10.5)	12.5 (12.1)	17.4 (17.4)	22.3 (21.9)	10.1 (12.8)	6.4 (7.8)	7.9 (9.7)	8.6 (9.7)	8.9 (11.0)	-
Crustose	0.0 (0.0)	0.1 (0.5)	3.2 (6.4)	1.2 (2.8)	1.0 (2.8)	0.6 (2.0)	0.3 (1.3)	0.4 (1.7)	0.5 (1.4)	-
Foliose	3.9 (4.9)	4.1 (4.4)	5.0 (5.0)	6.2 (6.8)	3.1 (3.7)	1.6 (2.0)	2.9 (3.8)	3.2 (3.5)	3.1 (3.8)	-
Fruticose	5.4 (6.5)	8.3 (8.5)	9.3 (9.5)	14.9 (14.4)	6.1 (7.3)	4.3 (5.0)	4.7 (5.5)	5.0 (5.7)	5.2 (6.9)	-
<b>Standing dead plants</b>	59.7 (36.3)	100.1 (45.3)	67.4 (34.0)	64.2 (28.0)	32.4 (18.0)	48.5 (29.2)	62.1 (37.9)	87.6 (41.3)	35.8 (17.3)	-
<b>Leaf litter</b>	27.7 (12.0)	35.5 (15.1)	30.2 (14.9)	37.9 (18.4)	56.2 (19.8)	56.0 (23.1)	40.4 (17.6)	37.2 (13.9)	67.2 (34.4)	↑
Bare ground	0.0	0.0	0.6	0.1	0.4	0.1	0.3	2.0	4.5	0.0



The cover of ten of the species changed significantly with time

# Utqiagvik Cover

## Utqiagvik Grid

### Woody deciduous

*Salix pulchra*

*Salix rotundifolia*

### Forb

*Petasites frigidus*

*Stellaria laeta*

### Graminoid

*A. latifolia*

*Carex stans*

*Dupontia fisheri*

*E. russeolum*

*E. triste*

*Luzula arctica*

*Luzula confusa*

*Poa arctica*

### Bryophyte

**Acrocarpous moss**

Pleurocarpous moss

### Lichen

Foliose

Fruticose

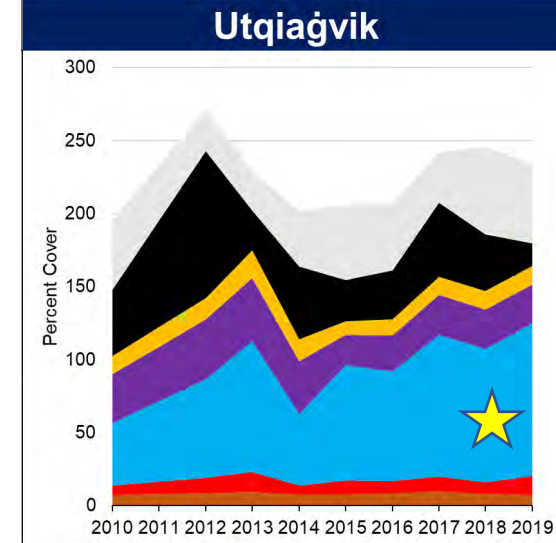
### Standing dead plants

Leaf litter

Bare ground

# Utqiagvik Cover

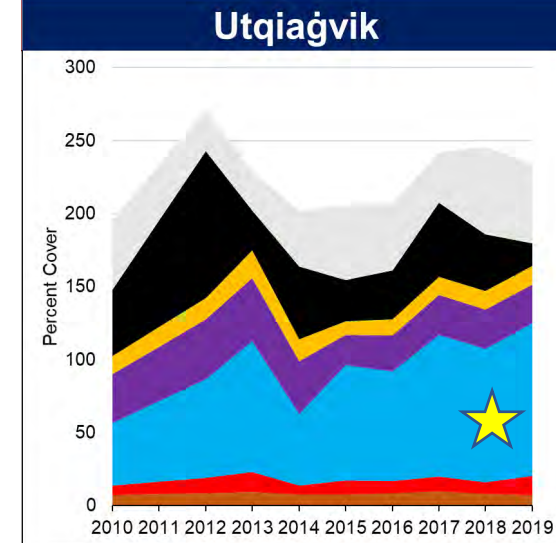
	2010	2012	2013	2014	2015	2016	2017	2018	2019
<b>Utqiagvik Grid</b>									
<b>Woody deciduous</b>	7.2 (12.9)	8.7 (16.3)	9.6 (16.8)	7.5 (13.7)	7.6 (14.4)	8.5 (16.7)	9.8 (18.2)	8.3 (15.1)	7.3 (14.0)
<i>Salix pulchra</i>	1.5 (6.9)	2.6 (11.4)	2.0 (8.5)	1.2 (5.0)	2.1 (9.1)	2.1 (9.3)	2.3 (10.2)	1.6 (7.1)	1.7 (7.9)
<i>Salix rotundifolia</i>	5.6 (10.6)	6.2 (10.9)	7.6 (13.4)	6.4 (12.1)	5.5 (11.0)	6.4 (12.4)	7.4 (14.3)	6.7 (13.3)	5.6 (12.0)
<b>Forb</b>	6.5 (7.2)	10.6 (17.9)	13.6 (17.0)	6.5 (9.1)	9.9 (19.9)	8.4 (17.2)	10.3 (20.8)	7.9 (17.4)	13.1 (30.8)
<i>Petasites frigidus</i>	<b>1.7 (3.6)</b>	<b>5.6 (16.2)</b>	<b>4.1 (11.4)</b>	<b>2.3 (6.2)</b>	<b>6.5 (19.0)</b>	<b>5.1 (15.0)</b>	<b>6.1 (17.5)</b>	<b>5.0 (14.7)</b>	<b>9.5 (29.0)</b>
<i>Stellaria laeta</i>	1.6 (3.3)	1.3 (2.3)	2.3 (4.1)	1.4 (2.6)	0.9 (2.0)	0.8 (1.5)	1.6 (3.9)	0.8 (2.5)	0.9 (2.0)
<b>Graminoid</b>	<b>43.1 (21.2)</b>	<b>67.5 (40.5)</b>	<b>89.3 (40.1)</b>	<b>48.6 (24.6)</b>	<b>78.9 (38.1)</b>	<b>75.0 (35.7)</b>	<b>97.1 (40.4)</b>	<b>91.0 (44.8)</b>	<b>104.7 (42.3)</b>
<i>A. latifolia</i>	<b>2.0 (4.2)</b>	<b>2.5 (5.0)</b>	<b>3.1 (5.8)</b>	<b>1.7 (4.4)</b>	<b>3.1 (6.4)</b>	<b>2.8 (6.6)</b>	<b>4.9 (11.1)</b>	<b>3.6 (10.0)</b>	<b>3.7 (8.7)</b>
<i>Carex stans</i>	17.0 (15.4)	26.8 (24.1)	38.8 (32.6)	16.6 (14.2)	36.0 (30.9)	29.9 (27.8)	39.7 (33.3)	37.4 (37.7)	41.7 (31.1)
<i>Dupontia fisheri</i>	6.6 (9.1)	9.6 (13.5)	9.9 (14.9)	6.0 (9.2)	8.2 (10.3)	10.4 (17.6)	16.6 (19.1)	10.5 (12.3)	12.9 (14.0)
<i>E. russeolum</i>	<b>5.0 (5.2)</b>	<b>7.8 (14.6)</b>	<b>10.7 (15.5)</b>	<b>7.6 (11.3)</b>	<b>11.8 (14.6)</b>	<b>12.6 (18.9)</b>	<b>9.9 (15.0)</b>	<b>13.2 (16.6)</b>	<b>16.9 (20.3)</b>
<i>E. triste</i>	<b>2.6 (4.9)</b>	<b>8.7 (16.0)</b>	<b>7.9 (14.8)</b>	<b>6.5 (12.3)</b>	<b>10.2 (16.6)</b>	<b>9.9 (15.6)</b>	<b>12.5 (19.5)</b>	<b>14.8 (25.1)</b>	<b>14.1 (23.1)</b>
<i>Luzula arctica</i>	<b>1.9 (4.9)</b>	<b>3.1 (6.5)</b>	<b>4.2 (10.2)</b>	<b>1.7 (5.3)</b>	<b>1.8 (4.6)</b>	<b>1.4 (3.6)</b>	<b>1.6 (5.6)</b>	<b>1.0 (3.4)</b>	<b>1.1 (3.0)</b>
<i>Luzula confusa</i>	1.7 (2.5)	1.6 (2.5)	2.4 (4.1)	1.0 (2.0)	2.3 (3.8)	2.2 (3.5)	1.9 (3.4)	2.0 (4.8)	1.7 (4.5)
<i>Poa arctica</i>	4.6 (7.5)	6.0 (15.5)	9.9 (20.2)	5.6 (10.3)	4.4 (9.6)	5.0 (9.2)	8.0 (15.4)	6.8 (14.1)	10.8 (20.5)
<b>Bryophyte</b>	32.6 (16.9)	40.5 (25.4)	40.5 (19.1)	34.2 (16.4)	20.6 (12.1)	24.7 (16.7)	27.3 (19.6)	27.0 (20.4)	26.6 (16.9)
<b>Acrocarpous moss</b>	<b>16.6 (15.6)</b>	<b>13.6 (14.2)</b>	<b>18.5 (13.1)</b>	<b>13.2 (11.7)</b>	<b>9.6 (9.2)</b>	<b>11.3 (14.1)</b>	<b>11.8 (12.8)</b>	<b>11.7 (16.7)</b>	<b>9.8 (13.1)</b>
Pleurocarpous moss	3.8 (7.2)	20.8 (23.3)	16.9 (19.0)	14.6 (18.2)	9.6 (12.8)	12.0 (15.7)	13.2 (17.3)	12.2 (16.6)	15.1 (16.5)
<b>Lichen</b>	10.0 (13.2)	14.1 (16.8)	18.7 (22.5)	14.9 (17.8)	9.2 (12.4)	10.9 (15.2)	11.9 (15.4)	12.9 (19.3)	12.6 (17.3)
Foliose	3.2 (4.7)	4.9 (7.3)	6.3 (9.2)	4.5 (6.9)	3.0 (5.0)	4.0 (9.0)	4.2 (7.4)	4.1 (7.6)	4.6 (7.9)
Fruticose	6.8 (9.8)	9.1 (12.4)	11.9 (16.2)	10.0 (12.9)	6.0 (9.2)	6.7 (10.2)	7.6 (11.1)	8.8 (14.6)	7.9 (13.0)
<b>Standing dead plants</b>	45.2 (21.1)	100.4 (40.7)	27.2 (18.8)	49.8 (23.6)	28.2 (11.6)	33.4 (15.5)	50.7 (26.8)	38.7 (23.0)	32.8 (17.3)
<b>Leaf litter</b>	47.6 (20.9)	28.4 (20.7)	26.7 (19.5)	38.0 (17.2)	51.5 (23.0)	45.9 (27.2)	34.4 (22.8)	59.9 (25.4)	55.7 (28.0)
<b>Bare ground</b>	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.4 0.8	0.0 0.2	0.0 0.0	0.0 0.0	0.0 0.2





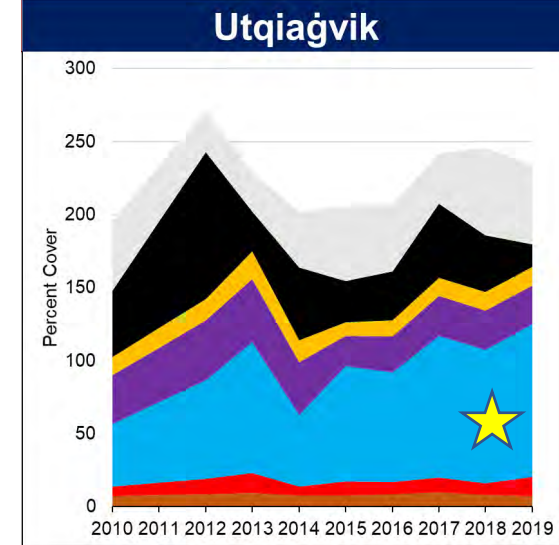
# Utqiagvik Cover

	2010	2012	2013	2014	2015	2016	2017	2018	2019	Ch
<b>Utqiagvik Grid</b>										
<b>Woody deciduous</b>	7.2 (12.9)	8.7 (16.3)	9.6 (16.8)	7.5 (13.7)	7.6 (14.4)	8.5 (16.7)	9.8 (18.2)	8.3 (15.1)	7.3 (14.0)	-
<i>Salix pulchra</i>	1.5 (6.9)	2.6 (11.4)	2.0 (8.5)	1.2 (5.0)	2.1 (9.1)	2.1 (9.3)	2.3 (10.2)	1.6 (7.1)	1.7 (7.9)	-
<i>Salix rotundifolia</i>	5.6 (10.6)	6.2 (10.9)	7.6 (13.4)	6.4 (12.1)	5.5 (11.0)	6.4 (12.4)	7.4 (14.3)	6.7 (13.3)	5.6 (12.0)	-
<b>Forb</b>	6.5 (7.2)	10.6 (17.9)	13.6 (17.0)	6.5 (9.1)	9.9 (19.9)	8.4 (17.2)	10.3 (20.8)	7.9 (17.4)	13.1 (30.8)	-
<i>Petasites frigidus</i>	<b>1.7 (3.6)</b>	<b>5.6 (16.2)</b>	<b>4.1 (11.4)</b>	<b>2.3 (6.2)</b>	<b>6.5 (19.0)</b>	<b>5.1 (15.0)</b>	<b>6.1 (17.5)</b>	<b>5.0 (14.7)</b>	<b>9.5 (29.0)</b>	↑
<i>Stellaria laeta</i>	1.6 (3.3)	1.3 (2.3)	2.3 (4.1)	1.4 (2.6)	0.9 (2.0)	0.8 (1.5)	1.6 (3.9)	0.8 (2.5)	0.9 (2.0)	-
<b>Graminoid</b>	<b>43.1 (21.2)</b>	<b>67.5 (40.5)</b>	<b>89.3 (40.1)</b>	<b>48.6 (24.6)</b>	<b>78.9 (38.1)</b>	<b>75.0 (35.7)</b>	<b>97.1 (40.4)</b>	<b>91.0 (44.8)</b>	<b>104.7 (42.3)</b>	↑
<i>A. latifolia</i>	<b>2.0 (4.2)</b>	<b>2.5 (5.0)</b>	<b>3.1 (5.8)</b>	<b>1.7 (4.4)</b>	<b>3.1 (6.4)</b>	<b>2.8 (6.6)</b>	<b>4.9 (11.1)</b>	<b>3.6 (10.0)</b>	<b>3.7 (8.7)</b>	↑
<i>Carex stans</i>	17.0 (15.4)	26.8 (24.1)	38.8 (32.6)	16.6 (14.2)	36.0 (30.9)	29.9 (27.8)	39.7 (33.3)	37.4 (37.7)	41.7 (31.1)	-
<i>Dupontia fisheri</i>	6.6 (9.1)	9.6 (13.5)	9.9 (14.9)	6.0 (9.2)	8.2 (10.3)	10.4 (17.6)	16.6 (19.1)	10.5 (12.3)	12.9 (14.0)	-
<i>E. russeolum</i>	<b>5.0 (5.2)</b>	<b>7.8 (14.6)</b>	<b>10.7 (15.5)</b>	<b>7.6 (11.3)</b>	<b>11.8 (14.6)</b>	<b>12.6 (18.9)</b>	<b>9.9 (15.0)</b>	<b>13.2 (16.6)</b>	<b>16.9 (20.3)</b>	↑
<i>E. triste</i>	<b>2.6 (4.9)</b>	<b>8.7 (16.0)</b>	<b>7.9 (14.8)</b>	<b>6.5 (12.3)</b>	<b>10.2 (16.6)</b>	<b>9.9 (15.6)</b>	<b>12.5 (19.5)</b>	<b>14.8 (25.1)</b>	<b>14.1 (23.1)</b>	↑
<i>Luzula arctica</i>	<b>1.9 (4.9)</b>	<b>3.1 (6.5)</b>	<b>4.2 (10.2)</b>	<b>1.7 (5.3)</b>	<b>1.8 (4.6)</b>	<b>1.4 (3.6)</b>	<b>1.6 (5.6)</b>	<b>1.0 (3.4)</b>	<b>1.1 (3.0)</b>	↓
<i>Luzula confusa</i>	1.7 (2.5)	1.6 (2.5)	2.4 (4.1)	1.0 (2.0)	2.3 (3.8)	2.2 (3.5)	1.9 (3.4)	2.0 (4.8)	1.7 (4.5)	-
<i>Poa arctica</i>	4.6 (7.5)	6.0 (15.5)	9.9 (20.2)	5.6 (10.3)	4.4 (9.6)	5.0 (9.2)	8.0 (15.4)	6.8 (14.1)	10.8 (20.5)	-
<b>Bryophyte</b>	32.6 (16.9)	40.5 (25.4)	40.5 (19.1)	34.2 (16.4)	20.6 (12.1)	24.7 (16.7)	27.3 (19.6)	27.0 (20.4)	26.6 (16.9)	-
<b>Acrocarpus moss</b>	<b>16.6 (15.6)</b>	<b>13.6 (14.2)</b>	<b>18.5 (13.1)</b>	<b>13.2 (11.7)</b>	<b>9.6 (9.2)</b>	<b>11.3 (14.1)</b>	<b>11.8 (12.8)</b>	<b>11.7 (16.7)</b>	<b>9.8 (13.1)</b>	↓
Pleurocarpus moss	3.8 (7.2)	20.8 (23.3)	16.9 (19.0)	14.6 (18.2)	9.6 (12.8)	12.0 (15.7)	13.2 (17.3)	12.2 (16.6)	15.1 (16.5)	-
<b>Lichen</b>	10.0 (13.2)	14.1 (16.8)	18.7 (22.5)	14.9 (17.8)	9.2 (12.4)	10.9 (15.2)	11.9 (15.4)	12.9 (19.3)	12.6 (17.3)	-
Foliose	3.2 (4.7)	4.9 (7.3)	6.3 (9.2)	4.5 (6.9)	3.0 (5.0)	4.0 (9.0)	4.2 (7.4)	4.1 (7.6)	4.6 (7.9)	-
Fruticose	6.8 (9.8)	9.1 (12.4)	11.9 (16.2)	10.0 (12.9)	6.0 (9.2)	6.7 (10.2)	7.6 (11.1)	8.8 (14.6)	7.9 (13.0)	-
<b>Standing dead plants</b>	45.2 (21.1)	100.4 (40.7)	27.2 (18.8)	49.8 (23.6)	28.2 (11.6)	33.4 (15.5)	50.7 (26.8)	38.7 (23.0)	32.8 (17.3)	-
Leaf litter	47.6 (20.9)	28.4 (20.7)	26.7 (19.5)	38.0 (17.2)	51.5 (23.0)	45.9 (27.2)	34.4 (22.8)	59.9 (25.4)	55.7 (28.0)	-
Bare ground	0.0	0.0	0.0	0.0	0.4	0.8	0.0	0.0	0.2	-



# Utqiagvik Cover

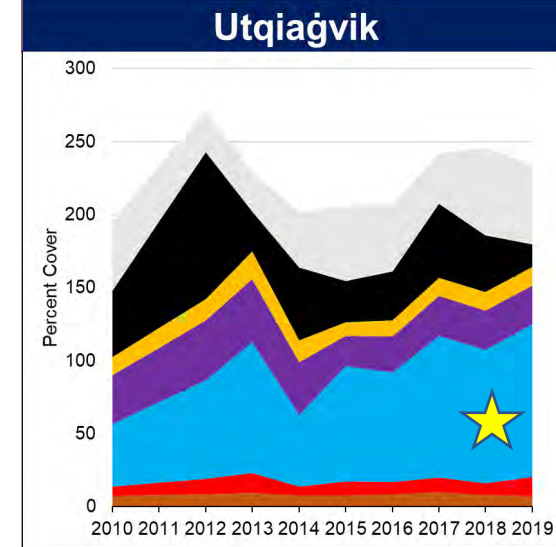
	2010	2012	2013	2014	2015	2016	2017	2018	2019	Ch
<b>Utqiagvik Grid</b>										
<b>Woody deciduous</b>	7.2 (12.9)	8.7 (16.3)	9.6 (16.8)	7.5 (13.7)	7.6 (14.4)	8.5 (16.7)	9.8 (18.2)	8.3 (15.1)	7.3 (14.0)	-
<i>Salix pulchra</i>	1.5 (6.9)	2.6 (11.4)	2.0 (8.5)	1.2 (5.0)	2.1 (9.1)	2.1 (9.3)	2.3 (10.2)	1.6 (7.1)	1.7 (7.9)	-
<i>Salix rotundifolia</i>	5.6 (10.6)	6.2 (10.9)	7.6 (13.4)	6.4 (12.1)	5.5 (11.0)	6.4 (12.4)	7.4 (14.3)	6.7 (13.3)	5.6 (12.0)	-
<b>Forb</b>	6.5 (7.2)	10.6 (17.9)	13.6 (17.0)	6.5 (9.1)	9.9 (19.9)	8.4 (17.2)	10.3 (20.8)	7.9 (17.4)	13.1 (30.8)	-
<i>Petasites frigidus</i>	<b>1.7 (3.6)</b>	<b>5.6 (16.2)</b>	<b>4.1 (11.4)</b>	<b>2.3 (6.2)</b>	<b>6.5 (19.0)</b>	<b>5.1 (15.0)</b>	<b>6.1 (17.5)</b>	<b>5.0 (14.7)</b>	<b>9.5 (29.0)</b>	↑
<i>Stellaria laeta</i>	1.6 (3.3)	1.3 (2.3)	2.3 (4.1)	1.4 (2.6)	0.9 (2.0)	0.8 (1.5)	1.6 (3.9)	0.8 (2.5)	0.9 (2.0)	-
<b>Graminoid</b>	<b>43.1 (21.2)</b>	<b>67.5 (40.5)</b>	<b>89.3 (40.1)</b>	<b>48.6 (24.6)</b>	<b>78.9 (38.1)</b>	<b>75.0 (35.7)</b>	<b>97.1 (40.4)</b>	<b>91.0 (44.8)</b>	<b>104.7 (42.3)</b>	↑
<i>A. latifolia</i>	<b>2.0 (4.2)</b>	<b>2.5 (5.0)</b>	<b>3.1 (5.8)</b>	<b>1.7 (4.4)</b>	<b>3.1 (6.4)</b>	<b>2.8 (6.6)</b>	<b>4.9 (11.1)</b>	<b>3.6 (10.0)</b>	<b>3.7 (8.7)</b>	↑
<i>Carex stans</i>	17.0 (15.4)	26.8 (24.1)	38.8 (32.6)	16.6 (14.2)	36.0 (30.9)	29.9 (27.8)	39.7 (33.3)	37.4 (37.7)	41.7 (31.1)	-
<i>Dupontia fisheri</i>	6.6 (9.1)	9.6 (13.5)	9.9 (14.9)	6.0 (9.2)	8.2 (10.3)	10.4 (17.6)	16.6 (19.1)	10.5 (12.3)	12.9 (14.0)	-
<i>E. russeolum</i>	<b>5.0 (5.2)</b>	<b>7.8 (14.6)</b>	<b>10.7 (15.5)</b>	<b>7.6 (11.3)</b>	<b>11.8 (14.6)</b>	<b>12.6 (18.9)</b>	<b>9.9 (15.0)</b>	<b>13.2 (16.6)</b>	<b>16.9 (20.3)</b>	↑
<i>E. triste</i>	<b>2.6 (4.9)</b>	<b>8.7 (16.0)</b>	<b>7.9 (14.8)</b>	<b>6.5 (12.3)</b>	<b>10.2 (16.6)</b>	<b>9.9 (15.6)</b>	<b>12.5 (19.5)</b>	<b>14.8 (25.1)</b>	<b>14.1 (23.1)</b>	↑
<i>Luzula arctica</i>	<b>1.9 (4.9)</b>	<b>3.1 (6.5)</b>	<b>4.2 (10.2)</b>	<b>1.7 (5.3)</b>	<b>1.8 (4.6)</b>	<b>1.4 (3.6)</b>	<b>1.6 (5.6)</b>	<b>1.0 (3.4)</b>	<b>1.1 (3.0)</b>	↓
<i>Luzula confusa</i>	1.7 (2.5)	1.6 (2.5)	2.4 (4.1)	1.0 (2.0)	2.3 (3.8)	2.2 (3.5)	1.9 (3.4)	2.0 (4.8)	1.7 (4.5)	-
<i>Poa arctica</i>	4.6 (7.5)	6.0 (15.5)	9.9 (20.2)	5.6 (10.3)	4.4 (9.6)	5.0 (9.2)	8.0 (15.4)	6.8 (14.1)	10.8 (20.5)	-
<b>Bryophyte</b>	32.6 (16.9)	40.5 (25.4)	40.5 (19.1)	34.2 (16.4)	20.6 (12.1)	24.7 (16.7)	27.3 (19.6)	27.0 (20.4)	26.6 (16.9)	-
<b>Acrocarpous moss</b>	<b>16.6 (15.6)</b>	<b>13.6 (14.2)</b>	<b>18.5 (13.1)</b>	<b>13.2 (11.7)</b>	<b>9.6 (9.2)</b>	<b>11.3 (14.1)</b>	<b>11.8 (12.8)</b>	<b>11.7 (16.7)</b>	<b>9.8 (13.1)</b>	↓
Pleurocarpous moss	3.8 (7.2)	20.8 (23.3)	16.9 (19.0)	14.6 (18.2)	9.6 (12.8)	12.0 (15.7)	13.2 (17.3)	12.2 (16.6)	15.1 (16.5)	-
<b>Lichen</b>	10.0 (13.2)	14.1 (16.8)	18.7 (22.5)	14.9 (17.8)	9.2 (12.4)	10.9 (15.2)	11.9 (15.4)	12.9 (19.3)	12.6 (17.3)	-
Foliose	3.2 (4.7)	4.9 (7.3)	6.3 (9.2)	4.5 (6.9)	3.0 (5.0)	4.0 (9.0)	4.2 (7.4)	4.1 (7.6)	4.6 (7.9)	-
Fruticose	6.8 (9.8)	9.1 (12.4)	11.9 (16.2)	10.0 (12.9)	6.0 (9.2)	6.7 (10.2)	7.6 (11.1)	8.8 (14.6)	7.9 (13.0)	-
<b>Standing dead plants</b>	45.2 (21.1)	100.4 (40.7)	27.2 (18.8)	49.8 (23.6)	28.2 (11.6)	33.4 (15.5)	50.7 (26.8)	38.7 (23.0)	32.8 (17.3)	-
Leaf litter	47.6 (20.9)	28.4 (20.7)	26.7 (19.5)	38.0 (17.2)	51.5 (23.0)	45.9 (27.2)	34.4 (22.8)	59.9 (25.4)	55.7 (28.0)	-
Bare ground	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.4 0.8	0.0 0.2	0.0 0.0	0.0 0.0	0.0 0.2	-



Only the cover of  
graminoids changed  
significantly with time

# Utqiagvik Cover

	2010	2012	2013	2014	2015	2016	2017	2018	2019	Ch
<b>Utqiagvik Grid</b>										
<b>Woody deciduous</b>	7.2 (12.9)	8.7 (16.3)	9.6 (16.8)	7.5 (13.7)	7.6 (14.4)	8.5 (16.7)	9.8 (18.2)	8.3 (15.1)	7.3 (14.0)	-
<i>Salix pulchra</i>	1.5 (6.9)	2.6 (11.4)	2.0 (8.5)	1.2 (5.0)	2.1 (9.1)	2.1 (9.3)	2.3 (10.2)	1.6 (7.1)	1.7 (7.9)	-
<i>Salix rotundifolia</i>	5.6 (10.6)	6.2 (10.9)	7.6 (13.4)	6.4 (12.1)	5.5 (11.0)	6.4 (12.4)	7.4 (14.3)	6.7 (13.3)	5.6 (12.0)	-
<b>Forb</b>	6.5 (7.2)	10.6 (17.9)	13.6 (17.0)	6.5 (9.1)	9.9 (19.9)	8.4 (17.2)	10.3 (20.8)	7.9 (17.4)	13.1 (30.8)	-
<i>Petasites frigidus</i>	<b>1.7 (3.6)</b>	<b>5.6 (16.2)</b>	<b>4.1 (11.4)</b>	<b>2.3 (6.2)</b>	<b>6.5 (19.0)</b>	<b>5.1 (15.0)</b>	<b>6.1 (17.5)</b>	<b>5.0 (14.7)</b>	<b>9.5 (29.0)</b>	↑
<i>Stellaria laeta</i>	1.6 (3.3)	1.3 (2.3)	2.3 (4.1)	1.4 (2.6)	0.9 (2.0)	0.8 (1.5)	1.6 (3.9)	0.8 (2.5)	0.9 (2.0)	-
<b>Graminoid</b>	<b>43.1 (21.2)</b>	<b>67.5 (40.5)</b>	<b>89.3 (40.1)</b>	<b>48.6 (24.6)</b>	<b>78.9 (38.1)</b>	<b>75.0 (35.7)</b>	<b>97.1 (40.4)</b>	<b>91.0 (44.8)</b>	<b>104.7 (42.3)</b>	↑
<i>A. latifolia</i>	<b>2.0 (4.2)</b>	<b>2.5 (5.0)</b>	<b>3.1 (5.8)</b>	<b>1.7 (4.4)</b>	<b>3.1 (6.4)</b>	<b>2.8 (6.6)</b>	<b>4.9 (11.1)</b>	<b>3.6 (10.0)</b>	<b>3.7 (8.7)</b>	↑
<i>Carex stans</i>	17.0 (15.4)	26.8 (24.1)	38.8 (32.6)	16.6 (14.2)	36.0 (30.9)	29.9 (27.8)	39.7 (33.3)	37.4 (37.7)	41.7 (31.1)	-
<i>Dupontia fisheri</i>	6.6 (9.1)	9.6 (13.5)	9.9 (14.9)	6.0 (9.2)	8.2 (10.3)	10.4 (17.6)	16.6 (19.1)	10.5 (12.3)	12.9 (14.0)	-
<i>E. russeolum</i>	<b>5.0 (5.2)</b>	<b>7.8 (14.6)</b>	<b>10.7 (15.5)</b>	<b>7.6 (11.3)</b>	<b>11.8 (14.6)</b>	<b>12.6 (18.9)</b>	<b>9.9 (15.0)</b>	<b>13.2 (16.6)</b>	<b>16.9 (20.3)</b>	↑
<i>E. triste</i>	<b>2.6 (4.9)</b>	<b>8.7 (16.0)</b>	<b>7.9 (14.8)</b>	<b>6.5 (12.3)</b>	<b>10.2 (16.6)</b>	<b>9.9 (15.6)</b>	<b>12.5 (19.5)</b>	<b>14.8 (25.1)</b>	<b>14.1 (23.1)</b>	↑
<i>Luzula arctica</i>	<b>1.9 (4.9)</b>	<b>3.1 (6.5)</b>	<b>4.2 (10.2)</b>	<b>1.7 (5.3)</b>	<b>1.8 (4.6)</b>	<b>1.4 (3.6)</b>	<b>1.6 (5.6)</b>	<b>1.0 (3.4)</b>	<b>1.1 (3.0)</b>	↓
<i>Luzula confusa</i>	1.7 (2.5)	1.6 (2.5)	2.4 (4.1)	1.0 (2.0)	2.3 (3.8)	2.2 (3.5)	1.9 (3.4)	2.0 (4.8)	1.7 (4.5)	-
<i>Poa arctica</i>	4.6 (7.5)	6.0 (15.5)	9.9 (20.2)	5.6 (10.3)	4.4 (9.6)	5.0 (9.2)	8.0 (15.4)	6.8 (14.1)	10.8 (20.5)	-
<b>Bryophyte</b>	32.6 (16.9)	40.5 (25.4)	40.5 (19.1)	34.2 (16.4)	20.6 (12.1)	24.7 (16.7)	27.3 (19.6)	27.0 (20.4)	26.6 (16.9)	-
<b>Acrocarpous moss</b>	<b>16.6 (15.6)</b>	<b>13.6 (14.2)</b>	<b>18.5 (13.1)</b>	<b>13.2 (11.7)</b>	<b>9.6 (9.2)</b>	<b>11.3 (14.1)</b>	<b>11.8 (12.8)</b>	<b>11.7 (16.7)</b>	<b>9.8 (13.1)</b>	↓
Pleurocarpous moss	3.8 (7.2)	20.8 (23.3)	16.9 (19.0)	14.6 (18.2)	9.6 (12.8)	12.0 (15.7)	13.2 (17.3)	12.2 (16.6)	15.1 (16.5)	-
<b>Lichen</b>	10.0 (13.2)	14.1 (16.8)	18.7 (22.5)	14.9 (17.8)	9.2 (12.4)	10.9 (15.2)	11.9 (15.4)	12.9 (19.3)	12.6 (17.3)	-
Foliose	3.2 (4.7)	4.9 (7.3)	6.3 (9.2)	4.5 (6.9)	3.0 (5.0)	4.0 (9.0)	4.2 (7.4)	4.1 (7.6)	4.6 (7.9)	-
Fruticose	6.8 (9.8)	9.1 (12.4)	11.9 (16.2)	10.0 (12.9)	6.0 (9.2)	6.7 (10.2)	7.6 (11.1)	8.8 (14.6)	7.9 (13.0)	-
<b>Standing dead plants</b>	45.2 (21.1)	100.4 (40.7)	27.2 (18.8)	49.8 (23.6)	28.2 (11.6)	33.4 (15.5)	50.7 (26.8)	38.7 (23.0)	32.8 (17.3)	-
<b>Leaf litter</b>	47.6 (20.9)	28.4 (20.7)	26.7 (19.5)	38.0 (17.2)	51.5 (23.0)	45.9 (27.2)	34.4 (22.8)	59.9 (25.4)	55.7 (28.0)	-
<b>Bare ground</b>	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.4 0.8	0.0 0.2	0.0 0.0	0.0 0.0	0.0 0.2	-



The cover of six of the species changed significantly with time

# Cover to Cover

<b>Functional Groups</b>	Woody Deciduous	Woody Evergreen	Forb	Graminoid	Bryophyte	Lichen	Standing dead	Leaf litter
<b>Atqasuk Grid</b>								
Woody Deciduous	<b>1116</b>	<b>1289</b>	1291	1296	<b>1290</b>	1292	1280	<b>1284</b>
Woody Evergreen	<b>1423</b>	<b>1177</b>	1428	<b>1400</b>	1431	<b>1426</b>	<b>1401</b>	<b>1413</b>
Forb	816	819	<b>641</b>	<b>809</b>	803	800	817	<b>813</b>
Graminoid	3446	<b>2751</b>	<b>2767</b>	<b>2100</b>	2784	<b>2784</b>	<b>2703</b>	<b>2782</b>
Bryophyte	<b>2335</b>	2336	<b>2344</b>	2339	<b>1560</b>	<b>2339</b>	2341	2203
Lichen	1253	<b>1246</b>	<b>1257</b>	<b>1236</b>	1227	<b>1102</b>	<b>1213</b>	<b>1184</b>
Standing dead	<b>2646</b>	<b>2585</b>	2640	<b>2428</b>	<b>2641</b>	<b>2608</b>	<b>1768</b>	<b>2530</b>
Leaf litter	2766	<b>2742</b>	2778	<b>2777</b>	2659	<b>2716</b>	<b>2647</b>	<b>1710</b>
<b>Utqiagvik Grid</b>								
Woody Deciduous	<b>587</b>	-	<b>707</b>	<b>701</b>	713	712	<b>705</b>	<b>699</b>
Woody Evergreen	-	-	-	-	-	-	-	-
Forb	<b>1560</b>	-	<b>1303</b>	1534	<b>1560</b>	<b>1565</b>	<b>1548</b>	<b>1556</b>
Graminoid	<b>2682</b>	-	<b>2722</b>	<b>1956</b>	2719	<b>2719</b>	<b>2720</b>	<b>2674</b>
Bryophyte	2981	-	<b>2980</b>	2987	<b>1764</b>	<b>2984</b>	2984	<b>2428</b>
Lichen	1208	-	1202	<b>1192</b>	1190	<b>994</b>	1198	<b>1161</b>
Standing dead	<b>2588</b>	-	<b>2582</b>	2561	2600	<b>2596</b>	<b>1640</b>	<b>2536</b>
Leaf litter	<b>3029</b>	-	<b>3047</b>	<b>3041</b>	<b>2558</b>	<b>3016</b>	<b>3006</b>	<b>1749</b>



# Cover to Cover

Functional Groups	Woody Deciduous	Woody Evergreen	Forb	Graminoid	Bryophyte	Lichen	Standing dead	Leaf litter
Atqasuk Grid								
Woody Deciduous								
Woody Evergreen	1423	1177	1428	1400	1431	1426	1401	1413
Forb								
Graminoid								
Bryophyte								
Lichen								
Standing dead								
Leaf litter								
Utqiagvik Grid								
Woody Deciduous								
Woody Evergreen	-	-	-	-	-	-	-	-
Forb								
Graminoid								
Bryophyte								
Lichen								
Standing dead								
Leaf litter								

No evergreen shrubs on this grid!













# Cover to Cover

Functional Groups	Woody Deciduous	Woody Evergreen	Forb	Graminoid	Bryophyte	Lichen	Standing dead	Leaf litter
Atqasuk Grid								
Woody Deciduous								
Woody Evergreen								
Forb								
Graminoid								
Bryophyte								
Lichen								
Standing dead								
Leaf litter	2766	2742	2778	2777	2659	2716	2647	1710
Utqiagvik Grid								
Woody Deciduous								
Woody Evergreen								
Forb								
Graminoid								
Bryophyte								
Lichen								
Standing dead								
Leaf litter	3029	-	3047	3041	2558	3016	3006	1749

# Atqasuk Cover to Abiotic

Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Atqasuk Grid</b>								
Woody deciduous								
<i>Betula nana</i>								
<i>Salix pulchra</i>								
Woody evergreen								
<i>Cassiope tetragona</i>								
<i>Ledum palustre</i>								
<i>Vaccinium vitis-idaea</i>								
<b>Forb</b>								
<i>Rubus chamaemorus</i>								
Graminoid								
<i>Carex aquatilis</i>								
<i>Carex bigelowii</i>								
<i>Eriophorum angustifolium</i>								
<i>Eriophorum russeolum</i>								
<i>Eriophorum vaginatum</i>								
<i>Trisetum spicatum</i>								
Bryophyte								
Acrocarpous moss								
Pleurocarpous moss								
Lichen								
Crustose								
Foliose								
Fruticose								
Standing dead								
Leaf litter								

# Atqasuk Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Atqasuk Grid</b>									
Woody deciduous	<b>1289</b>								
<i>Betula nana</i>	<b>846</b>								
<i>Salix pulchra</i>	<b>582</b>								
Woody evergreen	<b>1428</b>								
<i>Cassiope tetragona</i>	618								
<i>Ledum palustre</i>	1055								
<i>Vaccinium vitis-idaea</i>	<b>1047</b>								
<b>Forb</b>	<b>813</b>								
<i>Rubus chamaemorus</i>	<b>518</b>								
<b>Graminoid</b>	<b>2781</b>								
<i>Carex aquatilis</i>	<b>1446</b>								
<i>Carex bigelowii</i>	<b>277</b>								
<i>Eriophorum angustifolium</i>	<b>478</b>								
<i>Eriophorum russeolum</i>	<b>636</b>								
<i>Eriophorum vaginatum</i>	<b>1177</b>								
<i>Trisetum spicatum</i>	<b>577</b>								
<b>Bryophyte</b>	2336								
Acrocarpous moss	1553								
Pleurocarpous moss	983								
<b>Lichen</b>	1254								
Crustose	327								
Foliose	839								
Fruticose	1081								
<b>Standing dead</b>	3646								
<b>Leaf litter</b>	<b>2942</b>								

Year predicts woody deciduous and woody evergreen shrubs, forbs, graminoids, and standing dead.

# Atqasuk Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Atqasuk Grid</b>									
Woody deciduous	<b>1289</b>	1291							
<i>Betula nana</i>	<b>846</b>	847							
<i>Salix pulchra</i>	<b>582</b>	585							
Woody evergreen	<b>1428</b>	1427							
<i>Cassiope tetragona</i>	618	619							
<i>Ledum palustre</i>	1055	1055							
<i>Vaccinium vitis-idaea</i>	<b>1047</b>	1047							
<b>Forb</b>	<b>813</b>	815							
<i>Rubus chamaemorus</i>	<b>518</b>	522							
<b>Graminoid</b>	<b>2781</b>	2779							
<i>Carex aquatilis</i>	<b>1446</b>	1447							
<i>Carex bigelowii</i>	<b>277</b>	597							
<i>Eriophorum angustifolium</i>	<b>478</b>	480							
<i>Eriophorum russeolum</i>	<b>636</b>	636							
<i>Eriophorum vaginatum</i>	<b>1177</b>	1176							
<i>Trisetum spicatum</i>	<b>577</b>	578							
<b>Bryophyte</b>	2336	2334							
Acrocarpous moss	1553	1551							
Pleurocarpous moss	983	985							
<b>Lichen</b>	1254	1255							
Crustose	327	327							
Foliose	839	839							
Fruticose	1081	1081							
<b>Standing dead</b>	3646	3649							
<b>Leaf litter</b>	<b>2942</b>	2944							

# Atqasuk Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Atqasuk Grid</b>									
Woody deciduous	<b>1289</b>	1291	1185						
<i>Betula nana</i>	<b>846</b>	847	772						
<i>Salix pulchra</i>	<b>582</b>	585	536						
Woody evergreen	<b>1428</b>	1427	1258						
<i>Cassiope tetragona</i>	618	619	562						
<i>Ledum palustre</i>	1055	1055	926						
<i>Vaccinium vitis-idaea</i>	<b>1047</b>	1047	944						
<b>Forb</b>	<b>813</b>	815	733						
<i>Rubus chamaemorus</i>	<b>518</b>	522	471						
<b>Graminoid</b>	<b>2781</b>	2779	<b>2477</b>						
<i>Carex aquatilis</i>	<b>1446</b>	1447	<b>1251</b>						
<i>Carex bigelowii</i>	<b>277</b>	597	543						
<i>Eriophorum angustifolium</i>	<b>478</b>	480	<b>438</b>						
<i>Eriophorum russeolum</i>	<b>636</b>	636	585						
<i>Eriophorum vaginatum</i>	<b>1177</b>	1176	1059						
<i>Trisetum spicatum</i>	<b>577</b>	578	<b>465</b>						
<b>Bryophyte</b>	2336	2334	2127						
Acrocarpous moss	1553	1551	1358						
Pleurocarpous moss	983	985	<b>834</b>						
<b>Lichen</b>	1254	1255	1092						
Crustose	327	327	287						
Foliose	839	839	745						
Fruticose	1081	1081	959						
<b>Standing dead</b>	3646	3649	3249						
<b>Leaf litter</b>	<b>2942</b>	2944	<b>2697</b>						

Air temperature predicts  
graminoids only



# Atqasuk Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Atqasuk Grid</b>									
Woody deciduous	<b>1289</b>	1291	1185	1290					
<i>Betula nana</i>	<b>846</b>	847	772	846					
<i>Salix pulchra</i>	<b>582</b>	585	536	584					
Woody evergreen	<b>1428</b>	1427	1258	1427					
<i>Cassiope tetragona</i>	618	619	562	619					
<i>Ledum palustre</i>	1055	1055	926	1055					
<i>Vaccinium vitis-idaea</i>	<b>1047</b>	1047	944	8575					
<b>Forb</b>	<b>813</b>	815	733	815					
<i>Rubus chamaemorus</i>	<b>518</b>	522	471	522					
<b>Graminoid</b>	<b>2781</b>	2779	<b>2477</b>	2782					
<i>Carex aquatilis</i>	<b>1446</b>	1447	<b>1251</b>	1449					
<i>Carex bigelowii</i>	<b>277</b>	597	543	792					
<i>Eriophorum angustifolium</i>	<b>478</b>	480	<b>438</b>	480					
<i>Eriophorum russeolum</i>	<b>636</b>	636	585	636					
<i>Eriophorum vaginatum</i>	<b>1177</b>	1176	1059	1177					
<i>Trisetum spicatum</i>	<b>577</b>	578	<b>465</b>	578					
<b>Bryophyte</b>	2336	2334	2127	2339					
Acrocarpous moss	1553	1551	1358	1551					
Pleurocarpous moss	983	985	<b>834</b>	984					
<b>Lichen</b>	1254	1255	1092	1254					
Crustose	327	327	287	327					
Foliose	839	839	745	840					
Fruticose	1081	1081	959	1187					
<b>Standing dead</b>	3646	3649	3249	3761					
<b>Leaf litter</b>	<b>2942</b>	2944	<b>2697</b>	2940					

# Atqasuk Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Atqasuk Grid</b>									
Woody deciduous	<b>1289</b>	1291	1185	1290	1185				
<i>Betula nana</i>	<b>846</b>	847	772	846	771				
<i>Salix pulchra</i>	<b>582</b>	585	536	584	537				
Woody evergreen	<b>1428</b>	1427	1258	1427	<b>1255</b>				
<i>Cassiope tetragona</i>	618	619	562	619	562				
<i>Ledum palustre</i>	1055	1055	926	1055	926				
<i>Vaccinium vitis-idaea</i>	<b>1047</b>	1047	944	8575	944				
<b>Forb</b>	<b>813</b>	815	733	815	<b>729</b>				
<i>Rubus chamaemorus</i>	<b>518</b>	522	471	522	<b>466</b>				
<b>Graminoid</b>	<b>2781</b>	2779	<b>2477</b>	2782	<b>2461</b>				
<i>Carex aquatilis</i>	<b>1446</b>	1447	<b>1251</b>	1449	<b>1247</b>				
<i>Carex bigelowii</i>	<b>277</b>	597	543	792	543				
<i>Eriophorum angustifolium</i>	<b>478</b>	480	<b>438</b>	480	440				
<i>Eriophorum russeolum</i>	<b>636</b>	636	585	636	585				
<i>Eriophorum vaginatum</i>	<b>1177</b>	1176	1059	1177	1059				
<i>Trisetum spicatum</i>	<b>577</b>	578	<b>465</b>	578	471				
<b>Bryophyte</b>	2336	2334	2127	2339	<b>2123</b>				
Acrocarpous moss	1553	1551	1358	1551	1358				
Pleurocarpous moss	983	985	<b>834</b>	984	<b>817</b>				
<b>Lichen</b>	1254	1255	1092	1254	1093				
Crustose	327	327	287	327	289				
Foliose	839	839	745	840	747				
Fruticose	1081	1081	959	1187	959				
<b>Standing dead</b>	3646	3649	3249	3761	3248				
<b>Leaf litter</b>	<b>2942</b>	2944	<b>2697</b>	2940	<b>2695</b>				

# Atqasuk Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Atqasuk Grid</b>									
Woody deciduous	<b>1289</b>	1291	1185	1290	1185	1290			
<i>Betula nana</i>	<b>846</b>	847	772	846	771	847			
<i>Salix pulchra</i>	<b>582</b>	585	536	584	537	584			
Woody evergreen	<b>1428</b>	1427	1258	1427	<b>1255</b>	1427			
<i>Cassiope tetragona</i>	618	619	562	619	562	615			
<i>Ledum palustre</i>	1055	1055	926	1055	926	1054			
<i>Vaccinium vitis-idaea</i>	<b>1047</b>	1047	944	8575	944	1046			
<b>Forb</b>	<b>813</b>	815	733	815	<b>729</b>	813			
<i>Rubus chamaemorus</i>	<b>518</b>	522	471	522	<b>466</b>	522			
<b>Graminoid</b>	<b>2781</b>	2779	<b>2477</b>	2782	<b>2461</b>	2782			
<i>Carex aquatilis</i>	<b>1446</b>	1447	<b>1251</b>	1449	<b>1247</b>	1448			
<i>Carex bigelowii</i>	<b>277</b>	597	543	792	543	596			
<i>Eriophorum angustifolium</i>	<b>478</b>	480	<b>438</b>	480	440	480			
<i>Eriophorum russeolum</i>	<b>636</b>	636	585	636	585	635			
<i>Eriophorum vaginatum</i>	<b>1177</b>	1176	1059	1177	1059	1175			
<i>Trisetum spicatum</i>	<b>577</b>	578	<b>465</b>	578	471	578			
<b>Bryophyte</b>	2336	2334	2127	2339	<b>2123</b>	2337			
Acrocarpous moss	1553	1551	1358	1551	1358	1550			
Pleurocarpous moss	983	985	<b>834</b>	984	<b>817</b>	985			
<b>Lichen</b>	1254	1255	1092	1254	1093	1254			
Crustose	327	327	287	327	289	327			
Foliose	839	839	745	840	747	839			
Fruticose	1081	1081	959	1187	959	1081			
<b>Standing dead</b>	3646	3649	3249	3761	3248	3647			
<b>Leaf litter</b>	<b>2942</b>	2944	<b>2697</b>	2940	<b>2695</b>	<b>2940</b>			

Soil temperature predicts woody evergreens, forbs, graminoids, bryophytes and leaf litter

# Atqasuk Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Atqasuk Grid</b>									
Woody deciduous	1289	1291	1185	1290	1185	1290	1153		
<i>Betula nana</i>	846	847	772	846	771	847	749		
<i>Salix pulchra</i>	582	585	536	584	537	584	542		
Woody evergreen	1428	1427	1258	1427	1255	1427	1287		
<i>Cassiope tetragona</i>	618	619	562	619	562	615	559		
<i>Ledum palustre</i>	1055	1055	926	1055	926	1054	945		
<i>Vaccinium vitis-idaea</i>	1047	1047	944	8575	944	1046	930		
<b>Forb</b>	813	815	733	815	729	813	733		
<i>Rubus chamaemorus</i>	518	522	471	522	466	522	477		
<b>Graminoid</b>	2781	2779	2477	2782	2461	2782	2457		
<i>Carex aquatilis</i>	1446	1447	1251	1449	1247	1448	1238		
<i>Carex bigelowii</i>	277	597	543	792	543	596	540		
<i>Eriophorum angustifolium</i>	478	480	438	480	440	480	439		
<i>Eriophorum russeolum</i>	636	636	585	636	585	635	567		
<i>Eriophorum vaginatum</i>	1177	1176	1059	1177	1059	1175	1078		
<i>Trisetum spicatum</i>	577	578	465	578	471	578	541		
<b>Bryophyte</b>	2336	2334	2127	2339	2123	2337	2092		
Acrocarpous moss	1553	1551	1358	1551	1358	1550	1369		
Pleurocarpous moss	983	985	834	984	817	985	894		
<b>Lichen</b>	1254	1255	1092	1254	1093	1254	1133		
Crustose	327	327	287	327	289	327	235		
Foliose	839	839	745	840	747	839	731		
Fruticose	1081	1081	959	1187	959	1081	965		
<b>Standing dead</b>	3646	3649	3249	3761	3248	3647	3217		
<b>Leaf litter</b>	2942	2944	2697	2940	2695	2940	2552		

Thaw depth predicts  
graminoids, standing dead,  
and leaf litter

# Atqasuk Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Atqasuk Grid</b>									
Woody deciduous	<b>1289</b>	1291	1185	1290	1185	1290	1153	1290	
<i>Betula nana</i>	<b>846</b>	847	772	846	771	847	749	847	
<i>Salix pulchra</i>	<b>582</b>	585	536	584	537	584	542	585	
Woody evergreen	<b>1428</b>	1427	1258	1427	<b>1255</b>	1427	1287	1428	
<i>Cassiope tetragona</i>	618	619	562	619	562	615	559	618	
<i>Ledum palustre</i>	1055	1055	926	1055	926	1054	945	1054	
<i>Vaccinium vitis-idaea</i>	<b>1047</b>	1047	944	8575	944	1046	930	1047	
<b>Forb</b>	<b>813</b>	815	733	815	<b>729</b>	813	733	814	
<i>Rubus chamaemorus</i>	<b>518</b>	522	471	522	<b>466</b>	522	477	522	
<b>Graminoid</b>	<b>2781</b>	2779	<b>2477</b>	2782	<b>2461</b>	2782	<b>2457</b>	2781	
<i>Carex aquatilis</i>	<b>1446</b>	1447	<b>1251</b>	1449	<b>1247</b>	1448	<b>1238</b>	1448	
<i>Carex bigelowii</i>	<b>277</b>	597	543	792	543	596	540	596	
<i>Eriophorum angustifolium</i>	<b>478</b>	480	<b>438</b>	480	440	480	439	480	
<i>Eriophorum russeolum</i>	<b>636</b>	636	585	636	585	635	567	635	
<i>Eriophorum vaginatum</i>	<b>1177</b>	1176	1059	1177	1059	1175	1078	1175	
<i>Trisetum spicatum</i>	<b>577</b>	578	<b>465</b>	578	471	578	541	577	
<b>Bryophyte</b>	2336	2334	2127	2339	<b>2123</b>	2337	2092	<b>2336</b>	
Acrocarpous moss	1553	1551	1358	1551	1358	1550	<b>1369</b>	<b>1550</b>	
Pleurocarpous moss	983	985	<b>834</b>	984	<b>817</b>	985	<b>894</b>	983	
<b>Lichen</b>	1254	1255	1092	1254	1093	1254	1133	1254	
Crustose	327	327	287	327	289	327	235	327	
Foliose	839	839	745	840	747	839	731	839	
Fruticose	1081	1081	959	1187	959	1081	965	1080	
<b>Standing dead</b>	3646	3649	3249	3761	3248	3647	<b>3217</b>	3647	
<b>Leaf litter</b>	<b>2942</b>	2944	<b>2697</b>	2940	<b>2695</b>	<b>2940</b>	<b>2552</b>	2942	

Precipitation predicts bryophytes

# Atqasuk Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Atqasuk Grid</b>									
Woody deciduous	<b>1289</b>	1291	1185	1290	1185	1290	1153	1290	<b>1288</b>
<i>Betula nana</i>	<b>846</b>	847	772	846	771	847	749	847	848
<i>Salix pulchra</i>	<b>582</b>	585	536	584	537	584	542	585	586
Woody evergreen	<b>1428</b>	1427	1258	1427	<b>1255</b>	1427	1287	1428	<b>1410</b>
<i>Cassiope tetragona</i>	618	619	562	619	562	615	559	618	620
<i>Ledum palustre</i>	1055	1055	926	1055	926	1054	945	1054	<b>1040</b>
<i>Vaccinium vitis-idaea</i>	<b>1047</b>	1047	944	8575	944	1046	930	1047	<b>1043</b>
<b>Forb</b>	<b>813</b>	815	733	815	<b>729</b>	813	733	814	816
<i>Rubus chamaemorus</i>	<b>518</b>	522	471	522	<b>466</b>	522	477	522	521
Graminoid	<b>2781</b>	2779	<b>2477</b>	2782	<b>2461</b>	2782	<b>2457</b>	2781	<b>2781</b>
<i>Carex aquatilis</i>	<b>1446</b>	1447	<b>1251</b>	1449	<b>1247</b>	1448	<b>1238</b>	1448	<b>1445</b>
<i>Carex bigelowii</i>	<b>277</b>	597	543	792	543	596	540	596	<b>592</b>
<i>Eriophorum angustifolium</i>	<b>478</b>	480	<b>438</b>	480	440	480	439	480	484
<i>Eriophorum russeolum</i>	<b>636</b>	636	585	636	585	635	567	635	637
<i>Eriophorum vaginatum</i>	<b>1177</b>	1176	1059	1177	1059	1175	1078	1175	<b>1169</b>
<i>Trisetum spicatum</i>	<b>577</b>	578	<b>465</b>	578	471	578	541	577	579
Bryophyte	2336	2334	2127	2339	<b>2123</b>	2337	2092	<b>2336</b>	2337
Acrocarpous moss	1553	1551	1358	1551	1358	1550	<b>1369</b>	<b>1550</b>	1554
Pleurocarpous moss	983	985	<b>834</b>	984	<b>817</b>	985	<b>894</b>	983	<b>974</b>
Lichen	1254	1255	1092	1254	1093	1254	1133	1254	<b>1241</b>
Crustose	327	327	287	327	289	327	235	327	329
Foliose	839	839	745	840	747	839	731	839	<b>837</b>
Fruticose	1081	1081	959	1187	959	1081	965	1080	<b>1069</b>
Standing dead	3646	3649	3249	3761	3248	3647	<b>3217</b>	3647	<b>3654</b>
Leaf litter	<b>2942</b>	2944	<b>2697</b>	2940	<b>2695</b>	<b>2940</b>	<b>2552</b>	2942	<b>2911</b>

Soil moisture predicts both deciduous and evergreen shrubs, graminoids, standing dead, and litter

# Utqiagvik Cover to Abiotic

Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Utqiagvik Grid</b>								
Woody deciduous								
<i>Salix pulchra</i>								
<i>Salix rotundifolia</i>								
<b>Forb</b>								
<i>Petasites frigidus</i>								
<i>Stellaria laeta</i>								
<b>Graminoid</b>								
<i>Arctagrostis latifolia</i>								
<i>Carex stans</i>								
<i>Dupontia fisheri</i>								
<i>Eriophorum russeolum</i>								
<i>Eriophorum triste</i>								
<i>Luzula arctica</i>								
<i>Luzula confusa</i>								
<i>Poa arctica</i>								
<b>Bryophyte</b>								
Acrocarpous moss								
Pleurocarpous moss								
<b>Lichen</b>								
Foliose								
Fruticose								
<b>Standing dead</b>								
Leaf litter								

# Utqiagvik Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Utqiagvik Grid</b>									
Woody deciduous	713								
<i>Salix pulchra</i>	183								
<i>Salix rotundifolia</i>	689								
<b>Forb</b>	1562								
<i>Petasites frigidus</i>	623								
<i>Stellaria laeta</i>	562								
<b>Graminoid</b>	2715								
<i>Arctagrostis latifolia</i>	567								
<i>Carex stans</i>	1820								
<i>Dupontia fisheri</i>	1516								
<i>Eriophorum russeolum</i>	1561								
<i>Eriophorum triste</i>	1408								
<i>Luzula arctica</i>	480								
<i>Luzula confusa</i>	703								
<i>Poa arctica</i>	1191								
<b>Bryophyte</b>	2978								
Acrocarpous moss	2261								
Pleurocarpous moss	2068								
<b>Lichen</b>	1203								
Foliose	863								
Fruticose	949								
<b>Standing dead</b>	3788								
<b>Leaf litter</b>	3047								

Year predicts graminoids only



# Utqiagvik Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Utqiagvik Grid</b>									
Woody deciduous	713	713							
<i>Salix pulchra</i>	183	183							
<i>Salix rotundifolia</i>	689	689							
<b>Forb</b>	1562	1563							
<i>Petasites frigidus</i>	623	622							
<i>Stellaria laeta</i>	562	562							
<b>Graminoid</b>	2715	2714							
<i>Arctagrostis latifolia</i>	567	569							
<i>Carex stans</i>	1820	1820							
<i>Dupontia fisheri</i>	1516	1514							
<i>Eriophorum russeolum</i>	1561	1560							
<i>Eriophorum triste</i>	1408	1406							
<i>Luzula arctica</i>	480	481							
<i>Luzula confusa</i>	703	703							
<i>Poa arctica</i>	1191	1188							
<b>Bryophyte</b>	2978	2976							
Acrocarpous moss	2261	2268							
Pleurocarpous moss	2068	2067							
<b>Lichen</b>	1203	1203							
Foliose	863	865							
Fruticose	949	948							
<b>Standing dead</b>	3788	3792							
<b>Leaf litter</b>	3047	3047							

# Utqiagvik Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Utqiagvik Grid</b>									
Woody deciduous	713	713	713						
<i>Salix pulchra</i>	183	183	183						
<i>Salix rotundifolia</i>	689	689	688						
<b>Forb</b>	1562	1563	1561						
<i>Petasites frigidus</i>	623	622	623						
<i>Stellaria laeta</i>	562	562	563						
<b>Graminoid</b>	2715	2714	2713						
<i>Arctagrostis latifolia</i>	567	569	568						
<i>Carex stans</i>	1820	1820	1818						
<i>Dupontia fisheri</i>	1516	1514	1514						
<i>Eriophorum russeolum</i>	1561	1560	1558						
<i>Eriophorum triste</i>	1408	1406	1409						
<i>Luzula arctica</i>	480	481	481						
<i>Luzula confusa</i>	703	703	702						
<i>Poa arctica</i>	1191	1188	1189						
<b>Bryophyte</b>	2978	2976	2980						
Acrocarpous moss	2261	2268	2263						
Pleurocarpous moss	2068	2067	2067						
<b>Lichen</b>	1203	1203	1204						
Foliose	863	865	863						
Fruticose	949	948	949						
<b>Standing dead</b>	3788	3792	3791						
<b>Leaf litter</b>	3047	3047	3049						

# Utqiagvik Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Utqiagvik Grid</b>									
Woody deciduous	713	713	713	713					
<i>Salix pulchra</i>	183	183	183	183					
<i>Salix rotundifolia</i>	689	689	688	689					
<b>Forb</b>	1562	1563	1561	1560					
<i>Petasites frigidus</i>	623	622	623	622					
<i>Stellaria laeta</i>	562	562	563	563					
<b>Graminoid</b>	2715	2714	2713	2716					
<i>Arctagrostis latifolia</i>	567	569	568	569					
<i>Carex stans</i>	1820	1820	1818	1819					
<i>Dupontia fisheri</i>	1516	1514	1514	1513					
<i>Eriophorum russeolum</i>	1561	1560	1558	1560					
<i>Eriophorum triste</i>	1408	1406	1409	1408					
<i>Luzula arctica</i>	480	481	481	481					
<i>Luzula confusa</i>	703	703	702	702					
<i>Poa arctica</i>	1191	1188	1189	1189					
<b>Bryophyte</b>	2978	2976	2980	2979					
Acrocarpous moss	2261	2268	2263	2266					
Pleurocarpous moss	2068	2067	2067	2068					
<b>Lichen</b>	1203	1203	1204	1203					
Foliose	863	865	863	864					
Fruticose	949	948	949	949					
<b>Standing dead</b>	3788	3792	3791	3790					
<b>Leaf litter</b>	3047	3047	3049	3047					

# Utqiagvik Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Utqiagvik Grid</b>									
Woody deciduous	713	713	713	713	<b>633</b>				
<i>Salix pulchra</i>	183	183	183	183	173				
<i>Salix rotundifolia</i>	689	689	688	689	614				
<b>Forb</b>	1562	1563	1561	1560	<b>1339</b>				
<i>Petasites frigidus</i>	<b>623</b>	<b>622</b>	<b>623</b>	<b>622</b>	551				
<i>Stellaria laeta</i>	562	562	563	563	498				
<b>Graminoid</b>	<b>2715</b>	2714	2713	2716	2445				
<i>Arctagrostis latifolia</i>	<b>567</b>	569	568	569	514				
<i>Carex stans</i>	1820	1820	<b>1818</b>	1819	1656				
<i>Dupontia fisheri</i>	1516	1514	1514	1513	1341				
<i>Eriophorum russeolum</i>	<b>1561</b>	1560	<b>1558</b>	1560	1356				
<i>Eriophorum triste</i>	<b>1408</b>	1406	1409	1408	1259				
<i>Luzula arctica</i>	<b>480</b>	481	481	481	<b>428</b>				
<i>Luzula confusa</i>	703	703	702	702	640				
<i>Poa arctica</i>	1191	1188	1189	1189	1044				
<b>Bryophyte</b>	2978	2976	2980	2979	<b>2620</b>				
Acrocarpous moss	<b>2261</b>	2268	<b>2263</b>	2266	<b>1800</b>				
Pleurocarpous moss	2068	2067	2067	2068	1818				
<b>Lichen</b>	1203	1203	1204	1203	1081				
Foliose	863	865	863	864	767				
Fruticose	949	948	949	949	860				
<b>Standing dead</b>	3788	3792	3791	3790	3358				
<b>Leaf litter</b>	3047	3047	3049	3047	<b>2778</b>				

# Utqiagvik Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Utqiagvik Grid</b>									
<b>Woody deciduous</b>	713	713	713	713	<b>633</b>	635			
<i>Salix pulchra</i>	183	183	183	183	173	172			
<i>Salix rotundifolia</i>	689	689	688	689	614	614			
<b>Forb</b>	1562	1563	1561	1560	<b>1339</b>	<b>1328</b>			
<i>Petasites frigidus</i>	<b>623</b>	<b>622</b>	<b>623</b>	<b>622</b>	551	550			
<i>Stellaria laeta</i>	562	562	563	563	498	497			
<b>Graminoid</b>	<b>2715</b>	2714	2713	2716	2445	2449			
<i>Arctagrostis latifolia</i>	<b>567</b>	569	568	569	514	516			
<i>Carex stans</i>	1820	1820	<b>1818</b>	1819	1656	1653			
<i>Dupontia fisheri</i>	1516	1514	1514	1513	1341	1341			
<i>Eriophorum russeolum</i>	<b>1561</b>	1560	<b>1558</b>	1560	1356	1355			
<i>Eriophorum triste</i>	<b>1408</b>	1406	1409	1408	1259	1256			
<i>Luzula arctica</i>	<b>480</b>	481	481	481	<b>428</b>	431			
<i>Luzula confusa</i>	703	703	702	702	640	634			
<i>Poa arctica</i>	1191	1188	1189	1189	1044	1046			
<b>Bryophyte</b>	2978	2976	2980	2979	<b>2620</b>	<b>2614</b>			
Acrocarpous moss	<b>2261</b>	2268	<b>2263</b>	2266	<b>1800</b>	<b>1800</b>			
Pleurocarpous moss	2068	2067	2067	2068	1818	1811			
<b>Lichen</b>	1203	1203	1204	1203	1081	1080			
Foliose	863	865	863	864	767	763			
Fruticose	949	948	949	949	860	860			
<b>Standing dead</b>	3788	3792	3791	3790	3358	3358			
<b>Leaf litter</b>	3047	3047	3049	3047	<b>2778</b>	<b>2771</b>			

Soil temperature predicts woody deciduous shrubs, forbs, bryophytes, and leaf litter

# Utqiagvik Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Utqiagvik Grid</b>									
Woody deciduous	713	713	713	713	633	635	711		
<i>Salix pulchra</i>	183	183	183	183	173	172	183		
<i>Salix rotundifolia</i>	689	689	688	689	614	614	689		
<b>Forb</b>	1562	1563	1561	1560	1339	1328	1535		
<i>Petasites frigidus</i>	623	622	623	622	551	550	625		
<i>Stellaria laeta</i>	562	562	563	563	498	497	557		
<b>Graminoid</b>	2715	2714	2713	2716	2445	2449	2721		
<i>Arctagrostis latifolia</i>	567	569	568	569	514	516	571		
<i>Carex stans</i>	1820	1820	1818	1819	1656	1653	1825		
<i>Dupontia fisheri</i>	1516	1514	1514	1513	1341	1341	1520		
<i>Eriophorum russeolum</i>	1561	1560	1558	1560	1356	1355	1565		
<i>Eriophorum triste</i>	1408	1406	1409	1408	1259	1256	1421		
<i>Luzula arctica</i>	480	481	481	481	428	431	480		
<i>Luzula confusa</i>	703	703	702	702	640	634	706		
<i>Poa arctica</i>	1191	1188	1189	1189	1044	1046	1183		
<b>Bryophyte</b>	2978	2976	2980	2979	2620	2614	2971		
Acrocarpous moss	2261	2268	2263	2266	1800	1800	2268		
Pleurocarpous moss	2068	2067	2067	2068	1818	1811	2071		
<b>Lichen</b>	1203	1203	1204	1203	1081	1080	1204		
Foliose	863	865	863	864	767	763	866		
Fruticose	949	948	949	949	860	860	948		
<b>Standing dead</b>	3788	3792	3791	3790	3358	3358	3801		
<b>Leaf litter</b>	3047	3047	3049	3047	2778	2771	3031		

Thaw depth predicts forbs, bryophytes, and leaf litter

# Utqiagvik Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Utqiagvik Grid</b>									
Woody deciduous	713	713	713	713	633	635	711	713	
<i>Salix pulchra</i>	183	183	183	183	173	172	183	182	
<i>Salix rotundifolia</i>	689	689	688	689	614	614	689	689	
<b>Forb</b>	1562	1563	1561	1560	1339	1328	1535	1562	
<i>Petasites frigidus</i>	623	622	623	622	551	550	625	622	
<i>Stellaria laeta</i>	562	562	563	563	498	497	557	562	
<b>Graminoid</b>	2715	2714	2713	2716	2445	2449	2721	2716	
<i>Arctagrostis latifolia</i>	567	569	568	569	514	516	571	569	
<i>Carex stans</i>	1820	1820	1818	1819	1656	1653	1825	1819	
<i>Dupontia fisheri</i>	1516	1514	1514	1513	1341	1341	1520	1515	
<i>Eriophorum russeolum</i>	1561	1560	1558	1560	1356	1355	1565	1561	
<i>Eriophorum triste</i>	1408	1406	1409	1408	1259	1256	1421	1411	
<i>Luzula arctica</i>	480	481	481	481	428	431	480	481	
<i>Luzula confusa</i>	703	703	702	702	640	634	706	702	
<i>Poa arctica</i>	1191	1188	1189	1189	1044	1046	1183	1189	
<b>Bryophyte</b>	2978	2976	2980	2979	2620	2614	2971	2976	
Acrocarpous moss	2261	2268	2263	2266	1800	1800	2268	2264	
Pleurocarpous moss	2068	2067	2067	2068	1818	1811	2071	2065	
<b>Lichen</b>	1203	1203	1204	1203	1081	1080	1204	1203	
Foliose	863	865	863	864	767	763	866	863	
Fruticose	949	948	949	949	860	860	948	950	
<b>Standing dead</b>	3788	3792	3791	3790	3358	3358	3801	3789	
<b>Leaf litter</b>	3047	3047	3049	3047	2778	2771	3031	3049	

# Utqiagvik Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Utqiagvik Grid</b>									
Woody deciduous	713	713	713	713	633	635	711	713	712
<i>Salix pulchra</i>	183	183	183	183	173	172	183	182	183
<i>Salix rotundifolia</i>	689	689	688	689	614	614	689	689	690
<b>Forb</b>	1562	1563	1561	1560	1339	1328	1535	1562	1566
<i>Petasites frigidus</i>	623	622	623	622	551	550	625	622	622
<i>Stellaria laeta</i>	562	562	563	563	498	497	557	562	561
<b>Graminoid</b>	2715	2714	2713	2716	2445	2449	2721	2716	2721
<i>Arctagrostis latifolia</i>	567	569	568	569	514	516	571	569	570
<i>Carex stans</i>	1820	1820	1818	1819	1656	1653	1825	1819	1822
<i>Dupontia fisheri</i>	1516	1514	1514	1513	1341	1341	1520	1515	1515
<i>Eriophorum russeolum</i>	1561	1560	1558	1560	1356	1355	1565	1561	1566
<i>Eriophorum triste</i>	1408	1406	1409	1408	1259	1256	1421	1411	1414
<i>Luzula arctica</i>	480	481	481	481	428	431	480	481	476
<i>Luzula confusa</i>	703	703	702	702	640	634	706	702	706
<i>Poa arctica</i>	1191	1188	1189	1189	1044	1046	1183	1189	1186
<b>Bryophyte</b>	2978	2976	2980	2979	2620	2614	2971	2976	2985
Acrocarpous moss	2261	2268	2263	2266	1800	1800	2268	2264	2276
Pleurocarpous moss	2068	2067	2067	2068	1818	1811	2071	2065	2075
<b>Lichen</b>	1203	1203	1204	1203	1081	1080	1204	1203	1204
Foliose	863	865	863	864	767	763	866	863	868
Fruticose	949	948	949	949	860	860	948	950	950
<b>Standing dead</b>	3788	3792	3791	3790	3358	3358	3801	3789	3794
<b>Leaf litter</b>	3047	3047	3049	3047	2778	2771	3031	3049	3048

Soil moisture predicts standing dead and leaf litter











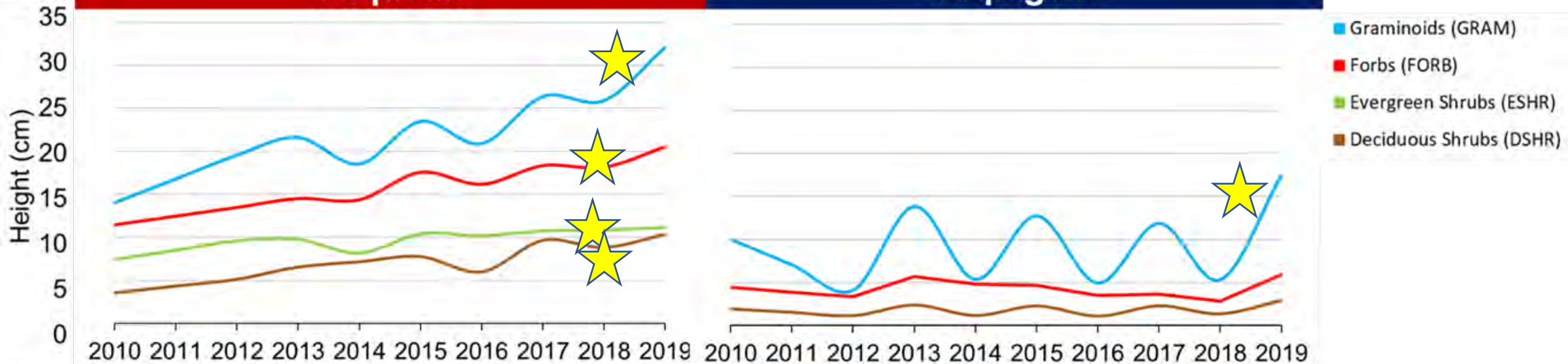


# Diversity

	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Atqasuk Grid</b>										
<i>Alpha</i>	5.77 (2.14)	5.53 (2.08)	5.63 (2.03)	5.83 (2.02)	6.30 (1.84)	5.13 (1.74)	6.00 (2.20)	6.07 (2.30)	5.70 (1.84)	0.00
<i>Beta</i>	0.22 (0.08)	0.22 (0.08)	0.23 (0.08)	0.23 (0.08)	0.25 (0.07)	0.21 (0.07)	0.23 (0.08)	0.23 (0.09)	0.26 (0.08)	0.21
<i>Gamma</i>	26	25	25	25	25	24	26	26	22	0.19
<b>Shannon</b>	<b>1.34 (0.45)</b>	<b>1.27 (0.41)</b>	<b>1.27 (0.41)</b>	<b>1.29 (0.44)</b>	<b>1.29 (0.38)</b>	<b>1.20 (0.41)</b>	<b>1.27 (0.39)</b>	<b>1.21 (0.44)</b>	<b>1.23 (0.39)</b>	<b>0.87</b>
<b>Evenness</b>	<b>0.81 (0.12)</b>	<b>0.79 (0.11)</b>	<b>0.79 (0.12)</b>	<b>0.76 (0.17)</b>	<b>0.72 (0.15)</b>	<b>0.77 (0.12)</b>	<b>0.75 (0.13)</b>	<b>0.70 (0.19)</b>	<b>0.72 (0.13)</b>	<b>0.72</b>
<b>Utqiagvik Grid</b>										
<i>Alpha</i>	7.30 (2.51)	6.77 (2.31)	8.13 (2.62)	7.23 (2.67)	7.60 (2.59)	6.63 (2.63)	7.93 (3.02)	6.43 (2.34)	7.33 (2.51)	0.02
<i>Beta</i>	0.25 (0.09)	0.27 (0.09)	0.27 (0.09)	0.27 (0.10)	0.24 (0.08)	0.24 (0.09)	0.26 (0.10)	0.25 (0.09)	0.25 (0.09)	0.11
<i>Gamma</i>	29	25	30	27	32	28	30	26	29	0.00
<b>Shannon</b>	<b>1.42 (0.45)</b>	<b>1.30 (0.37)</b>	<b>1.41 (0.39)</b>	<b>1.36 (0.39)</b>	<b>1.30 (0.35)</b>	<b>1.24 (0.36)</b>	<b>1.30 (0.33)</b>	<b>1.23 (0.34)</b>	<b>1.28 (0.32)</b>	<b>0.56</b>
<b>Evenness</b>	<b>0.72 (0.15)</b>	<b>0.70 (0.13)</b>	<b>0.68 (0.11)</b>	<b>0.71 (0.11)</b>	<b>0.66 (0.14)</b>	<b>0.68 (0.13)</b>	<b>0.65 (0.10)</b>	<b>0.68 (0.12)</b>	<b>0.67 (0.12)</b>	<b>0.49</b>

## Atqasuk

## Utqiagvik







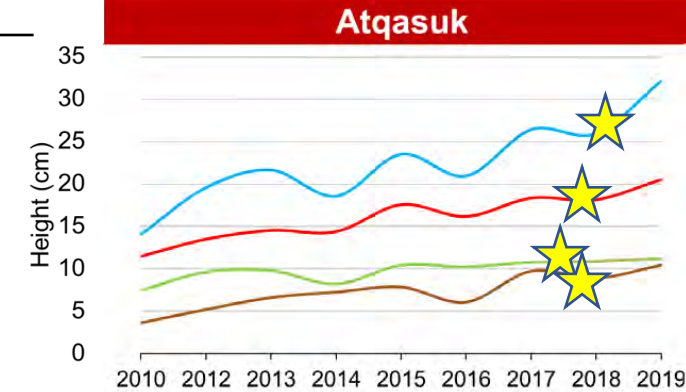
# Height

	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Atqasuk Grid</b>											
<b>Woody deciduous</b>	28										
<i>Betula nana</i>	12										
<i>Salix pulchra</i>	7										
<b>Woody evergreen</b>	19										
<i>Cassiope tetragona</i>	8										
<i>Ledum palustre</i>	17										
<i>V. vitis-idaea</i>	19										
<b>Forb</b>	21										
<i>Rubus chamaemorus</i>	8										
<b>Graminoid</b>	15										
<i>Carex aquatilis</i>	17										
<i>Carex bigelowii</i>	9										
<i>E. russeolum</i>	6										
<i>E. vaginatum</i>	14										
<i>Trisetum spicatum</i>	4										

Notice variable number of plots

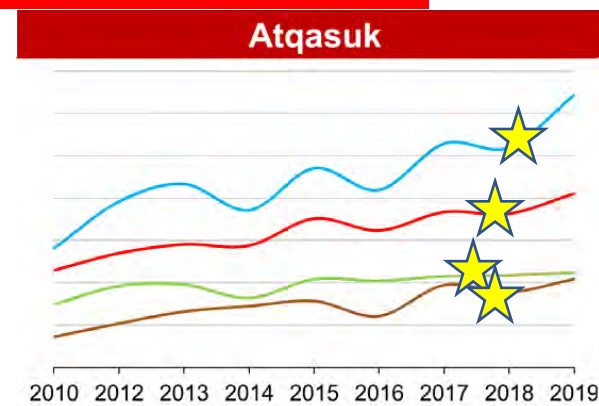
# Height

	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Atqasuk Grid</b>											
<b>Woody deciduous</b>	28	11.5 (6.0)	13.5 (6.0)	14.5 (7.8)	14.4 (7.3)	17.6 (8.1)	16.2 (6.6)	18.4 (7.2)	18.2 (8.1)	20.5 (9.7)	
<i>Betula nana</i>	12	12.5 (6.6)	15.6 (6.0)	16.6 (8.3)	16.0 (8.0)	18.5 (8.2)	17.0 (7.3)	19.1 (7.9)	18.9 (8.3)	20.3 (8.9)	
<i>Salix pulchra</i>	7	9.3 (3.3)	9.0 (2.2)	11.3 (4.2)	11.3 (3.5)	14.8 (6.7)	14.8 (3.9)	17.0 (4.8)	16.3 (6.6)	22.0 (10.5)	
<b>Woody evergreen</b>	19	7.4 (5.0)	9.6 (4.2)	9.8 (6.0)	8.2 (5.6)	10.4 (7.0)	10.2 (5.0)	10.8 (4.3)	10.9 (5.8)	11.2 (4.5)	
<i>Cassiope tetragona</i>	8	7.0 (4.8)	7.7 (3.7)	8.6 (5.9)	8.1 (7.7)	8.6 (5.2)	8.8 (4.1)	9.2 (3.5)	9.2 (5.7)	10.5 (7.3)	
<i>Ledum palustre</i>	17	6.9 (4.6)	8.6 (4.6)	9.7 (6.3)	6.7 (4.3)	8.5 (4.8)	9.9 (5.2)	10.2 (4.6)	11.4 (6.0)	10.5 (3.2)	
<i>V. vitis-idaea</i>	19	2.1 (3.5)	5.9 (3.4)	5.1 (3.6)	5.1 (3.0)	6.9 (7.1)	5.7 (3.7)	6.5 (3.9)	6.5 (4.4)	8.3 (3.0)	
<b>Forb</b>	21	3.6 (1.4)	5.2 (3.1)	6.6 (5.5)	7.2 (4.1)	7.8 (4.8)	6.0 (3.5)	9.7 (3.8)	8.9 (3.9)	10.4 (3.7)	
<i>Rubus chamaemorus</i>	8	3.7 (1.6)	5.0 (3.2)	5.1 (3.6)	5.5 (1.8)	8.0 (4.2)	6.1 (3.5)	8.9 (1.8)	8.8 (3.8)	10.8 (3.6)	
<b>Graminoid</b>	15	14.0 (5.2)	19.6 (7.3)	21.6 (8.6)	18.5 (6.8)	23.5 (8.7)	20.9 (8.3)	26.4 (9.1)	25.9 (9.8)	32.1 (10.8)	
<i>Carex aquatilis</i>	17	15.6 (4.5)	22.1 (7.3)	23.1 (8.0)	21.0 (6.1)	25.6 (7.8)	25.3 (7.8)	30.3 (8.6)	30.0 (9.3)	35.8 (10.4)	
<i>Carex bigelowii</i>	9	11.3 (6.0)	13.8 (7.6)	15.2 (6.9)	13.1 (6.1)	16.5 (8.5)	14.6 (3.2)	19.9 (7.9)	18.3 (6.8)	23.3 (10.9)	
<i>E. russeolum</i>	6	9.6 (3.7)	13.6 (5.9)	20.1 (3.7)	19.4 (6.4)	22.5 (6.3)	18.6 (5.4)	26.0 (4.5)	24.8 (7.0)	28.8 (7.6)	
<i>E. vaginatum</i>	14	9.5 (3.7)	14.4 (7.1)	17.7 (9.3)	13.7 (5.8)	19.1 (7.5)	14.5 (6.0)	18.4 (7.8)	19.6 (6.7)	25.5 (10.0)	
<i>Trisetum spicatum</i>	4	9.3 (3.0)	14.2 (3.8)	14.6 (4.7)	13.2 (3.1)	13.8 (5.3)	14.1 (4.2)	19.1 (2.3)	17.8 (3.9)	21.6 (9.1)	



# Height

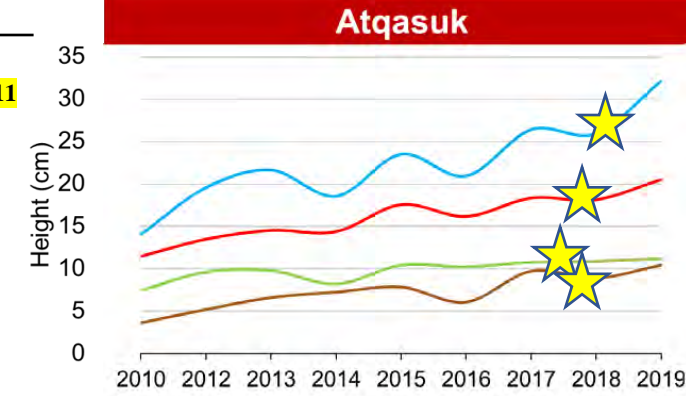
	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup> ★
<b>Atqasuk Grid</b>											
<b>Woody deciduous</b>	28	11.5 (6.0)	13.5 (6.0)	14.5 (7.8)	14.4 (7.3)	17.6 (8.1)	16.2 (6.6)	18.4 (7.2)	18.2 (8.1)	20.5 (9.7)	0.11
<i>Betula nana</i>	12	12.5 (6.6)	15.6 (6.0)	16.6 (8.3)	16.0 (8.0)	18.5 (8.2)	17.0 (7.3)	19.1 (7.9)	18.9 (8.3)	20.3 (8.9)	0.07
<i>Salix pulchra</i>	7	9.3 (3.3)	9.0 (2.2)	11.3 (4.2)	11.3 (3.5)	14.8 (6.7)	14.8 (3.9)	17.0 (4.8)	16.3 (6.6)	22.0 (10.5)	0.31
<b>Woody evergreen</b>	19	7.4 (5.0)	9.6 (4.2)	9.8 (6.0)	8.2 (5.6)	10.4 (7.0)	10.2 (5.0)	10.8 (4.3)	10.9 (5.8)	11.2 (4.5)	0.04
<i>Cassiope tetragona</i>	8	7.0 (4.8)	7.7 (3.7)	8.6 (5.9)	8.1 (7.7)	8.6 (5.2)	8.8 (4.1)	9.2 (3.5)	9.2 (5.7)	10.5 (7.3)	0.03
<i>Ledum palustre</i>	17	6.9 (4.6)	8.6 (4.6)	9.7 (6.3)	6.7 (4.3)	8.5 (4.8)	9.9 (5.2)	10.2 (4.6)	11.4 (6.0)	10.5 (3.2)	0.05
<i>V. vitis-idaea</i>	19	2.1 (3.5)	5.9 (3.4)	5.1 (3.6)	5.1 (3.0)	6.9 (7.1)	5.7 (3.7)	6.5 (3.9)	6.5 (4.4)	8.3 (3.0)	0.10
<b>Forb</b>	21	3.6 (1.4)	5.2 (3.1)	6.6 (5.5)	7.2 (4.1)	7.8 (4.8)	6.0 (3.5)	9.7 (3.8)	8.9 (3.9)	10.4 (3.7)	0.19
<i>Rubus chamaemorus</i>	8	3.7 (1.6)	5.0 (3.2)	5.1 (3.6)	5.5 (1.8)	8.0 (4.2)	6.1 (3.5)	8.9 (1.8)	8.8 (3.8)	10.8 (3.6)	0.30
<b>Graminoid</b>	15	14.0 (5.2)	19.6 (7.3)	21.6 (8.6)	18.5 (6.8)	23.5 (8.7)	20.9 (8.3)	26.4 (9.1)	25.9 (9.8)	32.1 (10.8)	0.21
<i>Carex aquatilis</i>	17	15.6 (4.5)	22.1 (7.3)	23.1 (8.0)	21.0 (6.1)	25.6 (7.8)	25.3 (7.8)	30.3 (8.6)	30.0 (9.3)	35.8 (10.4)	0.31
<i>Carex bigelowii</i>	9	11.3 (6.0)	13.8 (7.6)	15.2 (6.9)	13.1 (6.1)	16.5 (8.5)	14.6 (3.2)	19.9 (7.9)	18.3 (6.8)	23.3 (10.9)	0.15
<i>E. russeolum</i>	6	9.6 (3.7)	13.6 (5.9)	20.1 (3.7)	19.4 (6.4)	22.5 (6.3)	18.6 (5.4)	26.0 (4.5)	24.8 (7.0)	28.8 (7.6)	0.44
<i>E. vaginatum</i>	14	9.5 (3.7)	14.4 (7.1)	17.7 (9.3)	13.7 (5.8)	19.1 (7.5)	14.5 (6.0)	18.4 (7.8)	19.6 (6.7)	25.5 (10.0)	0.18
<i>Trisetum spicatum</i>	4	9.3 (3.0)	14.2 (3.8)	14.6 (4.7)	13.2 (3.1)	13.8 (5.3)	14.1 (4.2)	19.1 (2.3)	17.8 (3.9)	21.6 (9.1)	0.30



Marginal r<sup>2</sup> reported

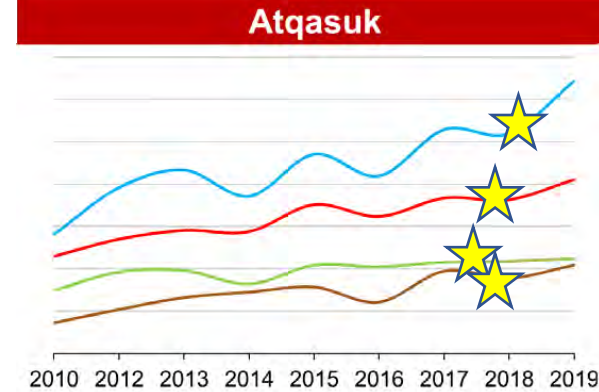
# Height

	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Atqasuk Grid</b>											
★ <b>Woody deciduous</b>	28	11.5 (6.0)	13.5 (6.0)	14.5 (7.8)	14.4 (7.3)	17.6 (8.1)	16.2 (6.6)	18.4 (7.2)	18.2 (8.1)	20.5 (9.7)	0.11
<i>Betula nana</i>											
<i>Salix pulchra</i>											
<b>Woody evergreen</b>											
<i>Cassiope tetragona</i>											
<i>Ledum palustre</i>											
<i>V. vitis-idaea</i>											
<b>Forb</b>											
<i>Rubus chamaemorus</i>											
<b>Graminoid</b>											
<i>Carex aquatilis</i>											
<i>Carex bigelowii</i>											
<i>E. russeolum</i>											
<i>E. vaginatum</i>											
<i>Trisetum spicatum</i>											



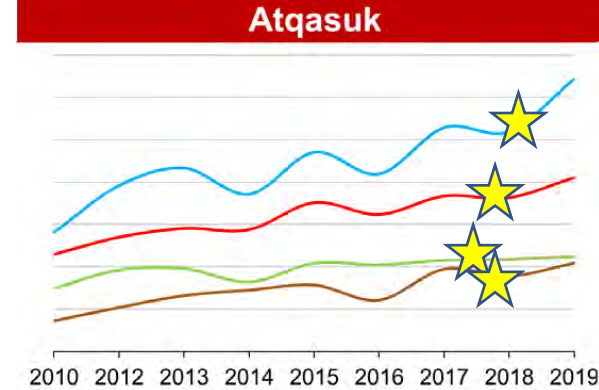
# Height

	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Atqasuk Grid</b>											
★ <b>Woody deciduous</b>	28	11.5 (6.0)	13.5 (6.0)	14.5 (7.8)	14.4 (7.3)	17.6 (8.1)	16.2 (6.6)	18.4 (7.2)	18.2 (8.1)	20.5 (9.7)	0.11
<i>Betula nana</i>	12	12.5 (6.6)	15.6 (6.0)	16.6 (8.3)	16.0 (8.0)	18.5 (8.2)	17.0 (7.3)	19.1 (7.9)	18.9 (8.3)	20.3 (8.9)	0.07
★ <i>Salix pulchra</i>	7	9.3 (3.3)	9.0 (2.2)	11.3 (4.2)	11.3 (3.5)	14.8 (6.7)	14.8 (3.9)	17.0 (4.8)	16.3 (6.6)	22.0 (10.5)	0.31
★ <b>Woody evergreen</b>	19	7.4 (5.0)	9.6 (4.2)	9.8 (6.0)	8.2 (5.6)	10.4 (7.0)	10.2 (5.0)	10.8 (4.3)	10.9 (5.8)	11.2 (4.5)	0.04
<i>Cassiope tetragona</i>											
<i>Ledum palustre</i>											
<i>V. vitis-idaea</i>											
<b>Forb</b>											
<i>Rubus chamaemorus</i>											
<b>Graminoid</b>											
<i>Carex aquatilis</i>											
<i>Carex bigelowii</i>											
<i>E. russeolum</i>											
<i>E. vaginatum</i>											
<i>Trisetum spicatum</i>											



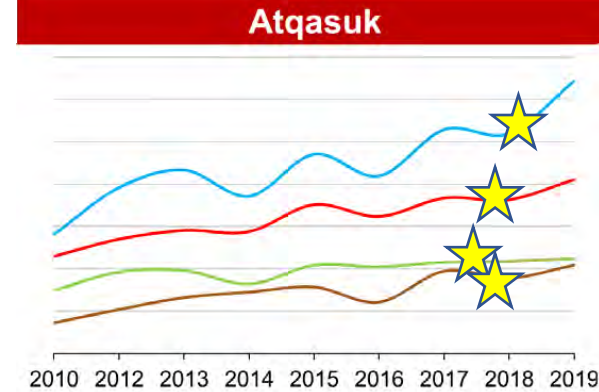
# Height

	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Atqasuk Grid</b>											
★ <b>Woody deciduous</b>	28	11.5 (6.0)	13.5 (6.0)	14.5 (7.8)	14.4 (7.3)	17.6 (8.1)	16.2 (6.6)	18.4 (7.2)	18.2 (8.1)	20.5 (9.7)	0.11
<i>Betula nana</i>	12	12.5 (6.6)	15.6 (6.0)	16.6 (8.3)	16.0 (8.0)	18.5 (8.2)	17.0 (7.3)	19.1 (7.9)	18.9 (8.3)	20.3 (8.9)	0.07
★ <b>Salix pulchra</b>	7	9.3 (3.3)	9.0 (2.2)	11.3 (4.2)	11.3 (3.5)	14.8 (6.7)	14.8 (3.9)	17.0 (4.8)	16.3 (6.6)	22.0 (10.5)	0.31
★ <b>Woody evergreen</b>	19	7.4 (5.0)	9.6 (4.2)	9.8 (6.0)	8.2 (5.6)	10.4 (7.0)	10.2 (5.0)	10.8 (4.3)	10.9 (5.8)	11.2 (4.5)	0.04
<i>Cassiope tetragona</i>	8	7.0 (4.8)	7.7 (3.7)	8.6 (5.9)	8.1 (7.7)	8.6 (5.2)	8.8 (4.1)	9.2 (3.5)	9.2 (5.7)	10.5 (7.3)	0.03
★ <i>Ledum palustre</i>	17	6.9 (4.6)	8.6 (4.6)	9.7 (6.3)	6.7 (4.3)	8.5 (4.8)	9.9 (5.2)	10.2 (4.6)	11.4 (6.0)	10.5 (3.2)	0.05
★ <i>V. vitis-idaea</i>	19	2.1 (3.5)	5.9 (3.4)	5.1 (3.6)	5.1 (3.0)	6.9 (7.1)	5.7 (3.7)	6.5 (3.9)	6.5 (4.4)	8.3 (3.0)	0.10
★ <b>Forb</b>	21	3.6 (1.4)	5.2 (3.1)	6.6 (5.5)	7.2 (4.1)	7.8 (4.8)	6.0 (3.5)	9.7 (3.8)	8.9 (3.9)	10.4 (3.7)	0.19
<i>Rubus chamaemorus</i>											
<b>Graminoid</b>											
<i>Carex aquatilis</i>											
<i>Carex bigelowii</i>											
<i>E. russeolum</i>											
<i>E. vaginatum</i>											
<i>Trisetum spicatum</i>											



# Height

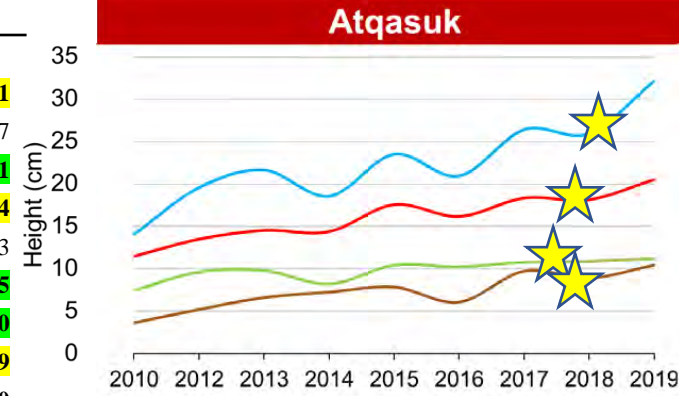
	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Atqasuk Grid</b>											
★ <b>Woody deciduous</b>	28	11.5 (6.0)	13.5 (6.0)	14.5 (7.8)	14.4 (7.3)	17.6 (8.1)	16.2 (6.6)	18.4 (7.2)	18.2 (8.1)	20.5 (9.7)	0.11
<i>Betula nana</i>	12	12.5 (6.6)	15.6 (6.0)	16.6 (8.3)	16.0 (8.0)	18.5 (8.2)	17.0 (7.3)	19.1 (7.9)	18.9 (8.3)	20.3 (8.9)	0.07
★ <i>Salix pulchra</i>	7	9.3 (3.3)	9.0 (2.2)	11.3 (4.2)	11.3 (3.5)	14.8 (6.7)	14.8 (3.9)	17.0 (4.8)	16.3 (6.6)	22.0 (10.5)	0.31
★ <b>Woody evergreen</b>	19	7.4 (5.0)	9.6 (4.2)	9.8 (6.0)	8.2 (5.6)	10.4 (7.0)	10.2 (5.0)	10.8 (4.3)	10.9 (5.8)	11.2 (4.5)	0.04
<i>Cassiope tetragona</i>	8	7.0 (4.8)	7.7 (3.7)	8.6 (5.9)	8.1 (7.7)	8.6 (5.2)	8.8 (4.1)	9.2 (3.5)	9.2 (5.7)	10.5 (7.3)	0.03
★ <i>Ledum palustre</i>	17	6.9 (4.6)	8.6 (4.6)	9.7 (6.3)	6.7 (4.3)	8.5 (4.8)	9.9 (5.2)	10.2 (4.6)	11.4 (6.0)	10.5 (3.2)	0.05
★ <i>V. vitis-idaea</i>	19	2.1 (3.5)	5.9 (3.4)	5.1 (3.6)	5.1 (3.0)	6.9 (7.1)	5.7 (3.7)	6.5 (3.9)	6.5 (4.4)	8.3 (3.0)	0.10
★ <b>Forb</b>	21	3.6 (1.4)	5.2 (3.1)	6.6 (5.5)	7.2 (4.1)	7.8 (4.8)	6.0 (3.5)	9.7 (3.8)	8.9 (3.9)	10.4 (3.7)	0.19
<i>Rubus chamaemorus</i>	8	3.7 (1.6)	5.0 (3.2)	5.1 (3.6)	5.5 (1.8)	8.0 (4.2)	6.1 (3.5)	8.9 (1.8)	8.8 (3.8)	10.8 (3.6)	0.30
★ <b>Graminoid</b>	15	14.0 (5.2)	19.6 (7.3)	21.6 (8.6)	18.5 (6.8)	23.5 (8.7)	20.9 (8.3)	26.4 (9.1)	25.9 (9.8)	32.1 (10.8)	0.21
<i>Carex aquatilis</i>	17	15.6 (4.5)	22.1 (7.3)	23.1 (8.0)	21.0 (6.1)	25.6 (7.8)	25.3 (7.8)	30.3 (8.6)	30.0 (9.3)	35.8 (10.4)	0.31
<i>Carex bigelowii</i>	9	11.3 (6.0)	13.8 (7.6)	15.2 (6.9)	13.1 (6.1)	16.5 (8.5)	14.6 (3.2)	19.9 (7.9)	18.3 (6.8)	23.3 (10.9)	0.15
<i>E. russeolum</i>	6	9.6 (3.7)	13.6 (5.9)	20.1 (3.7)	19.4 (6.4)	22.5 (6.3)	18.6 (5.4)	26.0 (4.5)	24.8 (7.0)	28.8 (7.6)	0.44
<i>E. vaginatum</i>	14	9.5 (3.7)	14.4 (7.1)	17.7 (9.3)	13.7 (5.8)	19.1 (7.5)	14.5 (6.0)	18.4 (7.8)	19.6 (6.7)	25.5 (10.0)	0.18
<i>Trisetum spicatum</i>	4	9.3 (3.0)	14.2 (3.8)	14.6 (4.7)	13.2 (3.1)	13.8 (5.3)	14.1 (4.2)	19.1 (2.3)	17.8 (3.9)	21.6 (9.1)	0.30



All functional groups changed significantly over time

# Height

	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Atqasuk Grid</b>											
<b>Woody deciduous</b>	28	11.5 (6.0)	13.5 (6.0)	14.5 (7.8)	14.4 (7.3)	17.6 (8.1)	16.2 (6.6)	18.4 (7.2)	18.2 (8.1)	20.5 (9.7)	0.11
<i>Betula nana</i>	12	12.5 (6.6)	15.6 (6.0)	16.6 (8.3)	16.0 (8.0)	18.5 (8.2)	17.0 (7.3)	19.1 (7.9)	18.9 (8.3)	20.3 (8.9)	0.07
<i>Salix pulchra</i>	7	9.3 (3.3)	9.0 (2.2)	11.3 (4.2)	11.3 (3.5)	14.8 (6.7)	14.8 (3.9)	17.0 (4.8)	16.3 (6.6)	22.0 (10.5)	0.31
<b>Woody evergreen</b>	19	7.4 (5.0)	9.6 (4.2)	9.8 (6.0)	8.2 (5.6)	10.4 (7.0)	10.2 (5.0)	10.8 (4.3)	10.9 (5.8)	11.2 (4.5)	0.04
<i>Cassiope tetragona</i>	8	7.0 (4.8)	7.7 (3.7)	8.6 (5.9)	8.1 (7.7)	8.6 (5.2)	8.8 (4.1)	9.2 (3.5)	9.2 (5.7)	10.5 (7.3)	0.03
<i>Ledum palustre</i>	17	6.9 (4.6)	8.6 (4.6)	9.7 (6.3)	6.7 (4.3)	8.5 (4.8)	9.9 (5.2)	10.2 (4.6)	11.4 (6.0)	10.5 (3.2)	0.05
<i>V. vitis-idaea</i>	19	2.1 (3.5)	5.9 (3.4)	5.1 (3.6)	5.1 (3.0)	6.9 (7.1)	5.7 (3.7)	6.5 (3.9)	6.5 (4.4)	8.3 (3.0)	0.10
<b>Forb</b>	21	3.6 (1.4)	5.2 (3.1)	6.6 (5.5)	7.2 (4.1)	7.8 (4.8)	6.0 (3.5)	9.7 (3.8)	8.9 (3.9)	10.4 (3.7)	0.19
<i>Rubus chamaemorus</i>	8	3.7 (1.6)	5.0 (3.2)	5.1 (3.6)	5.5 (1.8)	8.0 (4.2)	6.1 (3.5)	8.9 (1.8)	8.8 (3.8)	10.8 (3.6)	0.30
<b>Graminoid</b>	15	14.0 (5.2)	19.6 (7.3)	21.6 (8.6)	18.5 (6.8)	23.5 (8.7)	20.9 (8.3)	26.4 (9.1)	25.9 (9.8)	32.1 (10.8)	0.21
<i>Carex aquatilis</i>	17	15.6 (4.5)	22.1 (7.3)	23.1 (8.0)	21.0 (6.1)	25.6 (7.8)	25.3 (7.8)	30.3 (8.6)	30.0 (9.3)	35.8 (10.4)	0.31
<i>Carex bigelowii</i>	9	11.3 (6.0)	13.8 (7.6)	15.2 (6.9)	13.1 (6.1)	16.5 (8.5)	14.6 (3.2)	19.9 (7.9)	18.3 (6.8)	23.3 (10.9)	0.15
<i>E. russeolum</i>	6	9.6 (3.7)	13.6 (5.9)	20.1 (3.7)	19.4 (6.4)	22.5 (6.3)	18.6 (5.4)	26.0 (4.5)	24.8 (7.0)	28.8 (7.6)	0.44
<i>E. vaginatum</i>	14	9.5 (3.7)	14.4 (7.1)	17.7 (9.3)	13.7 (5.8)	19.1 (7.5)	14.5 (6.0)	18.4 (7.8)	19.6 (6.7)	25.5 (10.0)	0.18
<i>Trisetum spicatum</i>	4	9.3 (3.0)	14.2 (3.8)	14.6 (4.7)	13.2 (3.1)	13.8 (5.3)	14.1 (4.2)	19.1 (2.3)	17.8 (3.9)	21.6 (9.1)	0.30



Seven species changed significantly over time





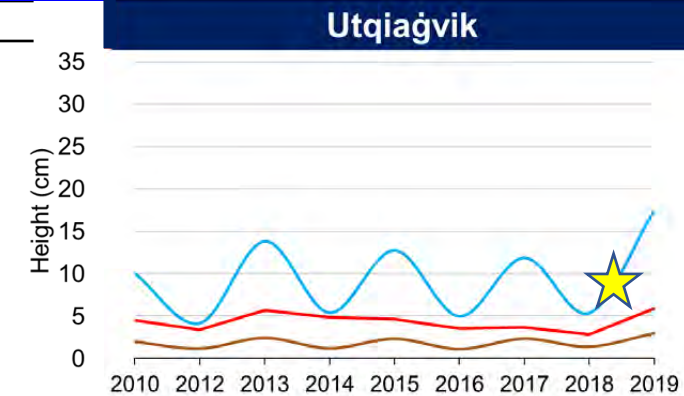
# Height

	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
★ Utqiagvik Grid											
Woody deciduous	28										
<i>Salix pulchra</i>	2										
<i>Salix rotundifolia</i>	7										
Forb	10										
<i>Petasites frigidus</i>	7										
<i>Saxifraga cernua</i>	4										
<i>Stellaria laeta</i>	4										
Graminoid	22										
<i>Arctagrostis latifolia</i>	4										
<i>Carex stans</i>	23										
<i>Dupontia fisheri</i>	16										
<i>E. russeolum</i>	14										
<i>E. triste</i>	9										
<i>Luzula arctica</i>	3										
<i>Luzula confusa</i>	8										
<i>Poa arctica</i>	13										

Notice variable number of plots

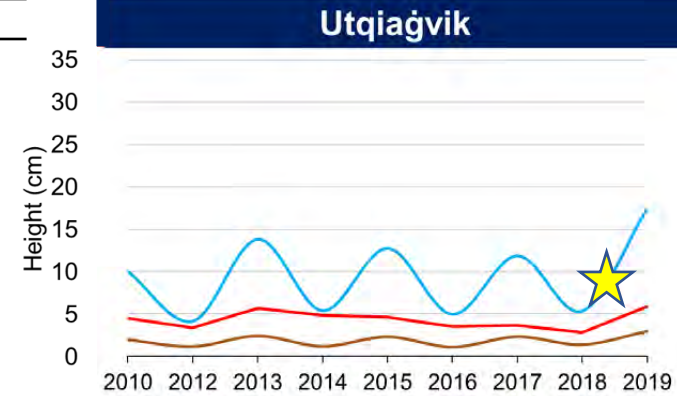
# Height

	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Utqiagvik Grid</b>											
<b>Woody deciduous</b>	28	2.0 (1.2)	2.4 (1.2)	2.3 (1.1)	2.3 (1.4)	2.9 (2.4)	2.9 (1.3)	3.9 (2.7)	2.9 (1.4)	3.0 (1.9)	
<i>Salix pulchra</i>	2	3.5 (1.1)	3.9 (1.3)	3.5 (0.9)	2.6 (0.8)	5.0 (3.6)	4.7 (0.5)	3.8 (2.4)	4.2 (1.4)	3.9 (1.5)	
<i>Salix rotundifolia</i>	7	1.6 (0.7)	2.0 (0.6)	2.0 (0.9)	2.2 (1.5)	2.2 (1.7)	2.5 (0.8)	3.6 (2.8)	2.5 (1.0)	2.7 (1.9)	
<b>Forb</b>	10	4.5 (3.4)	5.7 (4.8)	4.6 (3.5)	3.6 (2.8)	5.9 (3.9)	5.6 (3.9)	6.4 (4.3)	5.4 (3.7)	8.3 (5.4)	
<i>Petasites frigidus</i>	7	3.8 (2.6)	7.3 (6.1)	5.4 (3.8)	5.4 (3.5)	6.6 (4.6)	5.2 (4.2)	6.3 (4.5)	6.8 (4.1)	9.7 (6.5)	
<i>Saxifraga cernua</i>	4	<b>0.9 (0.5)</b>	<b>4.7 (4.4)</b>	<b>1.5 (1.2)</b>	<b>1.0 (1.3)</b>	<b>2.8 (1.2)</b>	<b>3.8 (2.5)</b>	<b>2.8 (0.7)</b>	<b>4.0 (0.4)</b>	<b>4.2 (1.4)</b>	
<i>Stellaria laeta</i>	4	2.8 (0.8)	4.9 (2.3)	3.7 (1.8)	3.7 (1.6)	5.4 (1.1)	3.5 (1.3)	5.1 (2.4)	3.7 (1.9)	5.6 (3.4)	
<b>Graminoid</b>	22	<b>10.0 (4.1)</b>	<b>13.8 (5.4)</b>	<b>12.7 (4.9)</b>	<b>11.9 (5.3)</b>	<b>17.4 (6.2)</b>	<b>15.1 (4.9)</b>	<b>18.8 (7.4)</b>	<b>17.1 (8.0)</b>	<b>23.1 (8.3)</b>	
<i>Arctagrostis latifolia</i>	4	7.2 (0.9)	7.3 (1.8)	7.5 (2.8)	7.1 (1.7)	8.4 (1.7)	9.8 (4.1)	12.5 (4.9)	11.5 (5.3)	13.8 (10.4)	
<i>Carex stans</i>	23	<b>10.2 (4.4)</b>	<b>14.2 (5.1)</b>	<b>12.8 (4.5)</b>	<b>12.0 (5.8)</b>	<b>16.2 (5.4)</b>	<b>15.1 (5.3)</b>	<b>19.1 (8.1)</b>	<b>17.3 (9.1)</b>	<b>22.8 (7.7)</b>	
<i>Dupontia fisheri</i>	16	<b>8.6 (3.2)</b>	<b>11.5 (5.2)</b>	<b>11.2 (3.7)</b>	<b>9.3 (3.9)</b>	<b>17.8 (5.9)</b>	<b>12.8 (4.2)</b>	<b>16.7 (5.3)</b>	<b>15.2 (4.0)</b>	<b>20.2 (7.0)</b>	
<i>E. russeolum</i>	14	<b>6.9 (2.0)</b>	<b>11.2 (3.5)</b>	<b>10.6 (3.5)</b>	<b>9.2 (2.7)</b>	<b>13.2 (3.0)</b>	<b>12.3 (2.2)</b>	<b>14.6 (3.3)</b>	<b>14.9 (4.5)</b>	<b>17.6 (4.5)</b>	
<i>E. triste</i>	9	<b>5.7 (2.9)</b>	<b>10.4 (4.2)</b>	<b>9.6 (4.9)</b>	<b>9.5 (1.5)</b>	<b>14.3 (5.0)</b>	<b>10.5 (2.8)</b>	<b>14.3 (3.8)</b>	<b>14.0 (4.7)</b>	<b>17.9 (5.0)</b>	
<i>Luzula arctica</i>	3	4.1 (1.2)	9.7 (4.2)	6.4 (2.7)	4.4 (0.4)	5.5 (5.1)	8.3 (2.2)	9.3 (3.2)	3.8 (3.4)	5.8 (2.9)	
<i>Luzula confusa</i>	8	<b>2.9 (1.2)</b>	<b>5.6 (2.1)</b>	<b>5.2 (2.6)</b>	<b>3.8 (1.6)</b>	<b>5.7 (3.6)</b>	<b>7.8 (3.1)</b>	<b>6.6 (3.7)</b>	<b>5.6 (2.8)</b>	<b>6.7 (3.3)</b>	
<i>Poa arctica</i>	13	<b>4.3 (1.8)</b>	<b>6.7 (4.1)</b>	<b>5.8 (3.3)</b>	<b>3.6 (2.2)</b>	<b>6.8 (2.9)</b>	<b>7.2 (4.4)</b>	<b>8.2 (3.5)</b>	<b>5.7 (3.0)</b>	<b>10.7 (6.4)</b>	



# Height

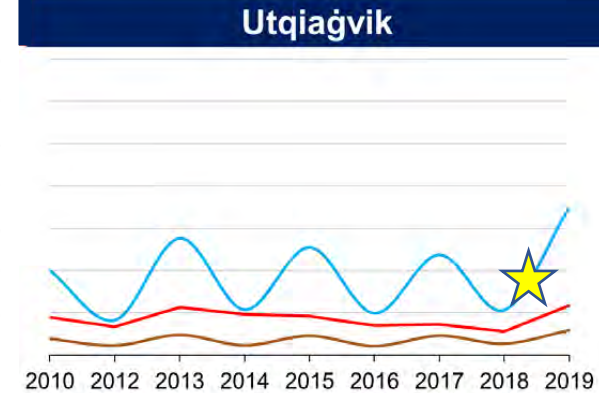
	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Utqiagvik Grid</b>											
Woody deciduous	28	2.0 (1.2)	2.4 (1.2)	2.3 (1.1)	2.3 (1.4)	2.9 (2.4)	2.9 (1.3)	3.9 (2.7)	2.9 (1.4)	3.0 (1.9)	0.06
<i>Salix pulchra</i>	2	3.5 (1.1)	3.9 (1.3)	3.5 (0.9)	2.6 (0.8)	5.0 (3.6)	4.7 (0.5)	3.8 (2.4)	4.2 (1.4)	3.9 (1.5)	0.02
<i>Salix rotundifolia</i>	7	1.6 (0.7)	2.0 (0.6)	2.0 (0.9)	2.2 (1.5)	2.2 (1.7)	2.5 (0.8)	3.6 (2.8)	2.5 (1.0)	2.7 (1.9)	0.08
Forb	10	4.5 (3.4)	5.7 (4.8)	4.6 (3.5)	3.6 (2.8)	5.9 (3.9)	5.6 (3.9)	6.4 (4.3)	5.4 (3.7)	8.3 (5.4)	0.04
<i>Petasites frigidus</i>	7	3.8 (2.6)	7.3 (6.1)	5.4 (3.8)	5.4 (3.5)	6.6 (4.6)	5.2 (4.2)	6.3 (4.5)	6.8 (4.1)	9.7 (6.5)	0.05
<i>Saxifraga cernua</i>	4	<b>0.9 (0.5)</b>	<b>4.7 (4.4)</b>	<b>1.5 (1.2)</b>	<b>1.0 (1.3)</b>	<b>2.8 (1.2)</b>	<b>3.8 (2.5)</b>	<b>2.8 (0.7)</b>	<b>4.0 (0.4)</b>	<b>4.2 (1.4)</b>	<b>0.16</b>
<i>Stellaria laeta</i>	4	2.8 (0.8)	4.9 (2.3)	3.7 (1.8)	3.7 (1.6)	5.4 (1.1)	3.5 (1.3)	5.1 (2.4)	3.7 (1.9)	5.6 (3.4)	0.05
Graminoid	22	<b>10.0 (4.1)</b>	<b>13.8 (5.4)</b>	<b>12.7 (4.9)</b>	<b>11.9 (5.3)</b>	<b>17.4 (6.2)</b>	<b>15.1 (4.9)</b>	<b>18.8 (7.4)</b>	<b>17.1 (8.0)</b>	<b>23.1 (8.3)</b>	<b>0.21</b>
<i>Arctagrostis latifolia</i>	4	7.2 (0.9)	7.3 (1.8)	7.5 (2.8)	7.1 (1.7)	8.4 (1.7)	9.8 (4.1)	12.5 (4.9)	11.5 (5.3)	13.8 (10.4)	0.20
<i>Carex stans</i>	23	<b>10.2 (4.4)</b>	<b>14.2 (5.1)</b>	<b>12.8 (4.5)</b>	<b>12.0 (5.8)</b>	<b>16.2 (5.4)</b>	<b>15.1 (5.3)</b>	<b>19.1 (8.1)</b>	<b>17.3 (9.1)</b>	<b>22.8 (7.7)</b>	<b>0.20</b>
<i>Dupontia fisheri</i>	16	<b>8.6 (3.2)</b>	<b>11.5 (5.2)</b>	<b>11.2 (3.7)</b>	<b>9.3 (3.9)</b>	<b>17.8 (5.9)</b>	<b>12.8 (4.2)</b>	<b>16.7 (5.3)</b>	<b>15.2 (4.0)</b>	<b>20.2 (7.0)</b>	<b>0.26</b>
<i>E. russeolum</i>	14	<b>6.9 (2.0)</b>	<b>11.2 (3.5)</b>	<b>10.6 (3.5)</b>	<b>9.2 (2.7)</b>	<b>13.2 (3.0)</b>	<b>12.3 (2.2)</b>	<b>14.6 (3.3)</b>	<b>14.9 (4.5)</b>	<b>17.6 (4.5)</b>	<b>0.39</b>
<i>E. triste</i>	9	<b>5.7 (2.9)</b>	<b>10.4 (4.2)</b>	<b>9.6 (4.9)</b>	<b>9.5 (1.5)</b>	<b>14.3 (5.0)</b>	<b>10.5 (2.8)</b>	<b>14.3 (3.8)</b>	<b>14.0 (4.7)</b>	<b>17.9 (5.0)</b>	<b>0.34</b>
<i>Luzula arctica</i>	3	4.1 (1.2)	9.7 (4.2)	6.4 (2.7)	4.4 (0.4)	5.5 (5.1)	8.3 (2.2)	9.3 (3.2)	3.8 (3.4)	5.8 (2.9)	0.00
<i>Luzula confusa</i>	8	<b>2.9 (1.2)</b>	<b>5.6 (2.1)</b>	<b>5.2 (2.6)</b>	<b>3.8 (1.6)</b>	<b>5.7 (3.6)</b>	<b>7.8 (3.1)</b>	<b>6.6 (3.7)</b>	<b>5.6 (2.8)</b>	<b>6.7 (3.3)</b>	<b>0.11</b>
<i>Poa arctica</i>	13	<b>4.3 (1.8)</b>	<b>6.7 (4.1)</b>	<b>5.8 (3.3)</b>	<b>3.6 (2.2)</b>	<b>6.8 (2.9)</b>	<b>7.2 (4.4)</b>	<b>8.2 (3.5)</b>	<b>5.7 (3.0)</b>	<b>10.7 (6.4)</b>	<b>0.12</b>



Marginal r<sup>2</sup> reported

# Height

	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Utqiagvik Grid</b>											
Woody deciduous	28	2.0 (1.2)	2.4 (1.2)	2.3 (1.1)	2.3 (1.4)	2.9 (2.4)	2.9 (1.3)	3.9 (2.7)	2.9 (1.4)	3.0 (1.9)	0.06
<i>Salix pulchra</i>	2	3.5 (1.1)	3.9 (1.3)	3.5 (0.9)	2.6 (0.8)	5.0 (3.6)	4.7 (0.5)	3.8 (2.4)	4.2 (1.4)	3.9 (1.5)	0.02
<i>Salix rotundifolia</i>	7	1.6 (0.7)	2.0 (0.6)	2.0 (0.9)	2.2 (1.5)	2.2 (1.7)	2.5 (0.8)	3.6 (2.8)	2.5 (1.0)	2.7 (1.9)	0.08
Forb	10	4.5 (3.4)	5.7 (4.8)	4.6 (3.5)	3.6 (2.8)	5.9 (3.9)	5.6 (3.9)	6.4 (4.3)	5.4 (3.7)	8.3 (5.4)	0.04
<i>Petasites frigidus</i>	7	3.8 (2.6)	7.3 (6.1)	5.4 (3.8)	5.4 (3.5)	6.6 (4.6)	5.2 (4.2)	6.3 (4.5)	6.8 (4.1)	9.7 (6.5)	0.05
<i>Saxifraga cernua</i>	4	<b>0.9 (0.5)</b>	<b>4.7 (4.4)</b>	<b>1.5 (1.2)</b>	<b>1.0 (1.3)</b>	<b>2.8 (1.2)</b>	<b>3.8 (2.5)</b>	<b>2.8 (0.7)</b>	<b>4.0 (0.4)</b>	<b>4.2 (1.4)</b>	<b>0.16</b>
<i>Stellaria laeta</i>	4	2.8 (0.8)	4.9 (2.3)	3.7 (1.8)	3.7 (1.6)	5.4 (1.1)	3.5 (1.3)	5.1 (2.4)	3.7 (1.9)	5.6 (3.4)	0.05
<b>Graminoid</b>	<b>22</b>										
<i>Arctagrostis latifolia</i>	4										
<i>Carex stans</i>	<b>23</b>										
<i>Dupontia fisheri</i>	<b>16</b>										
<i>E. russeolum</i>	<b>14</b>										
<i>E. triste</i>	<b>9</b>										
<i>Luzula arctica</i>	3										
<i>Luzula confusa</i>	<b>8</b>										
<i>Poa arctica</i>	<b>13</b>										



# Height

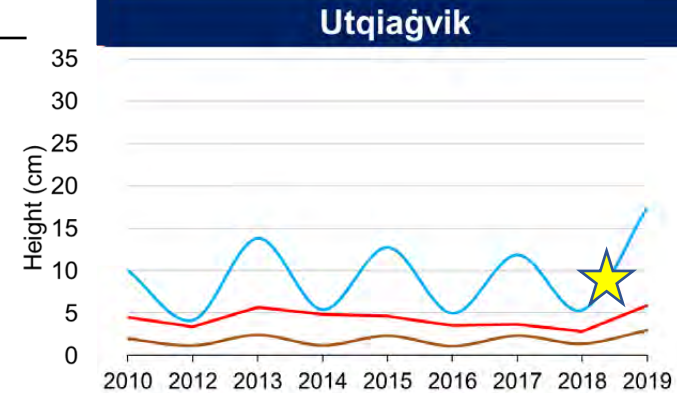
	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Utqiagvik Grid</b>											
Woody deciduous	28	2.0 (1.2)	2.4 (1.2)	2.3 (1.1)	2.3 (1.4)	2.9 (2.4)	2.9 (1.3)	3.9 (2.7)	2.9 (1.4)	3.0 (1.9)	0.06
<i>Salix pulchra</i>	2	3.5 (1.1)	3.9 (1.3)	3.5 (0.9)	2.6 (0.8)	5.0 (3.6)	4.7 (0.5)	3.8 (2.4)	4.2 (1.4)	3.9 (1.5)	0.02
<i>Salix rotundifolia</i>	7	1.6 (0.7)	2.0 (0.6)	2.0 (0.9)	2.2 (1.5)	2.2 (1.7)	2.5 (0.8)	3.6 (2.8)	2.5 (1.0)	2.7 (1.9)	0.08
<b>Forb</b>	10	4.5 (3.4)	5.7 (4.8)	4.6 (3.5)	3.6 (2.8)	5.9 (3.9)	5.6 (3.9)	6.4 (4.3)	5.4 (3.7)	8.3 (5.4)	0.04
<i>Petasites frigidus</i>	7	3.8 (2.6)	7.3 (6.1)	5.4 (3.8)	5.4 (3.5)	6.6 (4.6)	5.2 (4.2)	6.3 (4.5)	6.8 (4.1)	9.7 (6.5)	0.05
★ <i>Saxifraga cernua</i>	4	<b>0.9 (0.5)</b>	<b>4.7 (4.4)</b>	<b>1.5 (1.2)</b>	<b>1.0 (1.3)</b>	<b>2.8 (1.2)</b>	<b>3.8 (2.5)</b>	<b>2.8 (0.7)</b>	<b>4.0 (0.4)</b>	<b>4.2 (1.4)</b>	<b>0.16</b>
<i>Stellaria laeta</i>	4	2.8 (0.8)	4.9 (2.3)	3.7 (1.8)	3.7 (1.6)	5.4 (1.1)	3.5 (1.3)	5.1 (2.4)	3.7 (1.9)	5.6 (3.4)	0.05
★ <b>Graminoid</b>	22	<b>10.0 (4.1)</b>	<b>13.8 (5.4)</b>	<b>12.7 (4.9)</b>	<b>11.9 (5.3)</b>	<b>17.4 (6.2)</b>	<b>15.1 (4.9)</b>	<b>18.8 (7.4)</b>	<b>17.1 (8.0)</b>	<b>23.1 (8.3)</b>	<b>0.21</b>
<i>Arctagrostis latifolia</i>	4	7.2 (0.9)	7.3 (1.8)	7.5 (2.8)	7.1 (1.7)	8.4 (1.7)	9.8 (4.1)	12.5 (4.9)	11.5 (5.3)	13.8 (10.4)	0.20
★ <i>Carex stans</i>	<b>23</b>	<b>10.2 (4.4)</b>	<b>14.2 (5.1)</b>	<b>12.8 (4.5)</b>	<b>12.0 (5.8)</b>	<b>16.2 (5.4)</b>	<b>15.1 (5.3)</b>	<b>19.1 (8.1)</b>	<b>17.3 (9.1)</b>	<b>22.8 (7.7)</b>	<b>0.20</b>
★ <i>Dupontia fisheri</i>	<b>16</b>	<b>8.6 (3.2)</b>	<b>11.5 (5.2)</b>	<b>11.2 (3.7)</b>	<b>9.3 (3.9)</b>	<b>17.8 (5.9)</b>	<b>12.8 (4.2)</b>	<b>16.7 (5.3)</b>	<b>15.2 (4.0)</b>	<b>20.2 (7.0)</b>	<b>0.26</b>
★ <i>E. russeolum</i>	<b>14</b>	<b>6.9 (2.0)</b>	<b>11.2 (3.5)</b>	<b>10.6 (3.5)</b>	<b>9.2 (2.7)</b>	<b>13.2 (3.0)</b>	<b>12.3 (2.2)</b>	<b>14.6 (3.3)</b>	<b>14.9 (4.5)</b>	<b>17.6 (4.5)</b>	<b>0.39</b>
★ <i>E. triste</i>	<b>9</b>	<b>5.7 (2.9)</b>	<b>10.4 (4.2)</b>	<b>9.6 (4.9)</b>	<b>9.5 (1.5)</b>	<b>14.3 (5.0)</b>	<b>10.5 (2.8)</b>	<b>14.3 (3.8)</b>	<b>14.0 (4.7)</b>	<b>17.9 (5.0)</b>	<b>0.34</b>
<i>Luzula arctica</i>	3	4.1 (1.2)	9.7 (4.2)	6.4 (2.7)	4.4 (0.4)	5.5 (5.1)	8.3 (2.2)	9.3 (3.2)	3.8 (3.4)	5.8 (2.9)	0.00
★ <i>Luzula confusa</i>	<b>8</b>	<b>2.9 (1.2)</b>	<b>5.6 (2.1)</b>	<b>5.2 (2.6)</b>	<b>3.8 (1.6)</b>	<b>5.7 (3.6)</b>	<b>7.8 (3.1)</b>	<b>6.6 (3.7)</b>	<b>5.6 (2.8)</b>	<b>6.7 (3.3)</b>	<b>0.11</b>
★ <i>Poa arctica</i>	<b>13</b>	<b>4.3 (1.8)</b>	<b>6.7 (4.1)</b>	<b>5.8 (3.3)</b>	<b>3.6 (2.2)</b>	<b>6.8 (2.9)</b>	<b>7.2 (4.4)</b>	<b>8.2 (3.5)</b>	<b>5.7 (3.0)</b>	<b>10.7 (6.4)</b>	<b>0.12</b>



Graminoids are the only functional group to change significantly over time

# Height

	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Utqiagvik Grid</b>											
Woody deciduous	28	2.0 (1.2)	2.4 (1.2)	2.3 (1.1)	2.3 (1.4)	2.9 (2.4)	2.9 (1.3)	3.9 (2.7)	2.9 (1.4)	3.0 (1.9)	0.06
<i>Salix pulchra</i>	2	3.5 (1.1)	3.9 (1.3)	3.5 (0.9)	2.6 (0.8)	5.0 (3.6)	4.7 (0.5)	3.8 (2.4)	4.2 (1.4)	3.9 (1.5)	0.02
<i>Salix rotundifolia</i>	7	1.6 (0.7)	2.0 (0.6)	2.0 (0.9)	2.2 (1.5)	2.2 (1.7)	2.5 (0.8)	3.6 (2.8)	2.5 (1.0)	2.7 (1.9)	0.08
Forb	10	4.5 (3.4)	5.7 (4.8)	4.6 (3.5)	3.6 (2.8)	5.9 (3.9)	5.6 (3.9)	6.4 (4.3)	5.4 (3.7)	8.3 (5.4)	0.04
<i>Petasites frigidus</i>	7	3.8 (2.6)	7.3 (6.1)	5.4 (3.8)	5.4 (3.5)	6.6 (4.6)	5.2 (4.2)	6.3 (4.5)	6.8 (4.1)	9.7 (6.5)	0.05
★ <i>Saxifraga cernua</i>	4	<b>0.9 (0.5)</b>	<b>4.7 (4.4)</b>	<b>1.5 (1.2)</b>	<b>1.0 (1.3)</b>	<b>2.8 (1.2)</b>	<b>3.8 (2.5)</b>	<b>2.8 (0.7)</b>	<b>4.0 (0.4)</b>	<b>4.2 (1.4)</b>	<b>0.16</b>
<i>Stellaria laeta</i>	4	2.8 (0.8)	4.9 (2.3)	3.7 (1.8)	3.7 (1.6)	5.4 (1.1)	3.5 (1.3)	5.1 (2.4)	3.7 (1.9)	5.6 (3.4)	0.05
★ <b>Graminoid</b>	22	<b>10.0 (4.1)</b>	<b>13.8 (5.4)</b>	<b>12.7 (4.9)</b>	<b>11.9 (5.3)</b>	<b>17.4 (6.2)</b>	<b>15.1 (4.9)</b>	<b>18.8 (7.4)</b>	<b>17.1 (8.0)</b>	<b>23.1 (8.3)</b>	<b>0.21</b>
<i>Arctagrostis latifolia</i>	4	7.2 (0.9)	7.3 (1.8)	7.5 (2.8)	7.1 (1.7)	8.4 (1.7)	9.8 (4.1)	12.5 (4.9)	11.5 (5.3)	13.8 (10.4)	0.20
★ <i>Carex stans</i>	<b>23</b>	<b>10.2 (4.4)</b>	<b>14.2 (5.1)</b>	<b>12.8 (4.5)</b>	<b>12.0 (5.8)</b>	<b>16.2 (5.4)</b>	<b>15.1 (5.3)</b>	<b>19.1 (8.1)</b>	<b>17.3 (9.1)</b>	<b>22.8 (7.7)</b>	<b>0.20</b>
★ <i>Dupontia fisheri</i>	<b>16</b>	<b>8.6 (3.2)</b>	<b>11.5 (5.2)</b>	<b>11.2 (3.7)</b>	<b>9.3 (3.9)</b>	<b>17.8 (5.9)</b>	<b>12.8 (4.2)</b>	<b>16.7 (5.3)</b>	<b>15.2 (4.0)</b>	<b>20.2 (7.0)</b>	<b>0.26</b>
★ <i>E. russeolum</i>	<b>14</b>	<b>6.9 (2.0)</b>	<b>11.2 (3.5)</b>	<b>10.6 (3.5)</b>	<b>9.2 (2.7)</b>	<b>13.2 (3.0)</b>	<b>12.3 (2.2)</b>	<b>14.6 (3.3)</b>	<b>14.9 (4.5)</b>	<b>17.6 (4.5)</b>	<b>0.39</b>
★ <i>E. triste</i>	<b>9</b>	<b>5.7 (2.9)</b>	<b>10.4 (4.2)</b>	<b>9.6 (4.9)</b>	<b>9.5 (1.5)</b>	<b>14.3 (5.0)</b>	<b>10.5 (2.8)</b>	<b>14.3 (3.8)</b>	<b>14.0 (4.7)</b>	<b>17.9 (5.0)</b>	<b>0.34</b>
<i>Luzula arctica</i>	3	4.1 (1.2)	9.7 (4.2)	6.4 (2.7)	4.4 (0.4)	5.5 (5.1)	8.3 (2.2)	9.3 (3.2)	3.8 (3.4)	5.8 (2.9)	0.00
★ <i>Luzula confusa</i>	<b>8</b>	<b>2.9 (1.2)</b>	<b>5.6 (2.1)</b>	<b>5.2 (2.6)</b>	<b>3.8 (1.6)</b>	<b>5.7 (3.6)</b>	<b>7.8 (3.1)</b>	<b>6.6 (3.7)</b>	<b>5.6 (2.8)</b>	<b>6.7 (3.3)</b>	<b>0.11</b>
★ <i>Poa arctica</i>	<b>13</b>	<b>4.3 (1.8)</b>	<b>6.7 (4.1)</b>	<b>5.8 (3.3)</b>	<b>3.6 (2.2)</b>	<b>6.8 (2.9)</b>	<b>7.2 (4.4)</b>	<b>8.2 (3.5)</b>	<b>5.7 (3.0)</b>	<b>10.7 (6.4)</b>	<b>0.12</b>



Seven species changed significantly over time, all but one were graminoids

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
Atqasuk Grid									
Woody deciduous									
<i>Betula nana</i>									
<i>Salix pulchra</i>									
Woody evergreen									
<i>Cassiope tetragona</i>									
<i>Ledum palustre</i>									
<i>Vaccinium vitis-idaea</i>									
Forb									
<i>Rubus chamaemorus</i>									
Graminoid									
<i>Carex aquatilis</i>									
<i>Carex bigelowii</i>									
<i>Eriophorum russeolum</i>									
<i>E. vaginatum</i>									
<i>Trisetum spicatum</i>									



# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
<b>Atqasuk Grid</b>									
Woody deciduous									<b>0.11</b>
<i>Betula nana</i>									<b>0.07</b>
<i>Salix pulchra</i>									<b>0.31</b>
Woody evergreen									<b>0.04</b>
<i>Cassiope tetragona</i>									<b>0.03</b>
<i>Ledum palustre</i>									<b>0.05</b>
<i>Vaccinium vitis-idaea</i>									<b>0.10</b>
<b>Forb</b>									
<i>Rubus chamaemorus</i>									<b>0.30</b>
Graminoid									<b>0.21</b>
<i>Carex aquatilis</i>									<b>0.31</b>
<i>Carex bigelowii</i>									<b>0.15</b>
<i>Eriophorum russeolum</i>									<b>0.44</b>
<i>E. vaginatum</i>									<b>0.18</b>
<i>Trisetum spicatum</i>									<b>0.30</b>

Year predicts woody deciduous shrubs, evergreen shrubs, forbs, and graminoids

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
<b>Atqasuk Grid</b>									
Woody deciduous	0.11	0.02							
<i>Betula nana</i>	0.07	0.01							
<i>Salix pulchra</i>	0.31	0.03							
Woody evergreen	0.04	0.01							
<i>Cassiope tetragona</i>	0.03	0.00							
<i>Ledum palustre</i>	0.05	0.00							
<i>Vaccinium vitis-idaea</i>	0.10	0.04							
<b>Forb</b>									
<i>Rubus chamaemorus</i>	0.30	0.03							
<b>Graminoid</b>									
<i>Carex aquatilis</i>	0.31	0.04							
<i>Carex bigelowii</i>	0.15	0.02							
<i>Eriophorum russeolum</i>	0.44	0.05							
<i>E. vaginatum</i>	0.18	0.05							
<i>Trisetum spicatum</i>	0.30	0.03							

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
<b>Atqasuk Grid</b>									
Woody deciduous	0.11	0.02	0.03						
<i>Betula nana</i>	0.07	0.01	0.02						
<i>Salix pulchra</i>	0.31	0.03	0.08						
Woody evergreen	0.04	0.01	0.02						
<i>Cassiope tetragona</i>	0.03	0.00	0.01						
<i>Ledum palustre</i>	0.05	0.00	0.02						
<i>Vaccinium vitis-idaea</i>	0.10	0.04	0.05						
<b>Forb</b>									
<i>Rubus chamaemorus</i>	0.30	0.03	0.06						
<b>Graminoid</b>									
<i>Carex aquatilis</i>	0.31	0.04	0.09						
<i>Carex bigelowii</i>	0.15	0.02	0.06						
<i>Eriophorum russeolum</i>	0.44	0.05	0.11						
<i>E. vaginatum</i>	0.18	0.05	0.13						
<i>Trisetum spicatum</i>	0.30	0.03	0.08						

Air temp predicts woody evergreen shrubs and graminoids

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
<b>Atqasuk Grid</b>									
Woody deciduous	0.11	0.02	0.03	0.01					
<i>Betula nana</i>	0.07	0.01	0.02	0.01					
<i>Salix pulchra</i>	0.31	0.03	0.08	0.01					
Woody evergreen	0.04	0.01	0.02	0.01					
<i>Cassiope tetragona</i>	0.03	0.00	0.01	0.00					
<i>Ledum palustre</i>	0.05	0.00	0.02	0.00					
<i>Vaccinium vitis-idaea</i>	0.10	0.04	0.05	0.02					
<b>Forb</b>									
<i>Rubus chamaemorus</i>	0.30	0.03	0.06	0.00					
<b>Graminoid</b>									
<i>Carex aquatilis</i>	0.31	0.04	0.09	0.01					
<i>Carex bigelowii</i>	0.15	0.02	0.06	0.00					
<i>Eriophorum russeolum</i>	0.44	0.05	0.11	0.02					
<i>E. vaginatum</i>	0.18	0.05	0.13	0.02					
<i>Trisetum spicatum</i>	0.30	0.03	0.08	0.00					

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
<b>Atqasuk Grid</b>									
Woody deciduous	0.11	0.02	0.03	0.01	0.00				
<i>Betula nana</i>	0.07	0.01	0.02	0.01	0.00				
<i>Salix pulchra</i>	0.31	0.03	0.08	0.01	0.02				
Woody evergreen	0.04	0.01	0.02	0.01	0.04				
<i>Cassiope tetragona</i>	0.03	0.00	0.01	0.00	0.00				
<i>Ledum palustre</i>	0.05	0.00	0.02	0.00	0.04				
<i>Vaccinium vitis-idaea</i>	0.10	0.04	0.05	0.02	0.00				
<b>Forb</b>									
<i>Rubus chamaemorus</i>	0.30	0.03	0.06	0.00	0.02				
<b>Graminoid</b>									
<i>Carex aquatilis</i>	0.31	0.04	0.09	0.01	0.04				
<i>Carex bigelowii</i>	0.15	0.02	0.06	0.00	0.00				
<i>Eriophorum russeolum</i>	0.44	0.05	0.11	0.02	0.10				
<i>E. vaginatum</i>	0.18	0.05	0.13	0.02	0.00				
<i>Trisetum spicatum</i>	0.30	0.03	0.08	0.00	0.02				

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
<b>Atqasuk Grid</b>									
Woody deciduous	0.11	0.02	0.03	0.01	0.00	0.00			
<i>Betula nana</i>	0.07	0.01	0.02	0.01	0.00	0.00			
<i>Salix pulchra</i>	0.31	0.03	0.08	0.01	0.02	0.01			
Woody evergreen	0.04	0.01	0.02	0.01	0.04	0.03			
<i>Cassiope tetragona</i>	0.03	0.00	0.01	0.00	0.00	0.00			
<i>Ledum palustre</i>	0.05	0.00	0.02	0.00	0.04	0.02			
<i>Vaccinium vitis-idaea</i>	0.10	0.04	0.05	0.02	0.00	0.00			
<b>Forb</b>									
<i>Rubus chamaemorus</i>	0.30	0.03	0.06	0.00	0.02	0.02			
<b>Graminoid</b>									
<i>Carex aquatilis</i>	0.31	0.04	0.09	0.01	0.04	0.03			
<i>Carex bigelowii</i>	0.15	0.02	0.06	0.00	0.00	0.00			
<i>Eriophorum russeolum</i>	0.44	0.05	0.11	0.02	0.10	0.12			
<i>E. vaginatum</i>	0.18	0.05	0.13	0.02	0.00	0.00			
<i>Trisetum spicatum</i>	0.30	0.03	0.08	0.00	0.02	0.00			

Soil temperature predicts  
woody evergreen shrubs  
and graminoids

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
<b>Atqasuk Grid</b>									
Woody deciduous	0.11	0.02	0.03	0.01	0.00	0.00	0.02		
<i>Betula nana</i>	0.07	0.01	0.02	0.01	0.00	0.00	0.00		
<i>Salix pulchra</i>	0.31	0.03	0.08	0.01	0.02	0.01	0.10		
Woody evergreen	0.04	0.01	0.02	0.01	0.04	0.03	0.00		
<i>Cassiope tetragona</i>	0.03	0.00	0.01	0.00	0.00	0.00	0.00		
<i>Ledum palustre</i>	0.05	0.00	0.02	0.00	0.04	0.02	0.00		
<i>Vaccinium vitis-idaea</i>	0.10	0.04	0.05	0.02	0.00	0.00	0.01		
<b>Forb</b>									
<i>Rubus chamaemorus</i>	0.30	0.03	0.06	0.00	0.02	0.02	0.08		
<b>Graminoid</b>									
<i>Carex aquatilis</i>	0.31	0.04	0.09	0.01	0.04	0.03	0.04		
<i>Carex bigelowii</i>	0.15	0.02	0.06	0.00	0.00	0.00	0.00		
<i>Eriophorum russeolum</i>	0.44	0.05	0.11	0.02	0.10	0.12	0.04		
<i>E. vaginatum</i>	0.18	0.05	0.13	0.02	0.00	0.00	0.01		
<i>Trisetum spicatum</i>	0.30	0.03	0.08	0.00	0.02	0.00	0.17		

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
<b>Atqasuk Grid</b>									
Woody deciduous	0.11	0.02	0.03	0.01	0.00	0.00	0.02	0.00	
<i>Betula nana</i>	0.07	0.01	0.02	0.01	0.00	0.00	0.00	0.00	
<i>Salix pulchra</i>	0.31	0.03	0.08	0.01	0.02	0.01	0.10	0.00	
Woody evergreen	0.04	0.01	0.02	0.01	0.04	0.03	0.00	0.00	
<i>Cassiope tetragona</i>	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	
<i>Ledum palustre</i>	0.05	0.00	0.02	0.00	0.04	0.02	0.00	0.00	
<i>Vaccinium vitis-idaea</i>	0.10	0.04	0.05	0.02	0.00	0.00	0.01	0.00	
<b>Forb</b>									
<i>Rubus chamaemorus</i>	0.30	0.03	0.06	0.00	0.02	0.02	0.08	0.00	
<b>Graminoid</b>									
<i>Carex aquatilis</i>	0.31	0.04	0.09	0.01	0.04	0.03	0.04	0.00	
<i>Carex bigelowii</i>	0.15	0.02	0.06	0.00	0.00	0.00	0.00	0.00	
<i>Eriophorum russeolum</i>	0.44	0.05	0.11	0.02	0.10	0.12	0.04	0.06	
<i>E. vaginatum</i>	0.18	0.05	0.13	0.02	0.00	0.00	0.01	0.01	
<i>Trisetum spicatum</i>	0.30	0.03	0.08	0.00	0.02	0.00	0.17	0.01	



# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
<b>Atqasuk Grid</b>									
Woody deciduous	0.11	0.02	0.03	0.01	0.00	0.00	0.02	0.00	0.00
<i>Betula nana</i>	0.07	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00
<i>Salix pulchra</i>	0.31	0.03	0.08	0.01	0.02	0.01	0.10	0.00	0.00
Woody evergreen	0.04	0.01	0.02	0.01	0.04	0.03	0.00	0.00	0.00
<i>Cassiope tetragona</i>	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
<i>Ledum palustre</i>	0.05	0.00	0.02	0.00	0.04	0.02	0.00	0.00	0.00
<i>Vaccinium vitis-idaea</i>	0.10	0.04	0.05	0.02	0.00	0.00	0.01	0.00	0.00
<b>Forb</b>									
<i>Rubus chamaemorus</i>	0.30	0.03	0.06	0.00	0.02	0.02	0.08	0.00	0.00
<b>Graminoid</b>									
<i>Carex aquatilis</i>	0.31	0.04	0.09	0.01	0.04	0.03	0.04	0.00	0.03
<i>Carex bigelowii</i>	0.15	0.02	0.06	0.00	0.00	0.00	0.00	0.00	0.00
<i>Eriophorum russeolum</i>	0.44	0.05	0.11	0.02	0.10	0.12	0.04	0.06	0.00
<i>E. vaginatum</i>	0.18	0.05	0.13	0.02	0.00	0.00	0.01	0.01	0.00
<i>Trisetum spicatum</i>	0.30	0.03	0.08	0.00	0.02	0.00	0.17	0.01	0.00

Soil moisture predicts  
graminoids



# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
Utqiagvik Grid									
Woody deciduous	0.06								
<i>Salix pulchra</i>	0.02								
<i>Salix rotundifolia</i>	<b>0.08</b>								
Woody evergreen	-								
Forb									
<i>Petasites frigidus</i>	<b>0.05</b>								
<i>Saxifraga cernua</i>	<b>0.16</b>								
<i>Stellaria laeta</i>	0.05								
Graminoid									
<i>Arctagrostis latifolia</i>	<b>0.20</b>								
<i>Carex stans</i>	<b>0.20</b>								
<i>Dupontia fisheri</i>	<b>0.26</b>								
<i>Eriophorum triste</i>	<b>0.34</b>								
<i>Eriophorum russeolum</i>	<b>0.39</b>								
<i>Luzula arctica</i>	0.00								
<i>Luzula confusa</i>	<b>0.11</b>								
<i>Poa arctica</i>	<b>0.12</b>								

Year predicts only  
graminoids

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
Utqiagvik Grid									
Woody deciduous	0.06	0.04							
<i>Salix pulchra</i>	0.02	0.06							
<i>Salix rotundifolia</i>	0.08	0.02							
Woody evergreen	-	-							
Forb	0.04	0.05							
<i>Petasites frigidus</i>	0.05	0.04							
<i>Saxifraga cernua</i>	0.16	0.09							
<i>Stellaria laeta</i>	0.05	0.15							
Graminoid	0.21	0.14							
<i>Arctagrostis latifolia</i>	0.20	0.05							
<i>Carex stans</i>	0.20	0.11							
<i>Dupontia fisheri</i>	0.26	0.24							
<i>Eriophorum triste</i>	0.34	0.21							
<i>Eriophorum russeolum</i>	0.39	0.18							
<i>Luzula arctica</i>	0.00	0.07							
<i>Luzula confusa</i>	0.11	0.10							
<i>Poa arctica</i>	0.12	0.14							

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
Utqiagvik Grid									
Woody deciduous	0.06	0.04	0.03						
<i>Salix pulchra</i>	0.02	0.06	<b>0.10</b>						
<i>Salix rotundifolia</i>	<b>0.08</b>	0.02	0.01						
Woody evergreen	-	-	-						
Forb	0.04	0.05	<b>0.05</b>						
<i>Petasites frigidus</i>	<b>0.05</b>	0.04	<b>0.04</b>						
<i>Saxifraga cernua</i>	<b>0.16</b>	0.09	<b>0.18</b>						
<i>Stellaria laeta</i>	0.05	<b>0.15</b>	<b>0.12</b>						
Graminoid	<b>0.21</b>	<b>0.14</b>	<b>0.14</b>						
<i>Arctagrostis latifolia</i>	<b>0.20</b>	0.05	0.05						
<i>Carex stans</i>	<b>0.20</b>	<b>0.11</b>	<b>0.11</b>						
<i>Dupontia fisheri</i>	<b>0.26</b>	<b>0.24</b>	<b>0.24</b>						
<i>Eriophorum triste</i>	<b>0.34</b>	<b>0.21</b>	<b>0.22</b>						
<i>Eriophorum russeolum</i>	<b>0.39</b>	<b>0.18</b>	<b>0.22</b>						
<i>Luzula arctica</i>	0.00	0.07	0.06						
<i>Luzula confusa</i>	<b>0.11</b>	<b>0.10</b>	<b>0.13</b>						
<i>Poa arctica</i>	<b>0.12</b>	<b>0.14</b>	<b>0.12</b>						

Air temperature predicts woody deciduous shrubs, evergreen shrubs, forbs, and graminoids

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
Utqiagvik Grid									
Woody deciduous	0.06	0.04	0.03	0.02					
<i>Salix pulchra</i>	0.02	0.06	<b>0.10</b>	<b>0.07</b>					
<i>Salix rotundifolia</i>	<b>0.08</b>	0.02	0.01	0.01					
Woody evergreen	-	-	-	-					
Forb	0.04	0.05	<b>0.05</b>	<b>0.03</b>					
<i>Petasites frigidus</i>	<b>0.05</b>	0.04	<b>0.04</b>	0.02					
<i>Saxifraga cernua</i>	<b>0.16</b>	0.09	<b>0.18</b>	0.07					
<i>Stellaria laeta</i>	0.05	<b>0.15</b>	<b>0.12</b>	<b>0.10</b>					
Graminoid	<b>0.21</b>	<b>0.14</b>	<b>0.14</b>	0.09					
<i>Arctagrostis latifolia</i>	<b>0.20</b>	0.05	0.05	0.02					
<i>Carex stans</i>	<b>0.20</b>	<b>0.11</b>	<b>0.11</b>	0.06					
<i>Dupontia fisheri</i>	<b>0.26</b>	<b>0.24</b>	<b>0.24</b>	<b>0.17</b>					
<i>Eriophorum triste</i>	<b>0.34</b>	<b>0.21</b>	<b>0.22</b>	0.13					
<i>Eriophorum russeolum</i>	<b>0.39</b>	<b>0.18</b>	<b>0.22</b>	0.12					
<i>Luzula arctica</i>	0.00	0.07	0.06	0.06					
<i>Luzula confusa</i>	<b>0.11</b>	<b>0.10</b>	<b>0.13</b>	<b>0.10</b>					
<i>Poa arctica</i>	<b>0.12</b>	<b>0.14</b>	<b>0.12</b>	<b>0.10</b>					

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
Utqiagvik Grid									
Woody deciduous	0.06	0.04	0.03	0.02	0.01				
<i>Salix pulchra</i>	0.02	0.06	0.10	0.07	0.02				
<i>Salix rotundifolia</i>	0.08	0.02	0.01	0.01	0.01				
Woody evergreen	-	-	-	-	-				
Forb	0.04	0.05	0.05	0.03	0.00				
<i>Petasites frigidus</i>	0.05	0.04	0.04	0.02	0.00				
<i>Saxifraga cernua</i>	0.16	0.09	0.18	0.07	0.08				
<i>Stellaria laeta</i>	0.05	0.15	0.12	0.10	0.00				
Graminoid	0.21	0.14	0.14	0.09	0.00				
<i>Arctagrostis latifolia</i>	0.20	0.05	0.05	0.02	0.00				
<i>Carex stans</i>	0.20	0.11	0.11	0.06	0.00				
<i>Dupontia fisheri</i>	0.26	0.24	0.24	0.17	0.00				
<i>Eriophorum triste</i>	0.34	0.21	0.22	0.13	0.00				
<i>Eriophorum russeolum</i>	0.39	0.18	0.22	0.12	0.01				
<i>Luzula arctica</i>	0.00	0.07	0.06	0.06	0.03				
<i>Luzula confusa</i>	0.11	0.10	0.13	0.10	0.11				
<i>Poa arctica</i>	0.12	0.14	0.12	0.10	0.01				

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
Utqiagvik Grid									
Woody deciduous	0.06	0.04	0.03	0.02	0.01	0.01			
<i>Salix pulchra</i>	0.02	0.06	0.10	0.07	0.02	0.01			
<i>Salix rotundifolia</i>	0.08	0.02	0.01	0.01	0.01	0.01			
Woody evergreen	-	-	-	-	-	-			
Forb	0.04	0.05	0.05	0.03	0.00	0.00			
<i>Petasites frigidus</i>	0.05	0.04	0.04	0.02	0.00	0.00			
<i>Saxifraga cernua</i>	0.16	0.09	0.18	0.07	0.08	0.06			
<i>Stellaria laeta</i>	0.05	0.15	0.12	0.10	0.00	0.00			
Graminoid	0.21	0.14	0.14	0.09	0.00	0.00			
<i>Arctagrostis latifolia</i>	0.20	0.05	0.05	0.02	0.00	0.02			
<i>Carex stans</i>	0.20	0.11	0.11	0.06	0.00	0.00			
<i>Dupontia fisheri</i>	0.26	0.24	0.24	0.17	0.00	0.00			
<i>Eriophorum triste</i>	0.34	0.21	0.22	0.13	0.00	0.00			
<i>Eriophorum russeolum</i>	0.39	0.18	0.22	0.12	0.01	0.01			
<i>Luzula arctica</i>	0.00	0.07	0.06	0.06	0.03	0.09			
<i>Luzula confusa</i>	0.11	0.10	0.13	0.10	0.11	0.14			
<i>Poa arctica</i>	0.12	0.14	0.12	0.10	0.01	0.03			



# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
Utqiagvik Grid									
Woody deciduous	0.06	0.04	0.03	0.02	0.01	0.01	0.00		
<i>Salix pulchra</i>	0.02	0.06	0.10	0.07	0.02	0.01	0.00		
<i>Salix rotundifolia</i>	0.08	0.02	0.01	0.01	0.01	0.01	0.01		
Woody evergreen	-	-	-	-	-	-	-		
Forb	0.04	0.05	0.05	0.03	0.00	0.00	0.02		
<i>Petasites frigidus</i>	0.05	0.04	0.04	0.02	0.00	0.00	0.02		
<i>Saxifraga cernua</i>	0.16	0.09	0.18	0.07	0.08	0.06	0.00		
<i>Stellaria laeta</i>	0.05	0.15	0.12	0.10	0.00	0.00	0.05		
Graminoid	0.21	0.14	0.14	0.09	0.00	0.00	0.00		
<i>Arctagrostis latifolia</i>	0.20	0.05	0.05	0.02	0.00	0.02	0.08		
<i>Carex stans</i>	0.20	0.11	0.11	0.06	0.00	0.00	0.00		
<i>Dupontia fisheri</i>	0.26	0.24	0.24	0.17	0.00	0.00	0.00		
<i>Eriophorum triste</i>	0.34	0.21	0.22	0.13	0.00	0.00	0.01		
<i>Eriophorum russeolum</i>	0.39	0.18	0.22	0.12	0.01	0.01	0.01		
<i>Luzula arctica</i>	0.00	0.07	0.06	0.06	0.03	0.09	0.12		
<i>Luzula confusa</i>	0.11	0.10	0.13	0.10	0.11	0.14	0.17		
<i>Poa arctica</i>	0.12	0.14	0.12	0.10	0.01	0.03	0.00		

# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
Utqiagvik Grid									
Woody deciduous	0.06	0.04	0.03	0.02	0.01	0.01	0.00	0.00	
<i>Salix pulchra</i>	0.02	0.06	0.10	0.07	0.02	0.01	0.00	0.05	
<i>Salix rotundifolia</i>	0.08	0.02	0.01	0.01	0.01	0.01	0.01	0.01	
Woody evergreen	-	-	-	-	-	-	-	-	
Forb	0.04	0.05	0.05	0.03	0.00	0.00	0.02	0.00	
<i>Petasites frigidus</i>	0.05	0.04	0.04	0.02	0.00	0.00	0.02	0.00	
<i>Saxifraga cernua</i>	0.16	0.09	0.18	0.07	0.08	0.06	0.00	0.04	
<i>Stellaria laeta</i>	0.05	0.15	0.12	0.10	0.00	0.00	0.05	0.00	
Graminoid	0.21	0.14	0.14	0.09	0.00	0.00	0.00	0.00	
<i>Arctagrostis latifolia</i>	0.20	0.05	0.05	0.02	0.00	0.02	0.08	0.00	
<i>Carex stans</i>	0.20	0.11	0.11	0.06	0.00	0.00	0.00	0.00	
<i>Dupontia fisheri</i>	0.26	0.24	0.24	0.17	0.00	0.00	0.00	0.00	
<i>Eriophorum triste</i>	0.34	0.21	0.22	0.13	0.00	0.00	0.01	0.01	
<i>Eriophorum russeolum</i>	0.39	0.18	0.22	0.12	0.01	0.01	0.01	0.00	
<i>Luzula arctica</i>	0.00	0.07	0.06	0.06	0.03	0.09	0.12	0.01	
<i>Luzula confusa</i>	0.11	0.10	0.13	0.10	0.11	0.14	0.17	0.00	
<i>Poa arctica</i>	0.12	0.14	0.12	0.10	0.01	0.03	0.00	0.00	

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Vegetation Height									
Utqiagvik Grid									
Woody deciduous	0.06	0.04	0.03	0.02	0.01	0.01	0.00	0.00	0.00
<i>Salix pulchra</i>	0.02	0.06	0.10	0.07	0.02	0.01	0.00	0.05	0.00
<i>Salix rotundifolia</i>	0.08	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Woody evergreen	-	-	-	-	-	-	-	-	-
Forb	0.04	0.05	0.05	0.03	0.00	0.00	0.02	0.00	0.01
<i>Petasites frigidus</i>	0.05	0.04	0.04	0.02	0.00	0.00	0.02	0.00	0.05
<i>Saxifraga cernua</i>	0.16	0.09	0.18	0.07	0.08	0.06	0.00	0.04	0.00
<i>Stellaria laeta</i>	0.05	0.15	0.12	0.10	0.00	0.00	0.05	0.00	0.03
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<i>Luzula arctica</i>	0.00	0.07	0.06	0.06	0.03	0.09	0.12	0.01	0.19
<i>Luzula confusa</i>	0.11	0.10	0.13	0.10	0.11	0.14	0.17	0.00	0.00
<i>Poa arctica</i>	0.12	0.14	0.12	0.10	0.01	0.03	0.00	0.00	0.00

Soil moisture predicts only  
graminoids

# Conclusions

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  - Trends in Atqasuk agree with global trends in increase of shrub stature
  - Decline in bryophytes not notable at our sites; perhaps the effects of increasing vascular plant cover and height are not yet observed



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  - Height predictors include soil moisture, soil temperature, and air temperature
  - Thawing degree days and precipitation were poor predictors

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  - Changes are similar between sites
  - Effects appear to be geographically driven; climates of the sites drive the strength of vegetation response
  - The southernmost site, Atqasuk, has more noticeable changes relative to the northernmost site, Utqiagvik
  - Air temperature is more limiting in Utqiagvik

# Future Research

- Analyze cover and height datasets with multivariate modeling
- Integrate phenological data
- Integrate plant trait observations



Questions?



# Acknowledgements

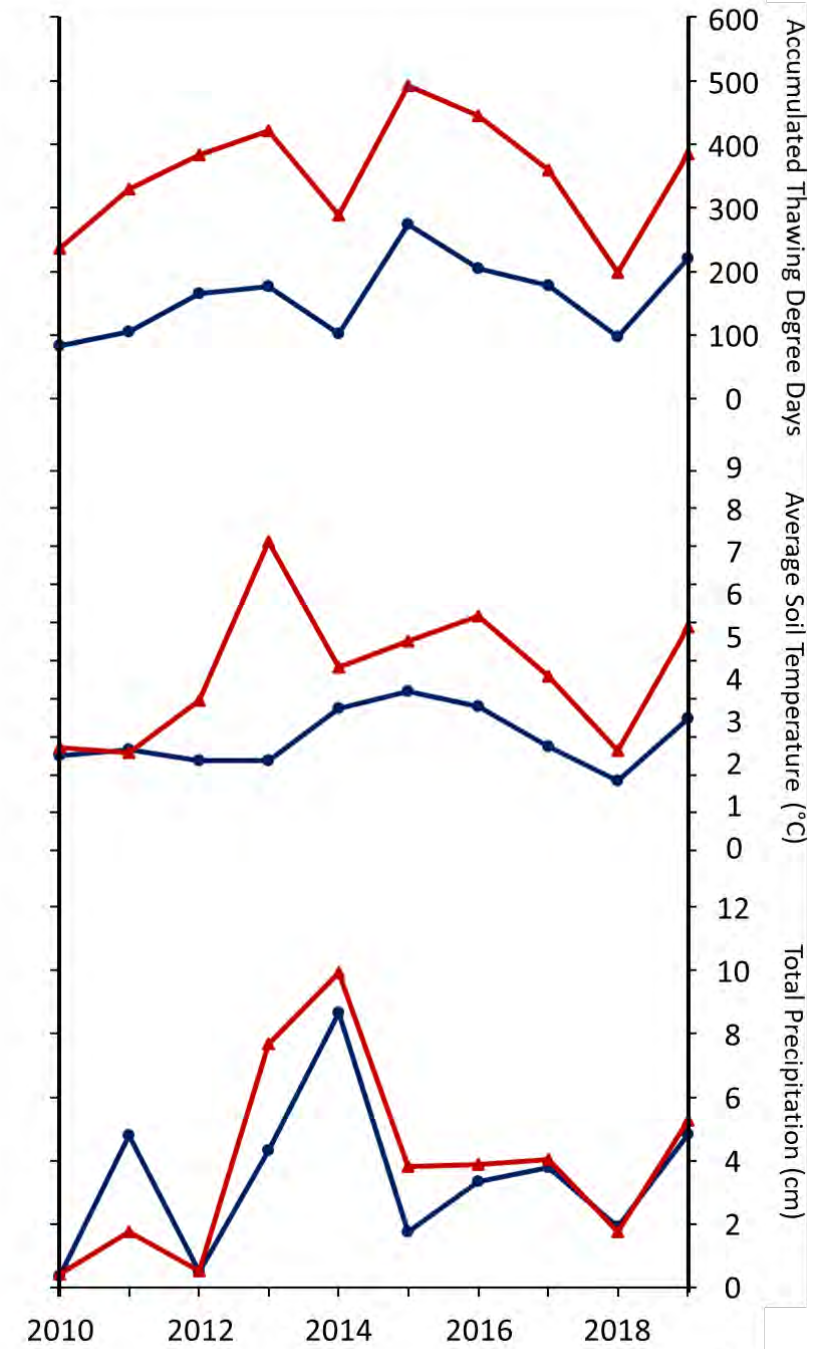
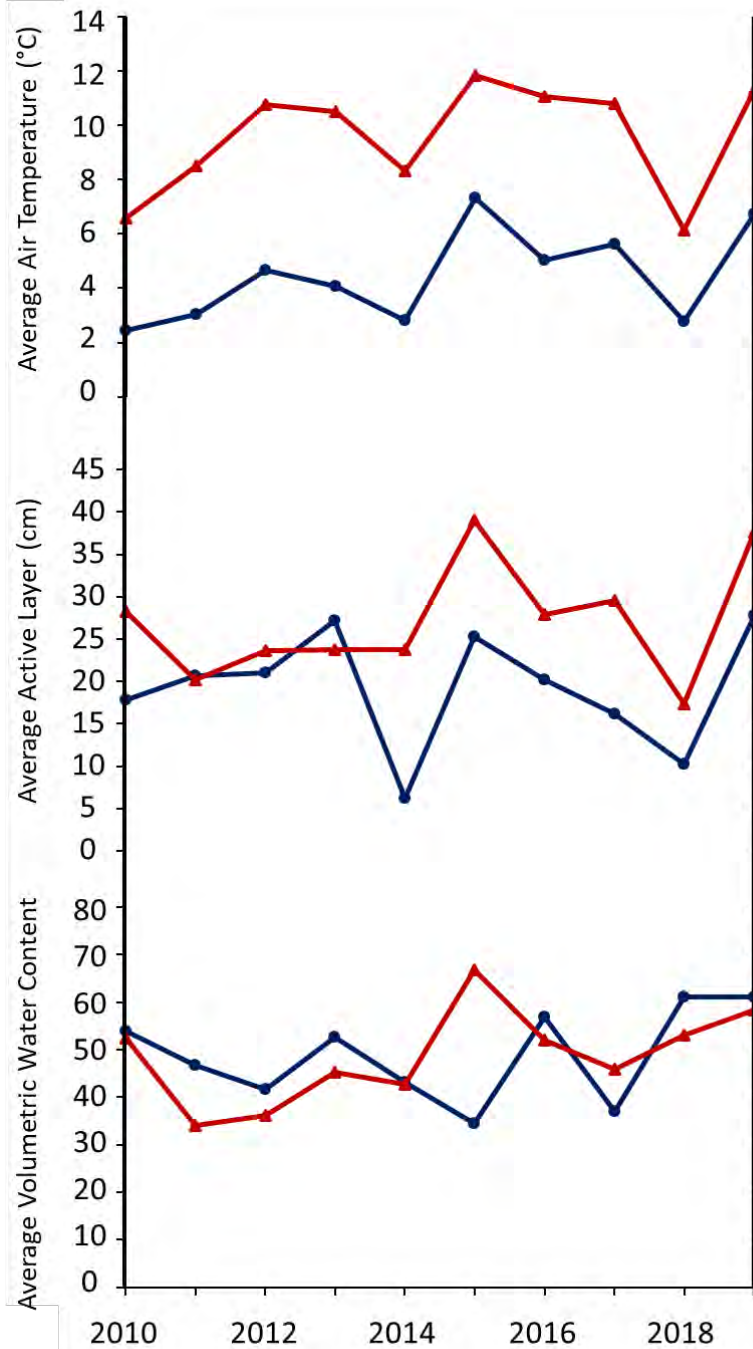
- Thanks goes out to all past and present members of the Arctic Ecology Program (AEP) at GVSU for inspiration and assistance with vegetation cover measurement collections. Thanks also to past and present members of the Systems Ecology Lab (SEL) at UTEP for assistance with abiotic measurement collections. Logistics was provided by UIC Science and we thank them and the communities of Atqasuk and Utqiagvik for their support.

# Environmental Data at both Sites

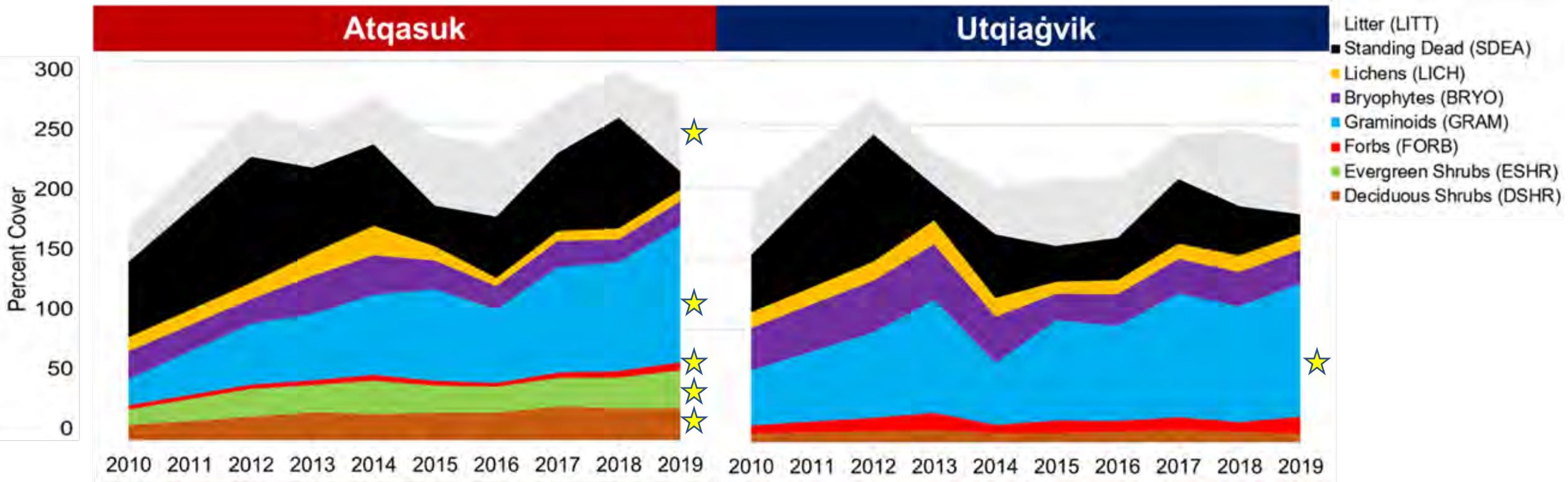
- Not shown

- Max air temperature
- Max soil temperature

▲ = ATQ  
● = UTQ



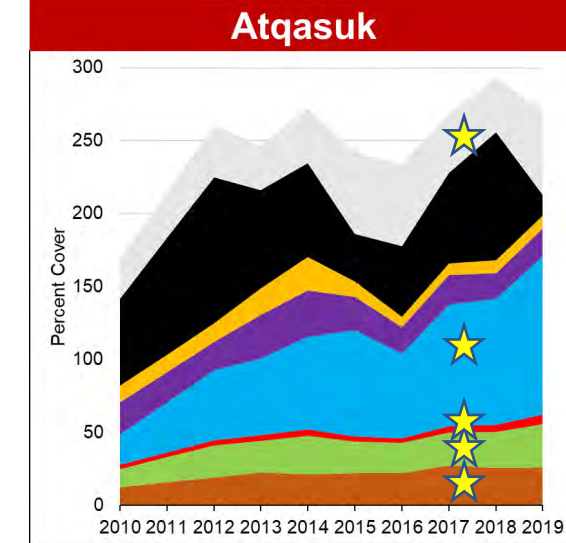
	2010	2012	2013	2014	2015	2016	2017	2018	2019	p
<b>Atqasuk Grid</b>										
<b>Air temp (avg)</b>	<b>6.6</b>	<b>10.8</b>	<b>10.5</b>	<b>8.3</b>	<b>11.9</b>	<b>11.1</b>	<b>10.8</b>	<b>6.1</b>	<b>11.3</b>	<b>0.38</b>
<b>Air temp (max)</b>	<b>21.2</b>	<b>22.9</b>	<b>25.4</b>	<b>21.2</b>	<b>24.4</b>	<b>23.7</b>	<b>22.7</b>	<b>22.0</b>	<b>25.9</b>	<b>0.45</b>
<b>Degree Day (sum)</b>	<b>236.0</b>	<b>383.0</b>	<b>421.0</b>	<b>289.0</b>	<b>492.0</b>	<b>445.0</b>	<b>360.0</b>	<b>198.0</b>	<b>385.0</b>	<b>0.18</b>
<b>Soil temp (avg)</b>	<b>2.7 (1.5)</b>	<b>4.0 (1.5)</b>	<b>8.1 (2.6)</b>	<b>4.8 (1.5)</b>	--	<b>6.2 (2.1)</b>	<b>4.6 (1.8)</b>	<b>2.6 (2.1)</b>	<b>5.9 (1.4)</b>	<b>0.26</b>
<b>Soil temp (max)</b>	<b>2.7 (1.5)</b>	<b>5.3 (2.2)</b>	<b>8.8 (2.6)</b>	<b>7.6 (2.5)</b>	--	<b>7.2 (2.0)</b>	<b>6.3 (2.0)</b>	<b>2.6 (2.1)</b>	<b>7.4 (1.3)</b>	<b>0.29</b>
<b>Thaw depth (avg)</b>	<b>28.2 (13.7)</b>	<b>23.7 (11.7)</b>	--	<b>23.8 (10.8)</b>	<b>39.0 (18.3)</b>	<b>27.9 (12.3)</b>	<b>29.6 (13.6)</b>	<b>17.3 (9.6)</b>	<b>37.6 (16.6)</b>	<b>0.15</b>
<b>Precip (sum)</b>	<b>0.4</b>	<b>0.5</b>	<b>7.7</b>	<b>9.9</b>	<b>3.8</b>	<b>3.9</b>	<b>4.0</b>	<b>1.8</b>	<b>5.3</b>	<b>0.41</b>
<b>Soil moist (avg)</b>	<b>52.4 (23.1)</b>	<b>36.1 (19.2)</b>	<b>45.2 (20.5)</b>	<b>42.8 (7.1)</b>	<b>66.8 (16.5)</b>	<b>52.1 (13.0)</b>	<b>45.9 (14.4)</b>	<b>53.1 (20.2)</b>	<b>58.4 (14.8)</b>	<b>0.25</b>
<b>Utqiagvik Grid</b>										
<b>Air temp (avg)</b>	<b>2.4</b>	<b>4.7</b>	<b>4.1</b>	<b>2.8</b>	<b>7.3</b>	<b>5.0</b>	<b>5.6</b>	<b>2.8</b>	<b>6.8</b>	<b>0.49</b>
<b>Air temp (max)</b>	<b>12.7</b>	<b>17.6</b>	<b>16.0</b>	<b>13.0</b>	<b>21.9</b>	<b>18.8</b>	<b>17.2</b>	<b>16.2</b>	<b>19.9</b>	<b>0.61</b>
<b>Degree Day (sum)</b>	<b>84.0</b>	<b>166.0</b>	<b>177.0</b>	<b>102.0</b>	<b>274.0</b>	<b>205.0</b>	<b>178.0</b>	<b>98.0</b>	<b>220.0</b>	<b>0.49</b>
Soil temp (avg)	--	2.4 (0.8)	2.4 (1.1)	3.8 (2.4)	4.2 (2.1)	3.8 (1.4)	2.7 (1.6)	1.8 (1.0)	3.5 (1.1)	0.10
<b>Soil temp (max)</b>	--	<b>3.1 (1.1)</b>	<b>3.5 (1.3)</b>	<b>5.0 (2.9)</b>	<b>4.2 (2.1)</b>	<b>5.4 (1.4)</b>	<b>4.0 (1.6)</b>	<b>1.8 (1.0)</b>	<b>4.9 (1.3)</b>	<b>0.13</b>
Thaw depth (avg)	17.9 (4.9)	21.0 (4.6)	27.2 (5.6)	6.3 (2.9)	25.3 (5.4)	20.3 (3.9)	16.2 (4.6)	10.2 (7.0)	27.8 (8.1)	-0.04
<b>Precip (sum)</b>	<b>0.4</b>	<b>0.5</b>	<b>4.3</b>	<b>8.7</b>	<b>1.8</b>	<b>3.3</b>	<b>3.8</b>	<b>1.9</b>	<b>4.8</b>	<b>0.31</b>
<b>Soil moist (avg)</b>	<b>53.9 (32.9)</b>	<b>41.6 (22.1)</b>	<b>52.6 (19.9)</b>	<b>43.2 (10.4)</b>	<b>34.6 (5.7)</b>	<b>56.9 (17.1)</b>	<b>37.0 (12.2)</b>	<b>61.2 (13.9)</b>	<b>61.0 (12.3)</b>	<b>0.19</b>





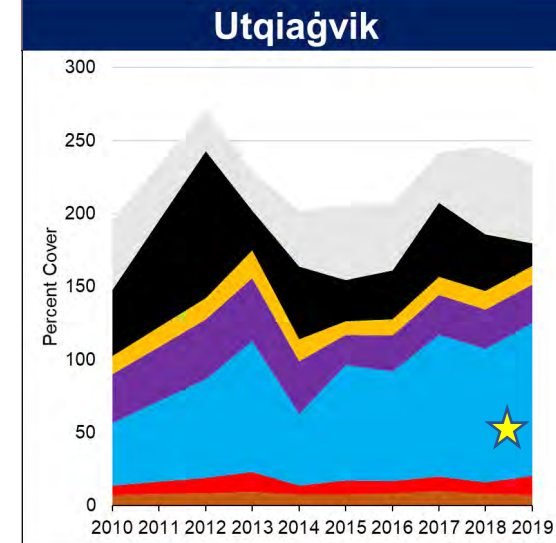
# Atqasuk Cover

	2010	2012	2013	2014	2015	2016	2017	2018	2019	Ch
<b>Atqasuk Grid</b>										
<b>Woody deciduous</b>	11.5 (17.5)	17.1 (23.3)	20.1 (28.6)	18.7 (27.0)	19.2 (26.4)	19.8 (28.6)	24.9 (34.4)	23.3 (33.6)	26.1 (38.0)	↑
<i>Betula nana</i>	8.0 (15.8)	12.8 (22.4)	15.0 (26.8)	14.1 (25.4)	13.0 (22.9)	14.2 (27.0)	16.6 (30.2)	14.8 (25.9)	16.1 (27.9)	↑
<i>Salix pulchra</i>	3.5 (10.0)	4.3 (11.6)	5.1 (13.8)	4.6 (13.0)	6.2 (17.0)	5.7 (14.2)	8.3 (22.0)	8.5 (26.4)	10.0 (30.5)	↑
<b>Woody evergreen</b>	12.2 (11.2)	22.0 (19.8)	21.6 (19.3)	26.4 (24.2)	21.5 (19.9)	20.7 (19.2)	22.5 (20.9)	24.5 (23.5)	29.6 (30.5)	↑
<i>Cassiope tetragona</i>	3.0 (6.5)	3.9 (9.5)	4.3 (10.8)	4.0 (9.2)	4.0 (8.9)	3.6 (8.1)	3.0 (7.0)	3.9 (9.9)	4.7 (11.9)	-
<i>Ledum palustre</i>	3.9 (4.4)	9.3 (9.9)	8.2 (8.5)	9.2 (10.3)	7.5 (7.9)	7.9 (8.8)	8.4 (8.8)	8.1 (9.1)	10.7 (12.7)	-
<i>V. vitis-idaea</i>	5.3 (6.2)	8.8 (9.1)	9.1 (9.7)	13.3 (13.2)	10.0 (10.9)	9.1 (10.0)	11.0 (12.4)	12.4 (13.0)	14.2 (16.0)	↑
<b>Forb</b>	3.2 (4.2)	3.4 (5.0)	3.7 (4.9)	4.6 (6.2)	3.8 (5.5)	3.2 (5.1)	4.3 (6.4)	5.1 (7.5)	6.4 (9.4)	↑
<i>R. chamaemorus</i>	1.9 (3.6)	2.3 (4.6)	2.0 (4.0)	2.5 (4.4)	2.8 (5.3)	2.5 (4.8)	2.9 (5.6)	3.4 (6.0)	4.6 (8.4)	↓
<b>Graminoid</b>	20.7 (11.5)	48.1 (28.2)	52.4 (27.8)	63.3 (28.1)	72.6 (35.4)	58.1 (35.9)	83.4 (39.5)	86.1 (45.0)	108.4 (46.0)	↑
<i>Carex aquatilis</i>	6.7 (8.2)	12.0 (13.2)	16.7 (18.6)	18.4 (20.7)	22.4 (25.5)	20.7 (26.4)	29.0 (32.6)	28.5 (33.5)	38.6 (44.5)	↑
<i>Carex bigelowii</i>	2.5 (4.6)	4.7 (9.3)	6.3 (12.1)	7.0 (14.1)	7.7 (14.9)	5.0 (9.9)	10.1 (18.8)	8.5 (15.8)	11.2 (21.7)	↑
<i>E. angustifolium</i>	0.4 (1.5)	1.6 (5.0)	1.7 (4.6)	2.0 (5.5)	3.4 (8.7)	2.1 (6.4)	4.8 (11.3)	5.0 (13.5)	7.1 (17.3)	↑
<i>E. russeolum</i>	1.2 (2.7)	4.3 (8.6)	6.5 (13.6)	9.5 (17.8)	9.5 (17.3)	6.4 (11.8)	8.4 (14.8)	6.9 (13.4)	12.3 (24.5)	↑
<i>E. vaginatum</i>	6.5 (9.6)	21.2 (29.7)	18.0 (25.1)	22.1 (29.8)	23.5 (33.2)	21.6 (32.8)	27.5 (38.4)	32.8 (44.3)	33.0 (42.2)	↑
<i>Trisetum spicatum</i>	0.9 (2.4)	2.5 (7.1)	1.6 (4.6)	2.3 (5.5)	2.7 (6.2)	1.2 (4.3)	2.2 (5.2)	3.3 (8.5)	4.6 (12.3)	↑
<b>Bryophyte</b>	12.4 (11.3)	12.2 (12.3)	29.7 (22.6)	31.4 (21.0)	22.4 (18.0)	18.1 (16.8)	20.2 (17.7)	17.9 (18.1)	18.9 (18.4)	-
Acrocarpus moss	7.7 (9.7)	8.2 (7.8)	15.5 (15.5)	16.3 (13.0)	9.4 (9.2)	6.5 (7.5)	9.5 (10.6)	7.4 (9.1)	8.0 (9.7)	-
Pleurocarpus moss	1.8 (4.4)	2.8 (7.4)	2.4 (6.6)	4.4 (9.6)	3.9 (7.9)	4.8 (11.7)	1.9 (5.7)	2.7 (6.9)	3.2 (6.8)	-
<b>Lichen</b>	9.3 (10.5)	12.5 (12.1)	17.4 (17.4)	22.3 (21.9)	10.1 (12.8)	6.4 (7.8)	7.9 (9.7)	8.6 (9.7)	8.9 (11.0)	-
Crustose	0.0 (0.0)	0.1 (0.5)	3.2 (6.4)	1.2 (2.8)	1.0 (2.8)	0.6 (2.0)	0.3 (1.3)	0.4 (1.7)	0.5 (1.4)	-
Foliose	3.9 (4.9)	4.1 (4.4)	5.0 (5.0)	6.2 (6.8)	3.1 (3.7)	1.6 (2.0)	2.9 (3.8)	3.2 (3.5)	3.1 (3.8)	-
Fruticose	5.4 (6.5)	8.3 (8.5)	9.3 (9.5)	14.9 (14.4)	6.1 (7.3)	4.3 (5.0)	4.7 (5.5)	5.0 (5.7)	5.2 (6.9)	-
<b>Standing dead plants</b>	59.7 (36.3)	100.1 (45.3)	67.4 (34.0)	64.2 (28.0)	32.4 (18.0)	48.5 (29.2)	62.1 (37.9)	87.6 (41.3)	35.8 (17.3)	-
<b>Leaf litter</b>	27.7 (12.0)	35.5 (15.1)	30.2 (14.9)	37.9 (18.4)	56.2 (19.8)	56.0 (23.1)	40.4 (17.6)	37.2 (13.9)	67.2 (34.4)	↑
Bare ground	0.0	0.0	0.6	0.1	0.4	0.1	0.4	0.6	1.6	0.4



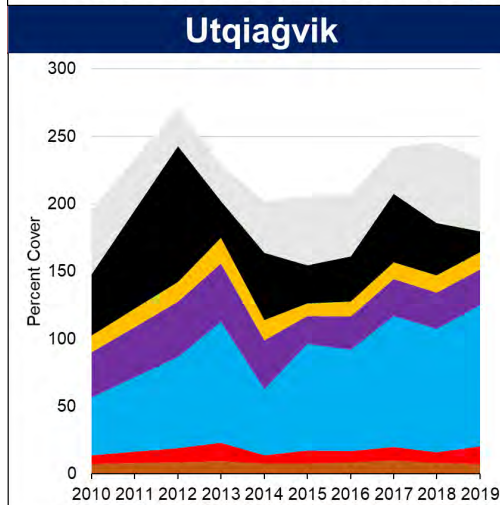
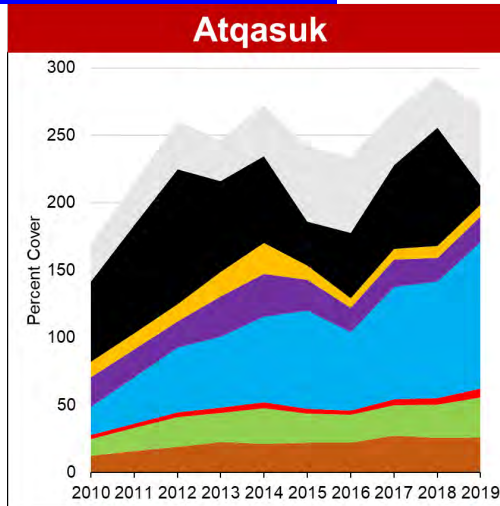
# Utqiagvik Cover

	2010	2012	2013	2014	2015	2016	2017	2018	2019	Ch
<b>Utqiagvik Grid</b>										
<b>Woody deciduous</b>	7.2 (12.9)	8.7 (16.3)	9.6 (16.8)	7.5 (13.7)	7.6 (14.4)	8.5 (16.7)	9.8 (18.2)	8.3 (15.1)	7.3 (14.0)	-
<i>Salix pulchra</i>	1.5 (6.9)	2.6 (11.4)	2.0 (8.5)	1.2 (5.0)	2.1 (9.1)	2.1 (9.3)	2.3 (10.2)	1.6 (7.1)	1.7 (7.9)	-
<i>Salix rotundifolia</i>	5.6 (10.6)	6.2 (10.9)	7.6 (13.4)	6.4 (12.1)	5.5 (11.0)	6.4 (12.4)	7.4 (14.3)	6.7 (13.3)	5.6 (12.0)	-
<b>Forb</b>	6.5 (7.2)	10.6 (17.9)	13.6 (17.0)	6.5 (9.1)	9.9 (19.9)	8.4 (17.2)	10.3 (20.8)	7.9 (17.4)	13.1 (30.8)	-
<i>Petasites frigidus</i>	1.7 (3.6)	5.6 (16.2)	4.1 (11.4)	2.3 (6.2)	6.5 (19.0)	5.1 (15.0)	6.1 (17.5)	5.0 (14.7)	9.5 (29.0)	↑
<i>Stellaria laeta</i>	1.6 (3.3)	1.3 (2.3)	2.3 (4.1)	1.4 (2.6)	0.9 (2.0)	0.8 (1.5)	1.6 (3.9)	0.8 (2.5)	0.9 (2.0)	-
<b>Graminoid</b>	43.1 (21.2)	67.5 (40.5)	89.3 (40.1)	48.6 (24.6)	78.9 (38.1)	75.0 (35.7)	97.1 (40.4)	91.0 (44.8)	104.7 (42.3)	↑
<i>A. latifolia</i>	2.0 (4.2)	2.5 (5.0)	3.1 (5.8)	1.7 (4.4)	3.1 (6.4)	2.8 (6.6)	4.9 (11.1)	3.6 (10.0)	3.7 (8.7)	↑
<i>Carex stans</i>	17.0 (15.4)	26.8 (24.1)	38.8 (32.6)	16.6 (14.2)	36.0 (30.9)	29.9 (27.8)	39.7 (33.3)	37.4 (37.7)	41.7 (31.1)	-
<i>Dupontia fisheri</i>	6.6 (9.1)	9.6 (13.5)	9.9 (14.9)	6.0 (9.2)	8.2 (10.3)	10.4 (17.6)	16.6 (19.1)	10.5 (12.3)	12.9 (14.0)	-
<i>E. russeolum</i>	5.0 (5.2)	7.8 (14.6)	10.7 (15.5)	7.6 (11.3)	11.8 (14.6)	12.6 (18.9)	9.9 (15.0)	13.2 (16.6)	16.9 (20.3)	↑
<i>E. triste</i>	2.6 (4.9)	8.7 (16.0)	7.9 (14.8)	6.5 (12.3)	10.2 (16.6)	9.9 (15.6)	12.5 (19.5)	14.8 (25.1)	14.1 (23.1)	↑
<i>Luzula arctica</i>	1.9 (4.9)	3.1 (6.5)	4.2 (10.2)	1.7 (5.3)	1.8 (4.6)	1.4 (3.6)	1.6 (5.6)	1.0 (3.4)	1.1 (3.0)	↓
<i>Luzula confusa</i>	1.7 (2.5)	1.6 (2.5)	2.4 (4.1)	1.0 (2.0)	2.3 (3.8)	2.2 (3.5)	1.9 (3.4)	2.0 (4.8)	1.7 (4.5)	-
<i>Poa arctica</i>	4.6 (7.5)	6.0 (15.5)	9.9 (20.2)	5.6 (10.3)	4.4 (9.6)	5.0 (9.2)	8.0 (15.4)	6.8 (14.1)	10.8 (20.5)	-
<b>Bryophyte</b>	32.6 (16.9)	40.5 (25.4)	40.5 (19.1)	34.2 (16.4)	20.6 (12.1)	24.7 (16.7)	27.3 (19.6)	27.0 (20.4)	26.6 (16.9)	-
<b>Acrocarpous moss</b>	16.6 (15.6)	13.6 (14.2)	18.5 (13.1)	13.2 (11.7)	9.6 (9.2)	11.3 (14.1)	11.8 (12.8)	11.7 (16.7)	9.8 (13.1)	↓
Pleurocarpous moss	3.8 (7.2)	20.8 (23.3)	16.9 (19.0)	14.6 (18.2)	9.6 (12.8)	12.0 (15.7)	13.2 (17.3)	12.2 (16.6)	15.1 (16.5)	-
<b>Lichen</b>	10.0 (13.2)	14.1 (16.8)	18.7 (22.5)	14.9 (17.8)	9.2 (12.4)	10.9 (15.2)	11.9 (15.4)	12.9 (19.3)	12.6 (17.3)	-
Foliose	3.2 (4.7)	4.9 (7.3)	6.3 (9.2)	4.5 (6.9)	3.0 (5.0)	4.0 (9.0)	4.2 (7.4)	4.1 (7.6)	4.6 (7.9)	-
Fruticose	6.8 (9.8)	9.1 (12.4)	11.9 (16.2)	10.0 (12.9)	6.0 (9.2)	6.7 (10.2)	7.6 (11.1)	8.8 (14.6)	7.9 (13.0)	-
<b>Standing dead plants</b>	45.2 (21.1)	100.4 (40.7)	27.2 (18.8)	49.8 (23.6)	28.2 (11.6)	33.4 (15.5)	50.7 (26.8)	38.7 (23.0)	32.8 (17.3)	-
Leaf litter	47.6 (20.9)	28.4 (20.7)	26.7 (19.5)	38.0 (17.2)	51.5 (23.0)	45.9 (27.2)	34.4 (22.8)	59.9 (25.4)	55.7 (28.0)	-
Bare ground	0.0	0.0	0.0	0.0	0.4	0.8	0.0	0.0	0.2	-



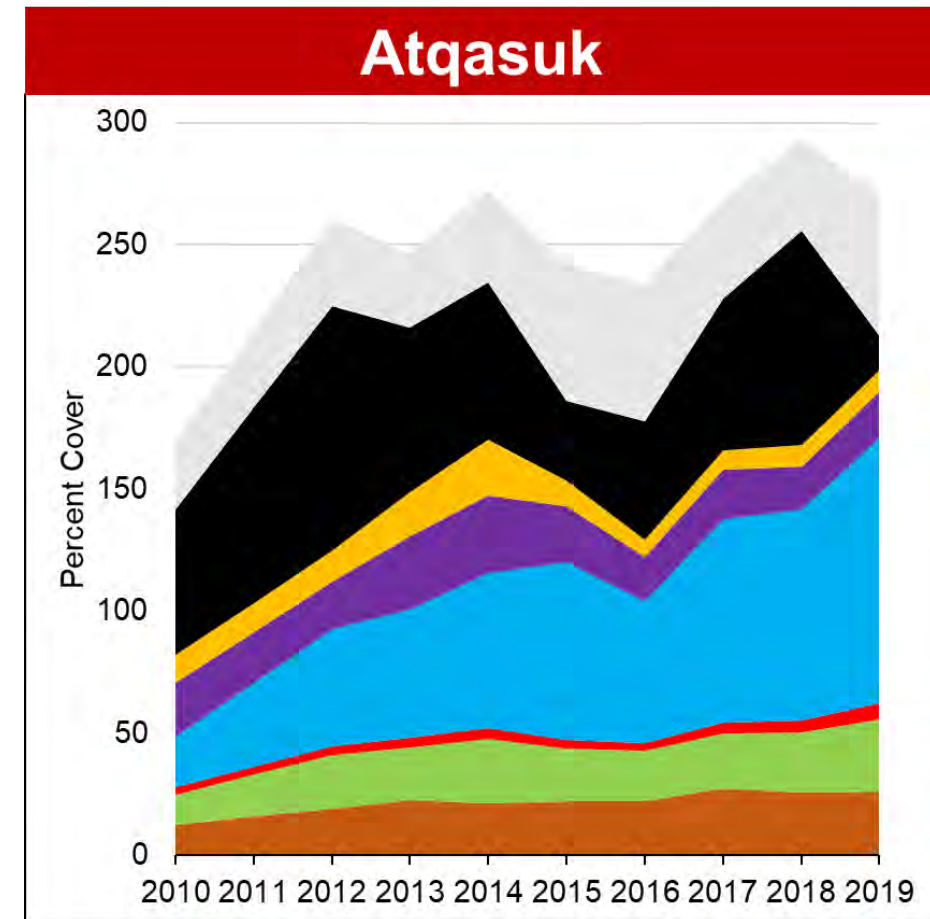
# Cover to Cover

Functional Groups	Woody Deciduous	Woody Evergreen	Forb	Graminoid	Bryophyte	Lichen	Standing dead	Leaf litter
<b>Atqasuk Grid</b>								
Woody Deciduous	1116	1289	1291	1296	1290	1292	1280	1284
Woody Evergreen	1423	1177	1428	1400	1431	1426	1401	1413
Forb	816	819	641	809	803	800	817	813
Graminoid	3446	2751	2767	2100	2784	2784	2703	2782
Bryophyte	2335	2336	2344	2339	1560	2339	2341	2203
Lichen	1253	1246	1257	1236	1227	1102	1213	1184
Standing dead	2646	2585	2640	2428	2641	2608	1768	2530
Leaf litter	2766	2742	2778	2777	2659	2716	2647	1710
<b>Utqiagvik Grid</b>								
Woody Deciduous	587	-	707	701	713	712	705	699
Woody Evergreen	-	-	-	-	-	-	-	-
Forb	1560	-	1303	1534	1560	1565	1548	1556
Graminoid	2682	-	2722	1956	2719	2719	2720	2674
Bryophyte	2981	-	2980	2987	1764	2984	2984	2428
Lichen	1208	-	1202	1192	1190	994	1198	1161
Standing dead	2588	-	2582	2561	2600	2596	1640	2536
Leaf litter	3029	-	3047	3041	2558	3016	3006	1749



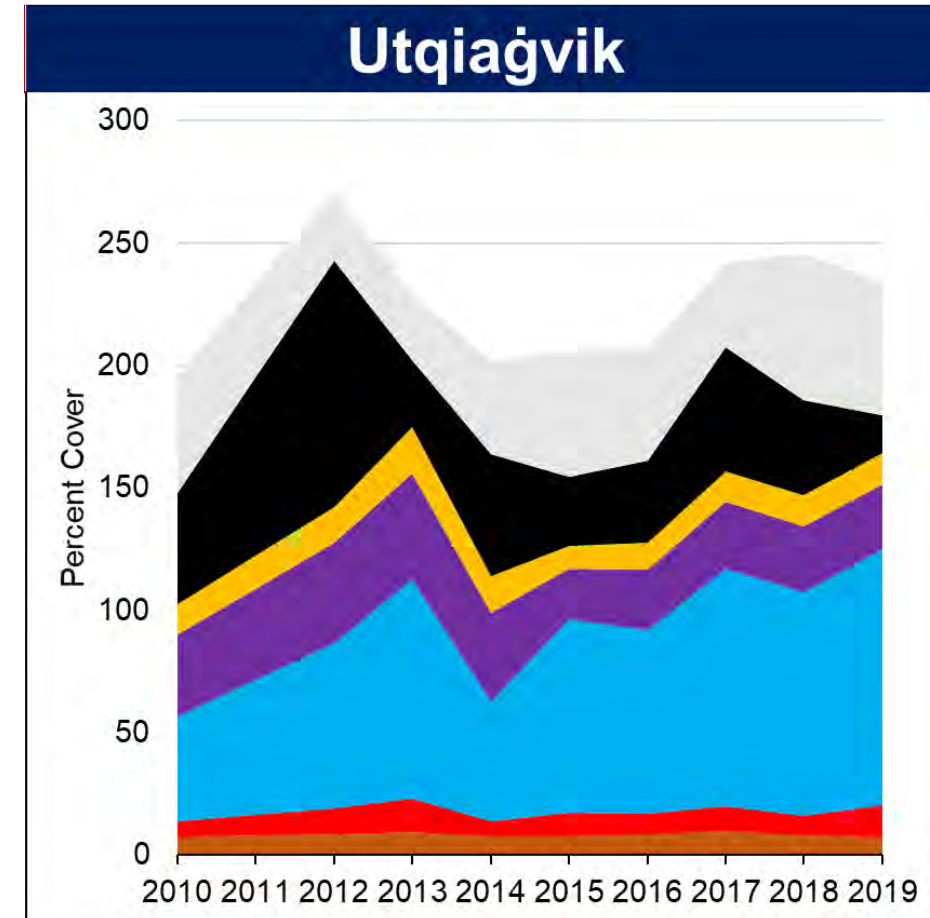
# Atqasuk Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Atqasuk Grid</b>									
Woody deciduous	1289	1291	1185	1290	1185	1290	1153	1290	1288
<i>Betula nana</i>	846	847	772	846	771	847	749	847	848
<i>Salix pulchra</i>	582	585	536	584	537	584	542	585	586
Woody evergreen	1428	1427	1258	1427	1255	1427	1287	1428	1410
<i>Cassiope tetragona</i>	618	619	562	619	562	615	559	618	620
<i>Ledum palustre</i>	1055	1055	926	1055	926	1054	945	1054	1040
<i>Vaccinium vitis-idaea</i>	1047	1047	944	8575	944	1046	930	1047	1043
<b>Forb</b>	813	815	733	815	729	813	733	814	816
<i>Rubus chamaemorus</i>	518	522	471	522	466	522	477	522	521
<b>Graminoid</b>	2781	2779	2477	2782	2461	2782	2457	2781	2781
<i>Carex aquatilis</i>	1446	1447	1251	1449	1247	1448	1238	1448	1445
<i>Carex bigelowii</i>	277	597	543	792	543	596	540	596	592
<i>Eriophorum angustifolium</i>	478	480	438	480	440	480	439	480	484
<i>Eriophorum russeolum</i>	636	636	585	636	585	635	567	635	637
<i>Eriophorum vaginatum</i>	1177	1176	1059	1177	1059	1175	1078	1175	1169
<i>Trisetum spicatum</i>	577	578	465	578	471	578	541	577	579
<b>Bryophyte</b>	2336	2334	2127	2339	2123	2337	2092	2336	2337
Acrocarpous moss	1553	1551	1358	1551	1358	1550	1369	1550	1554
Pleurocarpous moss	983	985	834	984	817	985	894	983	974
<b>Lichen</b>	1254	1255	1092	1254	1093	1254	1133	1254	1241
Crustose	327	327	287	327	289	327	235	327	329
Foliose	839	839	745	840	747	839	731	839	837
Fruticose	1081	1081	959	1187	959	1081	965	1080	1069
<b>Standing dead</b>	3646	3649	3249	3761	3248	3647	3217	3647	3654
<b>Leaf litter</b>	2942	2944	2697	2940	2695	2940	2552	2942	2911



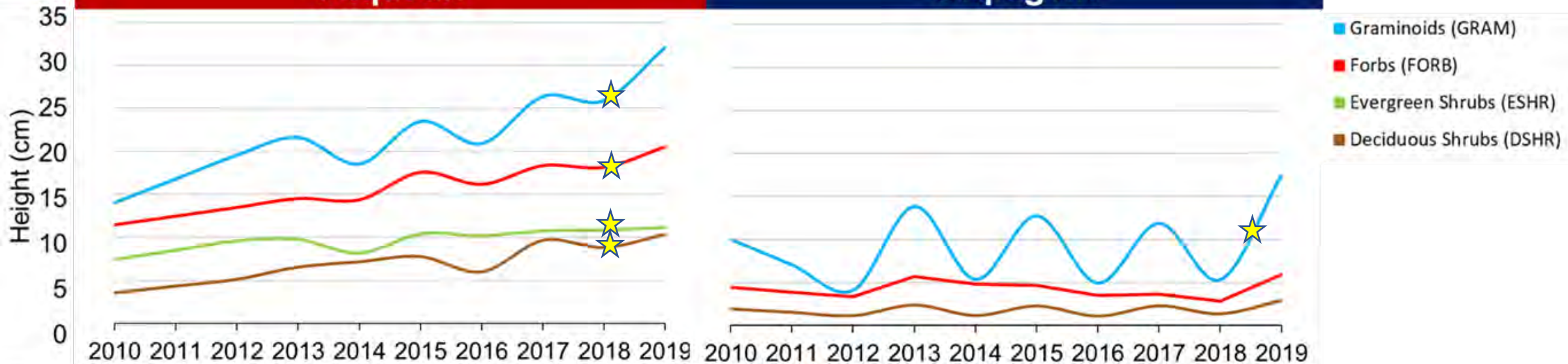
# Utqiagvik Cover to Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw depth (avg)	Precip (sum)	Soil moist (avg)
<b>Utqiagvik Grid</b>									
Woody deciduous	713	713	713	713	633	635	711	713	712
<i>Salix pulchra</i>	183	183	183	183	173	172	183	182	183
<i>Salix rotundifolia</i>	689	689	688	689	614	614	689	689	690
<b>Forb</b>	1562	1563	1561	1560	1339	1328	1535	1562	1566
<i>Petasites frigidus</i>	623	622	623	622	551	550	625	622	622
<i>Stellaria laeta</i>	562	562	563	563	498	497	557	562	561
<b>Graminoid</b>	2715	2714	2713	2716	2445	2449	2721	2716	2721
<i>Arctagrostis latifolia</i>	567	569	568	569	514	516	571	569	570
<i>Carex stans</i>	1820	1820	1818	1819	1656	1653	1825	1819	1822
<i>Dupontia fisheri</i>	1516	1514	1514	1513	1341	1341	1520	1515	1515
<i>Eriophorum russeolum</i>	1561	1560	1558	1560	1356	1355	1565	1561	1566
<i>Eriophorum triste</i>	1408	1406	1409	1408	1259	1256	1421	1411	1414
<i>Luzula arctica</i>	480	481	481	481	428	431	480	481	476
<i>Luzula confusa</i>	703	703	702	702	640	634	706	702	706
<i>Poa arctica</i>	1191	1188	1189	1189	1044	1046	1183	1189	1186
<b>Bryophyte</b>	2978	2976	2980	2979	2620	2614	2971	2976	2985
Acrocarpous moss	2261	2268	2263	2266	1800	1800	2268	2264	2276
Pleurocarpous moss	2068	2067	2067	2068	1818	1811	2071	2065	2075
<b>Lichen</b>	1203	1203	1204	1203	1081	1080	1204	1203	1204
Foliose	863	865	863	864	767	763	866	863	868
Fruticose	949	948	949	949	860	860	948	950	950
<b>Standing dead</b>	3788	3792	3791	3790	3358	3358	3801	3789	3794
Leaf litter	3047	3047	3049	3047	2778	2771	3031	3049	3048



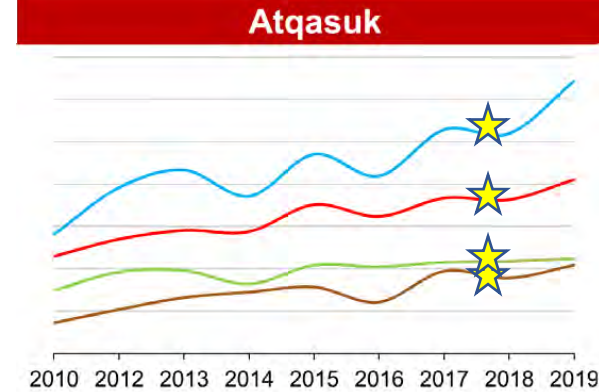
## Atqasuk

## Utqiagvik



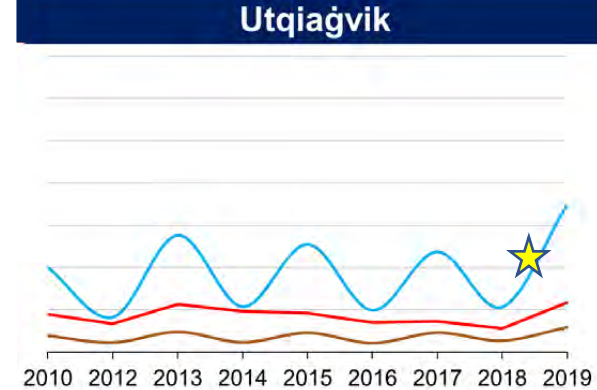
# Height

	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Atqasuk Grid</b>											
<b>Woody deciduous</b>	28	11.5 (6.0)	13.5 (6.0)	14.5 (7.8)	14.4 (7.3)	17.6 (8.1)	16.2 (6.6)	18.4 (7.2)	18.2 (8.1)	20.5 (9.7)	0.11
<i>Betula nana</i>	12	12.5 (6.6)	15.6 (6.0)	16.6 (8.3)	16.0 (8.0)	18.5 (8.2)	17.0 (7.3)	19.1 (7.9)	18.9 (8.3)	20.3 (8.9)	0.07
<i>Salix pulchra</i>	7	9.3 (3.3)	9.0 (2.2)	11.3 (4.2)	11.3 (3.5)	14.8 (6.7)	14.8 (3.9)	17.0 (4.8)	16.3 (6.6)	22.0 (10.5)	0.31
<b>Woody evergreen</b>	19	7.4 (5.0)	9.6 (4.2)	9.8 (6.0)	8.2 (5.6)	10.4 (7.0)	10.2 (5.0)	10.8 (4.3)	10.9 (5.8)	11.2 (4.5)	0.04
<i>Cassiope tetragona</i>	8	7.0 (4.8)	7.7 (3.7)	8.6 (5.9)	8.1 (7.7)	8.6 (5.2)	8.8 (4.1)	9.2 (3.5)	9.2 (5.7)	10.5 (7.3)	0.03
<i>Ledum palustre</i>	17	6.9 (4.6)	8.6 (4.6)	9.7 (6.3)	6.7 (4.3)	8.5 (4.8)	9.9 (5.2)	10.2 (4.6)	11.4 (6.0)	10.5 (3.2)	0.05
<i>V. vitis-idaea</i>	19	2.1 (3.5)	5.9 (3.4)	5.1 (3.6)	5.1 (3.0)	6.9 (7.1)	5.7 (3.7)	6.5 (3.9)	6.5 (4.4)	8.3 (3.0)	0.10
<b>Forb</b>	21	3.6 (1.4)	5.2 (3.1)	6.6 (5.5)	7.2 (4.1)	7.8 (4.8)	6.0 (3.5)	9.7 (3.8)	8.9 (3.9)	10.4 (3.7)	0.19
<i>Rubus chamaemorus</i>	8	3.7 (1.6)	5.0 (3.2)	5.1 (3.6)	5.5 (1.8)	8.0 (4.2)	6.1 (3.5)	8.9 (1.8)	8.8 (3.8)	10.8 (3.6)	0.30
<b>Graminoid</b>	15	14.0 (5.2)	19.6 (7.3)	21.6 (8.6)	18.5 (6.8)	23.5 (8.7)	20.9 (8.3)	26.4 (9.1)	25.9 (9.8)	32.1 (10.8)	0.21
<i>Carex aquatilis</i>	17	15.6 (4.5)	22.1 (7.3)	23.1 (8.0)	21.0 (6.1)	25.6 (7.8)	25.3 (7.8)	30.3 (8.6)	30.0 (9.3)	35.8 (10.4)	0.31
<i>Carex bigelowii</i>	9	11.3 (6.0)	13.8 (7.6)	15.2 (6.9)	13.1 (6.1)	16.5 (8.5)	14.6 (3.2)	19.9 (7.9)	18.3 (6.8)	23.3 (10.9)	0.15
<i>E. russeolum</i>	6	9.6 (3.7)	13.6 (5.9)	20.1 (3.7)	19.4 (6.4)	22.5 (6.3)	18.6 (5.4)	26.0 (4.5)	24.8 (7.0)	28.8 (7.6)	0.44
<i>E. vaginatum</i>	14	9.5 (3.7)	14.4 (7.1)	17.7 (9.3)	13.7 (5.8)	19.1 (7.5)	14.5 (6.0)	18.4 (7.8)	19.6 (6.7)	25.5 (10.0)	0.18
<i>Trisetum spicatum</i>	4	9.3 (3.0)	14.2 (3.8)	14.6 (4.7)	13.2 (3.1)	13.8 (5.3)	14.1 (4.2)	19.1 (2.3)	17.8 (3.9)	21.6 (9.1)	0.30



# Height

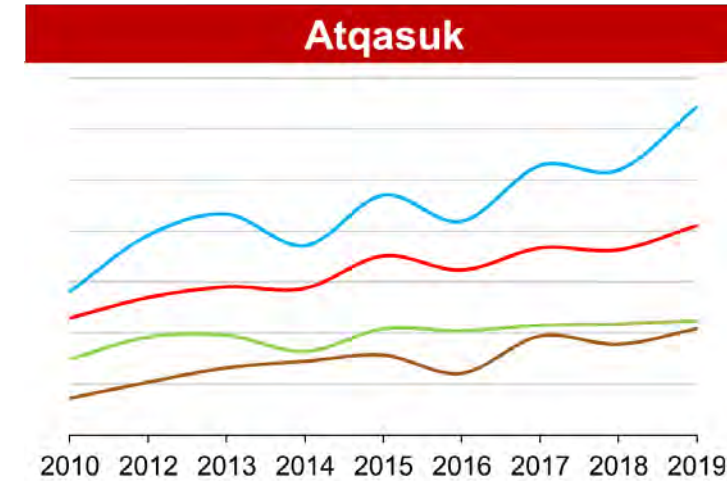
	n	2010	2012	2013	2014	2015	2016	2017	2018	2019	r <sup>2</sup>
<b>Utqiagvik Grid</b>											
Woody deciduous	28	2.0 (1.2)	2.4 (1.2)	2.3 (1.1)	2.3 (1.4)	2.9 (2.4)	2.9 (1.3)	3.9 (2.7)	2.9 (1.4)	3.0 (1.9)	0.06
<i>Salix pulchra</i>	2	3.5 (1.1)	3.9 (1.3)	3.5 (0.9)	2.6 (0.8)	5.0 (3.6)	4.7 (0.5)	3.8 (2.4)	4.2 (1.4)	3.9 (1.5)	0.02
<i>Salix rotundifolia</i>	7	1.6 (0.7)	2.0 (0.6)	2.0 (0.9)	2.2 (1.5)	2.2 (1.7)	2.5 (0.8)	3.6 (2.8)	2.5 (1.0)	2.7 (1.9)	0.08
Forb	10	4.5 (3.4)	5.7 (4.8)	4.6 (3.5)	3.6 (2.8)	5.9 (3.9)	5.6 (3.9)	6.4 (4.3)	5.4 (3.7)	8.3 (5.4)	0.04
<i>Petasites frigidus</i>	7	3.8 (2.6)	7.3 (6.1)	5.4 (3.8)	5.4 (3.5)	6.6 (4.6)	5.2 (4.2)	6.3 (4.5)	6.8 (4.1)	9.7 (6.5)	0.05
★ <i>Saxifraga cernua</i>	4	<b>0.9 (0.5)</b>	<b>4.7 (4.4)</b>	<b>1.5 (1.2)</b>	<b>1.0 (1.3)</b>	<b>2.8 (1.2)</b>	<b>3.8 (2.5)</b>	<b>2.8 (0.7)</b>	<b>4.0 (0.4)</b>	<b>4.2 (1.4)</b>	<b>0.16</b>
<i>Stellaria laeta</i>	4	2.8 (0.8)	4.9 (2.3)	3.7 (1.8)	3.7 (1.6)	5.4 (1.1)	3.5 (1.3)	5.1 (2.4)	3.7 (1.9)	5.6 (3.4)	0.05
★ <b>Graminoid</b>	22	<b>10.0 (4.1)</b>	<b>13.8 (5.4)</b>	<b>12.7 (4.9)</b>	<b>11.9 (5.3)</b>	<b>17.4 (6.2)</b>	<b>15.1 (4.9)</b>	<b>18.8 (7.4)</b>	<b>17.1 (8.0)</b>	<b>23.1 (8.3)</b>	<b>0.21</b>
<i>Arctagrostis latifolia</i>	4	7.2 (0.9)	7.3 (1.8)	7.5 (2.8)	7.1 (1.7)	8.4 (1.7)	9.8 (4.1)	12.5 (4.9)	11.5 (5.3)	13.8 (10.4)	0.20
★ <i>Carex stans</i>	<b>23</b>	<b>10.2 (4.4)</b>	<b>14.2 (5.1)</b>	<b>12.8 (4.5)</b>	<b>12.0 (5.8)</b>	<b>16.2 (5.4)</b>	<b>15.1 (5.3)</b>	<b>19.1 (8.1)</b>	<b>17.3 (9.1)</b>	<b>22.8 (7.7)</b>	<b>0.20</b>
★ <i>Dupontia fisheri</i>	<b>16</b>	<b>8.6 (3.2)</b>	<b>11.5 (5.2)</b>	<b>11.2 (3.7)</b>	<b>9.3 (3.9)</b>	<b>17.8 (5.9)</b>	<b>12.8 (4.2)</b>	<b>16.7 (5.3)</b>	<b>15.2 (4.0)</b>	<b>20.2 (7.0)</b>	<b>0.26</b>
★ <i>E. russeolum</i>	<b>14</b>	<b>6.9 (2.0)</b>	<b>11.2 (3.5)</b>	<b>10.6 (3.5)</b>	<b>9.2 (2.7)</b>	<b>13.2 (3.0)</b>	<b>12.3 (2.2)</b>	<b>14.6 (3.3)</b>	<b>14.9 (4.5)</b>	<b>17.6 (4.5)</b>	<b>0.39</b>
★ <i>E. triste</i>	<b>9</b>	<b>5.7 (2.9)</b>	<b>10.4 (4.2)</b>	<b>9.6 (4.9)</b>	<b>9.5 (1.5)</b>	<b>14.3 (5.0)</b>	<b>10.5 (2.8)</b>	<b>14.3 (3.8)</b>	<b>14.0 (4.7)</b>	<b>17.9 (5.0)</b>	<b>0.34</b>
<i>Luzula arctica</i>	3	4.1 (1.2)	9.7 (4.2)	6.4 (2.7)	4.4 (0.4)	5.5 (5.1)	8.3 (2.2)	9.3 (3.2)	3.8 (3.4)	5.8 (2.9)	0.00
★ <i>Luzula confusa</i>	<b>8</b>	<b>2.9 (1.2)</b>	<b>5.6 (2.1)</b>	<b>5.2 (2.6)</b>	<b>3.8 (1.6)</b>	<b>5.7 (3.6)</b>	<b>7.8 (3.1)</b>	<b>6.6 (3.7)</b>	<b>5.6 (2.8)</b>	<b>6.7 (3.3)</b>	<b>0.11</b>
★ <i>Poa arctica</i>	<b>13</b>	<b>4.3 (1.8)</b>	<b>6.7 (4.1)</b>	<b>5.8 (3.3)</b>	<b>3.6 (2.2)</b>	<b>6.8 (2.9)</b>	<b>7.2 (4.4)</b>	<b>8.2 (3.5)</b>	<b>5.7 (3.0)</b>	<b>10.7 (6.4)</b>	<b>0.12</b>





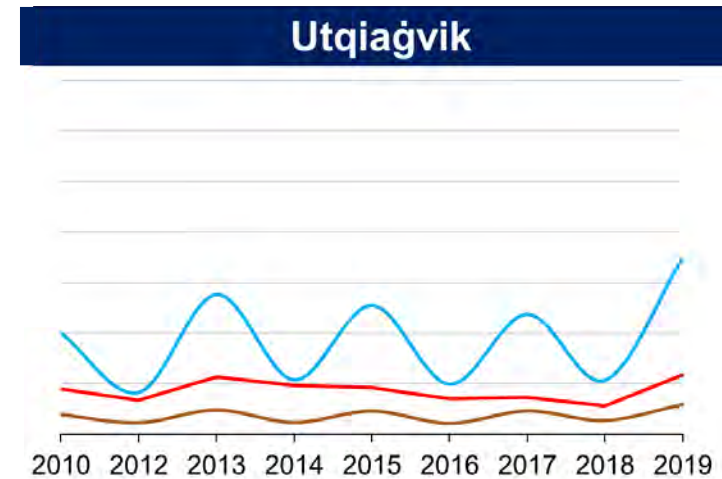
# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
<b>Atqasuk Grid</b>									
Woody deciduous	0.11	0.02	0.03	0.01	0.00	0.00	0.02	0.00	0.00
<i>Betula nana</i>	0.07	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00
<i>Salix pulchra</i>	0.31	0.03	0.08	0.01	0.02	0.01	0.10	0.00	0.00
Woody evergreen	0.04	0.01	0.02	0.01	0.04	0.03	0.00	0.00	0.00
<i>Cassiope tetragona</i>	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
<i>Ledum palustre</i>	0.05	0.00	0.02	0.00	0.04	0.02	0.00	0.00	0.00
<i>Vaccinium vitis-idaea</i>	0.10	0.04	0.05	0.02	0.00	0.00	0.01	0.00	0.00
<b>Forb</b>									
<i>Rubus chamaemorus</i>	0.30	0.03	0.06	0.00	0.02	0.02	0.08	0.00	0.00
<b>Graminoid</b>									
<i>Carex aquatilis</i>	0.31	0.04	0.09	0.01	0.04	0.03	0.04	0.00	0.03
<i>Carex bigelowii</i>	0.15	0.02	0.06	0.00	0.00	0.00	0.00	0.00	0.00
<i>Eriophorum russeolum</i>	0.44	0.05	0.11	0.02	0.10	0.12	0.04	0.06	0.00
<i>E. vaginatum</i>	0.18	0.05	0.13	0.02	0.00	0.00	0.01	0.01	0.00
<i>Trisetum spicatum</i>	0.30	0.03	0.08	0.00	0.02	0.00	0.17	0.01	0.00



# Height vs Abiotic

	Year	Air temp (avg)	Air temp (max)	Degree Day (sum)	Soil temp (avg)	Soil temp (max)	Thaw Depth (avg)	Precipitation (sum)	Soil moisture (avg)
Vegetation Height									
Utqiaġvik Grid									
Woody deciduous	0.06	0.04	0.03	0.02	0.01	0.01	0.00	0.00	0.00
<i>Salix pulchra</i>	0.02	0.06	0.10	0.07	0.02	0.01	0.00	0.05	0.00
<i>Salix rotundifolia</i>	0.08	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Woody evergreen	-	-	-	-	-	-	-	-	-
Forb	0.04	0.05	0.05	0.03	0.00	0.00	0.02	0.00	0.01
<i>Petasites frigidus</i>	0.05	0.04	0.04	0.02	0.00	0.00	0.02	0.00	0.05
<i>Saxifraga cernua</i>	0.16	0.09	0.18	0.07	0.08	0.06	0.00	0.04	0.00
<i>Stellaria laeta</i>	0.05	0.15	0.12	0.10	0.00	0.00	0.05	0.00	0.03
Graminoid	0.21	0.14	0.14	0.09	0.00	0.00	0.00	0.00	0.01
<i>Arctagrostis latifolia</i>	0.20	0.05	0.05	0.02	0.00	0.02	0.08	0.00	0.01
<i>Carex stans</i>	0.20	0.11	0.11	0.06	0.00	0.00	0.00	0.00	0.01
<i>Dupontia fisheri</i>	0.26	0.24	0.24	0.17	0.00	0.00	0.00	0.00	0.00
<i>Eriophorum triste</i>	0.34	0.21	0.22	0.13	0.00	0.00	0.01	0.01	0.00
<i>Eriophorum russeolum</i>	0.39	0.18	0.22	0.12	0.01	0.01	0.01	0.00	0.00
<i>Luzula arctica</i>	0.00	0.07	0.06	0.06	0.03	0.09	0.12	0.01	0.19
<i>Luzula confusa</i>	0.11	0.10	0.13	0.10	0.11	0.14	0.17	0.00	0.00
<i>Poa arctica</i>	0.12	0.14	0.12	0.10	0.01	0.03	0.00	0.00	0.00



	2010	2012	2013	2014	2015	2016	2017	2018	2019	Ch									
Atqasuk Grid																			
<b>Woody deciduous</b>	<b>11.5</b>	<b>(17.5)</b>	<b>17.1</b>	<b>(23.3)</b>	<b>20.1</b>	<b>(28.6)</b>	<b>18.7</b>	<b>(27.0)</b>	<b>19.2</b>	<b>(26.4)</b>	<b>19.8</b>	<b>(28.6)</b>	<b>24.9</b>	<b>(34.4)</b>	<b>23.3</b>	<b>(33.6)</b>	<b>26.1</b>	<b>(38.0)</b>	<b>↑</b>
<i>Betula nana</i>	8.0	(15.8)	12.8	(22.4)	15.0	(26.8)	14.1	(25.4)	13.0	(22.9)	14.2	(27.0)	16.6	(30.2)	14.8	(25.9)	16.1	(27.9)	-
<i>Salix pulchra</i>	<b>3.5</b>	<b>(10.0)</b>	<b>4.3</b>	<b>(11.6)</b>	<b>5.1</b>	<b>(13.8)</b>	<b>4.6</b>	<b>(13.0)</b>	<b>6.2</b>	<b>(17.0)</b>	<b>5.7</b>	<b>(14.2)</b>	<b>8.3</b>	<b>(22.0)</b>	<b>8.5</b>	<b>(26.4)</b>	<b>10.0</b>	<b>(30.5)</b>	<b>↑</b>
<b>Woody evergreen</b>	<b>12.2</b>	<b>(11.2)</b>	<b>22.0</b>	<b>(19.8)</b>	<b>21.6</b>	<b>(19.3)</b>	<b>26.4</b>	<b>(24.2)</b>	<b>21.5</b>	<b>(19.9)</b>	<b>20.7</b>	<b>(19.2)</b>	<b>22.5</b>	<b>(20.9)</b>	<b>24.5</b>	<b>(23.5)</b>	<b>29.6</b>	<b>(30.5)</b>	<b>↑</b>
<i>C. tetragona</i>	3.0	(6.5)	3.9	(9.5)	4.3	(10.8)	4.0	(9.2)	4.0	(8.9)	3.6	(8.1)	3.0	(7.0)	3.9	(9.9)	4.7	(11.9)	-
<i>Empetrum nigrum</i>	0.4	(2.0)	0.3	(1.5)	0.2	(0.9)	0.2	(1.3)	0.2	(1.1)	0.2	(0.9)	0.2	(0.9)	0.4	(2.0)	0.4	(2.0)	-
<i>Ledum palustre</i>	3.9	(4.4)	9.3	(9.9)	8.2	(8.5)	9.2	(10.3)	7.5	(7.9)	7.9	(8.8)	8.4	(8.8)	8.1	(9.1)	10.7	(12.7)	-
<i>V. vitis-idaea</i>	<b>5.3</b>	<b>(6.2)</b>	<b>8.8</b>	<b>(9.1)</b>	<b>9.1</b>	<b>(9.7)</b>	<b>13.3</b>	<b>(13.2)</b>	<b>10.0</b>	<b>(10.9)</b>	<b>9.1</b>	<b>(10.0)</b>	<b>11.0</b>	<b>(12.4)</b>	<b>12.4</b>	<b>(13.0)</b>	<b>14.2</b>	<b>(16.0)</b>	<b>↑</b>
<b>Forb</b>	<b>3.2</b>	<b>(4.2)</b>	<b>3.4</b>	<b>(5.0)</b>	<b>3.7</b>	<b>(4.9)</b>	<b>4.6</b>	<b>(6.2)</b>	<b>3.8</b>	<b>(5.5)</b>	<b>3.2</b>	<b>(5.1)</b>	<b>4.3</b>	<b>(6.4)</b>	<b>5.1</b>	<b>(7.5)</b>	<b>6.4</b>	<b>(9.4)</b>	<b>↑</b>
<i>A. polifolia</i>	0.0	(0.2)	0.0	(0.2)	0.5	(2.6)	0.7	(3.1)	0.0	(0.0)	0.0	(0.0)	0.5	(2.7)	0.6	(2.6)	0.7	(3.8)	-
<i>Oxyria digyna</i>	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.1	(0.5)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	-
<i>P. lapponica</i>	<b>0.1</b>	<b>(0.4)</b>	<b>0.3</b>	<b>(1.1)</b>	<b>0.2</b>	<b>(0.7)</b>	<b>0.3</b>	<b>(1.5)</b>	<b>0.2</b>	<b>(0.9)</b>	<b>0.0</b>	<b>(0.2)</b>	<b>0.1</b>	<b>(0.4)</b>	<b>0.1</b>	<b>(0.6)</b>	<b>0.0</b>	<b>(0.0)</b>	<b>↓</b>
<i>P. sudetica</i>	0.1	(0.4)	0.1	(0.4)	0.2	(0.7)	0.2	(0.5)	0.1	(0.3)	0.0	(0.2)	0.1	(0.4)	0.2	(1.1)	0.0	(0.2)	-
<i>Petasites frigidus</i>	0.0	(0.0)	0.0	(0.0)	0.0	(0.2)	0.1	(0.4)	0.1	(0.4)	0.1	(0.7)	0.1	(0.4)	0.1	(0.4)	0.1	(0.7)	-
<i>P. bistorta</i>	0.3	(1.0)	0.2	(1.1)	0.4	(1.7)	0.4	(1.7)	0.2	(0.9)	0.2	(1.1)	0.3	(1.5)	0.1	(0.5)	0.5	(1.9)	-
<i>P. grandiflora</i>	0.1	(0.4)	0.1	(0.5)	0.1	(0.5)	0.1	(0.7)	0.0	(0.0)	0.1	(0.5)	0.1	(0.4)	0.2	(0.9)	0.0	(0.0)	-
<i>R. pallasii</i>	0.0	(0.0)	0.1	(0.5)	0.1	(0.4)	0.1	(0.5)	0.1	(0.5)	0.0	(0.2)	0.0	(0.0)	0.1	(0.5)	0.1	(0.5)	-
<i>R. chamaemorus</i>	1.9	(3.6)	2.3	(4.6)	2.0	(4.0)	2.5	(4.4)	2.8	(5.3)	2.5	(4.8)	2.9	(5.6)	3.4	(6.0)	4.6	(8.4)	-
<b>Graminoid</b>	<b>20.7</b>	<b>(11.5)</b>	<b>48.1</b>	<b>(28.2)</b>	<b>52.4</b>	<b>(27.8)</b>	<b>63.3</b>	<b>(28.1)</b>	<b>72.6</b>	<b>(35.4)</b>	<b>58.1</b>	<b>(35.9)</b>	<b>83.4</b>	<b>(39.5)</b>	<b>86.1</b>	<b>(45.0)</b>	<b>108.4</b>	<b>(46.0)</b>	<b>↑</b>
<i>C. aquatilis</i>	<b>6.7</b>	<b>(8.2)</b>	<b>12.0</b>	<b>(13.2)</b>	<b>16.7</b>	<b>(18.6)</b>	<b>18.4</b>	<b>(20.7)</b>	<b>22.4</b>	<b>(25.5)</b>	<b>20.7</b>	<b>(26.4)</b>	<b>29.0</b>	<b>(32.6)</b>	<b>28.5</b>	<b>(33.5)</b>	<b>38.6</b>	<b>(44.5)</b>	<b>↑</b>
<i>C. bigelowii</i>	<b>2.5</b>	<b>(4.6)</b>	<b>4.7</b>	<b>(9.3)</b>	<b>6.3</b>	<b>(12.1)</b>	<b>7.0</b>	<b>(14.1)</b>	<b>7.7</b>	<b>(14.9)</b>	<b>5.0</b>	<b>(9.9)</b>	<b>10.1</b>	<b>(18.8)</b>	<b>8.5</b>	<b>(15.8)</b>	<b>11.2</b>	<b>(21.7)</b>	<b>↑</b>
<i>C. rotundata</i>	0.4	(1.7)	0.6	(3.5)	0.4	(2.2)	0.8	(3.7)	0.6	(2.3)	0.4	(1.4)	0.2	(1.1)	0.1	(0.4)	0.4	(1.7)	-
<i>D. psilosantha</i>	0.1	(0.5)	0.1	(0.3)	0.0	(0.0)	0.0	(0.0)	1.5	(3.1)	0.1	(0.4)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	-
<i>E. angustifolium</i>	<b>0.4</b>	<b>(1.5)</b>	<b>1.6</b>	<b>(5.0)</b>	<b>1.7</b>	<b>(4.6)</b>	<b>2.0</b>	<b>(5.5)</b>	<b>3.4</b>	<b>(8.7)</b>	<b>2.1</b>	<b>(6.4)</b>	<b>4.8</b>	<b>(11.3)</b>	<b>5.0</b>	<b>(13.5)</b>	<b>7.1</b>	<b>(17.3)</b>	<b>↑</b>
<i>E. russeolum</i>	1.2	(2.7)	4.3	(8.6)	6.5	(13.6)	9.5	(17.8)	9.5	(17.3)	6.4	(11.8)	8.4	(14.8)	6.9	(13.4)	12.3	(24.5)	-
<i>E. vaginatum</i>	<b>6.5</b>	<b>(9.6)</b>	<b>21.2</b>	<b>(29.7)</b>	<b>18.0</b>	<b>(25.1)</b>	<b>22.1</b>	<b>(29.8)</b>	<b>23.5</b>	<b>(33.2)</b>	<b>21.6</b>	<b>(32.8)</b>	<b>27.5</b>	<b>(38.4)</b>	<b>32.8</b>	<b>(44.3)</b>	<b>33.0</b>	<b>(42.2)</b>	<b>↑</b>
<i>Hierochloe alpina</i>	0.2	(0.7)	0.0	(0.0)	0.0	(0.0)	0.2	(1.1)	0.0	(0.0)	0.1	(0.7)	0.4	(1.5)	0.2	(0.7)	0.1	(0.6)	-
<i>Luzula arctica</i>	0.1	(0.4)	0.1	(0.3)	0.0	(0.2)	0.1	(0.4)	0.0	(0.2)	0.1	(0.4)	0.2	(0.5)	0.1	(0.3)	0.2	(0.7)	-
<i>Luzula confusa</i>	<b>1.6</b>	<b>(6.1)</b>	<b>0.9</b>	<b>(4.6)</b>	<b>1.1</b>	<b>(5.7)</b>	<b>0.8</b>	<b>(4.4)</b>	<b>0.9</b>	<b>(3.8)</b>	<b>0.4</b>	<b>(1.8)</b>	<b>0.5</b>	<b>(2.6)</b>	<b>0.6</b>	<b>(3.3)</b>	<b>0.9</b>	<b>(4.4)</b>	<b>↓</b>
<i>T. spicatum</i>	0.9	(2.4)	2.5	(7.1)	1.6	(4.6)	2.3	(5.5)	2.7	(6.2)	1.2	(4.3)	2.2	(5.2)	3.3	(8.5)	4.6	(12.3)	-

	2010	2012	2013	2014	2015	2016	2017	2018	2019	Ch										
Atqasuk Grid																				
continued																				
Bryophyte	12.4	(11.3)	12.2	(12.3)	29.7	(22.6)	31.4	(21.0)	22.4	(18.0)	18.1	(16.8)	20.2	(17.7)	17.9	(18.1)	18.9	(18.4)	-	
A. moss	7.7	(9.7)	8.2	(7.8)	15.5	(15.5)	16.3	(13.0)	9.4	(9.2)	6.5	(7.5)	9.5	(10.6)	7.4	(9.1)	8.0	(9.7)	-	
P. moss	1.8	(4.4)	2.8	(7.4)	2.4	(6.6)	4.4	(9.6)	3.9	(7.9)	4.8	(11.7)	1.9	(5.7)	2.7	(6.9)	3.2	(6.8)	-	
Lichen	9.3	(10.5)	12.5	(12.1)	17.4	(17.4)	22.3	(21.9)	10.1	(12.8)	6.4	(7.8)	7.9	(9.7)	8.6	(9.7)	8.9	(11.0)	-	
Crustose	0.0	(0.0)	0.1	(0.5)	3.2	(6.4)	1.2	(2.8)	1.0	(2.8)	0.6	(2.0)	0.3	(1.3)	0.4	(1.7)	0.5	(1.4)	-	
Foliose	3.9	(4.9)	4.1	(4.4)	5.0	(5.0)	6.2	(6.8)	3.1	(3.7)	1.6	(2.0)	2.9	(3.8)	3.2	(3.5)	3.1	(3.8)	-	
Fruticose	5.4	(6.5)	8.3	(8.5)	9.3	(9.5)	14.9	(14.4)	6.1	(7.3)	4.3	(5.0)	4.7	(5.5)	5.0	(5.7)	5.2	(6.9)	-	
Standing dead plants	59.7	(36.3)	100.1	(45.3)	67.4	(34.0)	64.2	(28.0)	32.4	(18.0)	48.5	(29.2)	62.1	(37.9)	87.6	(41.3)	35.8	(17.3)	-	
<b>Leaf litter</b>	<b>27.7</b>	<b>(12.0)</b>	<b>35.5</b>	<b>(15.1)</b>	<b>30.2</b>	<b>(14.9)</b>	<b>37.9</b>	<b>(18.4)</b>	<b>56.2</b>	<b>(19.8)</b>	<b>56.0</b>	<b>(23.1)</b>	<b>40.4</b>	<b>(17.6)</b>	<b>37.2</b>	<b>(13.9)</b>	<b>67.2</b>	<b>(34.4)</b>	<b>↑</b>	
Bare ground	0.0	0.0	0.6	1.6	0.1	0.4	0.1	0.3	2.0	4.5	0.0	0.2	0.1	0.4	0.6	1.6	0.6	0.4		
Utqiagvik Grid																				
Woody deciduous	7.2	(12.9)	8.7	(16.3)	9.6	(16.8)	7.5	(13.7)	7.6	(14.4)	8.5	(16.7)	9.8	(18.2)	8.3	(15.1)	7.3	(14.0)	-	
<i>Salix pulchra</i>	1.5	(6.9)	2.6	(11.4)	2.0	(8.5)	1.2	(5.0)	2.1	(9.1)	2.1	(9.3)	2.3	(10.2)	1.6	(7.1)	1.7	(7.9)	-	
<i>Salix rotundifolia</i>	5.6	(10.6)	6.2	(10.9)	7.6	(13.4)	6.4	(12.1)	5.5	(11.0)	6.4	(12.4)	7.4	(14.3)	6.7	(13.3)	5.6	(12.0)	-	
Forb	6.5	(7.2)	10.6	(17.9)	13.6	(17.0)	6.5	(9.1)	9.9	(19.9)	8.4	(17.2)	10.3	(20.8)	7.9	(17.4)	13.1	(30.8)	-	
<i>C. pratensis</i>	0.2	(0.7)	0.3	(0.9)	1.1	(2.9)	0.4	(0.9)	0.2	(0.5)	0.2	(0.7)	0.3	(0.8)	0.2	(0.6)	0.2	(0.9)	-	
<i>C. beeringianum</i>	<b>0.3</b>	<b>(1.0)</b>	<b>0.8</b>	<b>(2.8)</b>	<b>1.2</b>	<b>(4.2)</b>	<b>0.5</b>	<b>(1.7)</b>	<b>0.0</b>	<b>(0.0)</b>	<b>0.1</b>	<b>(0.4)</b>	<b>0.0</b>	<b>(0.0)</b>	<b>0.0</b>	<b>(0.2)</b>	<b>0.5</b>	<b>(1.5)</b>	<b>↓</b>	
<i>C. officinalis</i>	0.0	(0.2)	0.2	(0.8)	0.3	(0.8)	0.2	(0.6)	0.2	(0.5)	0.2	(0.9)	0.0	(0.2)	0.2	(0.7)	0.0	(0.2)	-	
<i>P. frigidus</i>	1.7	(3.6)	5.6	(16.2)	4.1	(11.4)	2.3	(6.2)	6.5	(19.0)	5.1	(15.0)	6.1	(17.5)	5.0	(14.7)	9.5	(29.0)	-	
<i>P. hyparctica</i>	0.0	(0.0)	0.0	(0.0)	0.0	(0.2)	0.0	(0.0)	0.0	(0.2)	0.0	(0.2)	0.1	(0.4)	0.0	(0.2)	0.1	(0.3)	-	
<i>R. nivalis</i>	0.0	(0.0)	0.0	(0.0)	0.1	(0.3)	0.0	(0.2)	0.1	(0.3)	0.1	(0.4)	0.0	(0.0)	0.0	(0.2)	0.1	(0.3)	-	
<i>Saxifraga cernua</i>	1.3	(2.4)	1.0	(1.9)	2.2	(3.4)	0.7	(1.2)	0.7	(1.1)	1.0	(1.6)	1.1	(1.8)	0.9	(1.5)	1.0	(1.5)	-	
<i>S. foliolosa</i>	0.3	(0.9)	0.5	(1.4)	0.9	(1.5)	0.5	(1.3)	0.0	(0.2)	0.2	(0.6)	0.2	(0.6)	0.1	(0.4)	0.1	(0.4)	-	
<i>S. hieracifolia</i>	0.1	(0.4)	0.1	(0.4)	0.2	(0.7)	0.0	(0.2)	0.1	(0.4)	0.1	(0.4)	0.0	(0.2)	0.1	(0.4)	0.1	(0.4)	-	
<i>S. punctata</i>	0.4	(0.9)	0.3	(0.7)	0.4	(1.4)	0.2	(0.7)	0.6	(1.4)	0.4	(1.5)	0.5	(1.4)	0.4	(1.3)	0.5	(1.5)	-	
<i>S. atropurpureus</i>	0.2	(0.5)	0.2	(0.7)	0.2	(0.6)	0.2	(0.6)	0.1	(0.3)	0.0	(0.0)	0.1	(0.4)	0.0	(0.0)	0.0	(0.2)	-	
<i>S. humifusa</i>	<b>0.2</b>	<b>(0.9)</b>	<b>0.2</b>	<b>(1.1)</b>	<b>0.3</b>	<b>(1.5)</b>	<b>0.0</b>	<b>(0.2)</b>	<b>0.2</b>	<b>(0.5)</b>	<b>0.2</b>	<b>(0.6)</b>	<b>0.0</b>	<b>(0.0)</b>	<b>0.0</b>	<b>(0.0)</b>	<b>0.0</b>	<b>(0.0)</b>	<b>↓</b>	
<i>Stellaria laeta</i>	1.6	(3.3)	1.3	(2.3)	2.3	(4.1)	1.4	(2.6)	0.9	(2.0)	0.8	(1.5)	1.6	(3.9)	0.8	(2.5)	0.9	(2.0)	-	



<b>Atqasuk Grid</b>	2010	2012	2013	2014	2015	2016	2017	2018	2019	Freq
<i>Andromeda polifolia</i>	1	1	1	1	-	-	1	1	1	7
<i>Betula nana</i>	1	1	1	1	1	1	1	1	1	9
<i>Carex aquatilis</i>	1	1	1	1	1	1	1	1	1	9
<i>Carex bigelowii</i>	1	1	1	1	1	1	1	1	1	9
<i>Carex rariflora</i>	-	-	-	-	-	-	1	1	-	2
<i>Carex rotundata</i>	1	1	1	1	1	1	1	1	1	9
<i>Cassiope tetragona</i>	1	1	1	1	1	1	1	1	1	9
<i>Diapensia lapponica</i>	-	-	-	-	-	-	1	-	-	1
<i>Dupontia psilosantha</i>	1	1	-	-	1	1	-	-	-	4
<i>Empetrum nigrum</i>	1	1	1	1	1	1	1	1	1	9
<i>Eriophorum angustifolium</i>	1	1	1	1	1	1	1	1	1	9
<i>Eriophorum russeolum</i>	1	1	1	1	1	1	1	1	1	9
<i>Eriophorum vaginatum</i>	1	1	1	1	1	1	1	1	1	9
<i>Hierochloe alpina</i>	1	-	-	1	-	1	1	1	1	6
<i>Juncus biglumis</i>	1	-	-	-	-	-	-	-	-	1
<i>Ledum palustre</i>	1	1	1	1	1	1	1	1	1	9
<i>Lloydia serotina</i>	1	-	-	-	-	-	-	-	-	1
<i>Luzula arctica</i>	1	1	1	1	1	1	1	1	1	9
<i>Luzula confusa</i>	1	1	1	1	1	1	1	1	1	9
<i>Luzula wahlenbergii</i>	-	1	1	1	1	-	-	-	-	4
<i>Oxyria digyna</i>	-	-	-	-	1	-	-	-	-	1
<i>Pedicularis lapponica</i>	1	1	1	1	1	1	1	1	-	8
<i>Pedicularis sudetica</i>	1	1	1	1	1	1	1	1	1	9
<i>Petasites frigidus</i>	-	-	1	1	1	1	1	1	1	7
<i>Poa arctica</i>	-	-	-	-	1	-	-	-	-	1
<i>Polygonum bistorta</i>	1	1	1	1	1	1	1	1	1	9
<i>Polygonum viviparum</i>	1	-	1	-	-	-	-	1	-	3
<i>Potentilla hyparctica</i>	-	1	-	-	-	-	-	-	-	1
<i>Pyrola grandiflora</i>	1	1	1	1	-	1	1	1	-	7
<i>Ranunculus pallasii</i>	-	1	1	1	1	1	1	1	1	8
<i>Rubus chamaemorus</i>	1	1	1	1	1	1	1	1	1	9
<i>Salix pulchra</i>	1	1	1	1	1	1	1	1	1	9
<i>Trisetum spicatum</i>	1	1	1	1	1	1	1	1	1	9
<i>Vaccinium vitis-idaea</i>	1	1	1	1	1	1	1	1	1	9
<i>gamma diversity</i>	26	25	25	25	25	24	26	26	22	7

<b>Utqiagvik Grid</b>	2010	2012	2013	2014	2015	2016	2017	2018	2019	Freq
<i>Alopecurus alpinus</i>	1	1	1	1	1	1	1	1	1	9
<i>Arctophila fulva</i>	1	1	1	1	1	1	1	1	1	9
<i>Arctagrostis latifolia</i>	1	1	1	1	1	1	1	1	1	9
<i>Calamagrostis holmii</i>	1	-	-	-	1	-	-	-	-	2
<i>Cardamine pratensis</i>	1	1	1	1	1	1	1	1	1	9
<i>Carex stans</i>	1	1	1	1	1	1	1	1	1	9
<i>Carex subspathacea</i>	1	-	-	-	-	-	-	-	-	1
<i>Cerastium beeringianum</i>	1	1	1	1	-	1	1	1	1	8
<i>Chrysosplenium tetrandrum</i>	1	-	1	-	-	1	-	-	-	3
<i>Cochlearia officinalis</i>	1	1	1	1	1	1	1	1	1	9
<i>Draba lactea</i>	1	-	-	-	1	-	1	-	-	3
<i>Draba micropetala</i>	-	-	1	-	1	1	-	-	-	3
<i>Dupontia fisheri</i>	1	1	1	1	1	1	1	1	1	9
<i>Eriophorum russeolum</i>	1	1	1	1	1	1	1	1	1	9
<i>Eriophorum triste</i>	1	1	1	1	1	1	1	1	1	9
<i>Eriophorum vaginatum</i>	-	-	-	-	-	-	1	-	1	2
<i>Festuca brachyphylla</i>	1	1	-	-	1	-	-	-	-	3
<i>Hierochloa pauciflora</i>	-	1	1	1	1	1	1	1	1	8
<i>Juncus biglumis</i>	-	-	-	-	-	-	-	-	1	1
<i>Luzula arctica</i>	1	1	1	1	1	1	1	1	1	9
<i>Luzula confusa</i>	1	1	1	1	1	1	1	1	1	9
<i>Oxyria digyna</i>	1	-	-	-	-	-	-	-	-	1
<i>Pedicularis kanei</i>	-	-	-	1	1	1	1	-	1	5
<i>Pedicularis sudetica</i>	-	-	-	-	1	-	1	1	-	3
<i>Petasites frigidus</i>	1	1	1	1	1	1	1	1	1	9
<i>Poa arctica</i>	1	1	1	1	1	1	1	1	1	9
<i>Potentilla hyparctica</i>	-	-	1	-	1	1	1	1	1	6
<i>Ranunculus nivalis</i>	-	-	1	1	1	1	1	1	1	7
<i>Ranunculus pallasii</i>	-	-	1	1	1	-	1	1	1	6
<i>Ranunculus pygmaeus</i>	-	-	1	-	-	-	-	-	-	1
<i>Salix pulchra</i>	1	1	1	1	1	1	1	1	1	9
<i>Salix rotundifolia</i>	1	1	1	1	1	1	1	1	1	9
<i>Saxifraga cernua</i>	1	1	1	1	1	1	1	1	1	9
<i>Saxifraga foliolosa</i>	1	1	1	1	1	1	1	1	1	9
<i>Saxifraga hieracifolia</i>	1	1	1	1	1	1	1	1	1	9
<i>Saxifraga punctata</i>	1	1	1	1	1	1	1	1	1	9
<i>Senecio atropurpureus</i>	1	1	1	1	1	-	1	-	1	7
<i>Stellaria humifusa</i>	1	1	1	1	1	1	-	-	-	6
<i>Stellaria laeta</i>	1	1	1	1	1	1	1	1	1	9
Gamma diversity	29	25	30	27	32	28	30	26	29	