

Response of arthropod communities to shrub expansion in Western Alaska



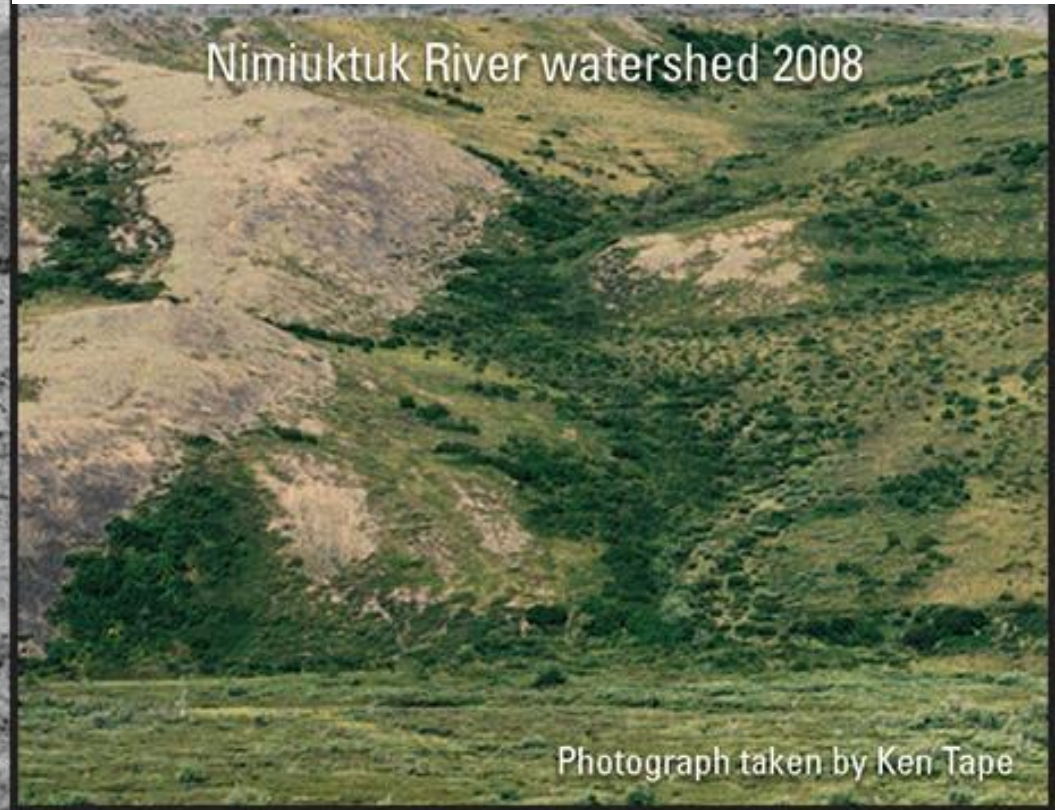
Molly McDermott
M.S. Student, IAB, UAF

Advisor: Pat Doak, IAB, UAF



Committee: Colleen Handel, USGS; Greg Breed, IAB, UAF; Christa Mulder, IAB, UAF

Introduction



Shrub expansion in the arctic



Questions

How might shrub expansion affect
arthropod communities in the arctic?

1. Do the **phenological patterns** of arthropod abundance vary by habitat type? By ecosystem role?
2. Are **arthropod abundance** and **diversity** significantly different in shrubby and open habitats?



Seward Peninsula

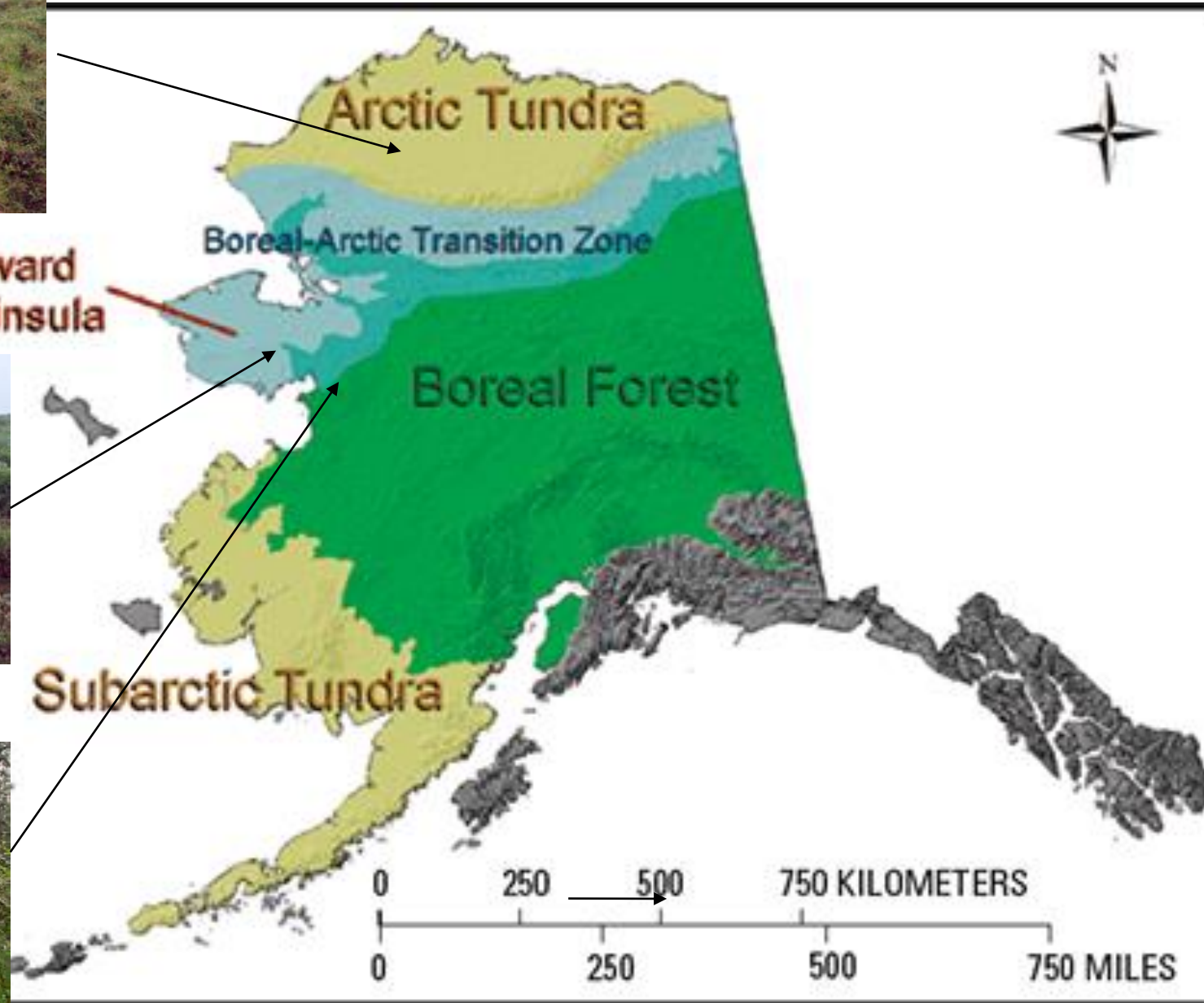
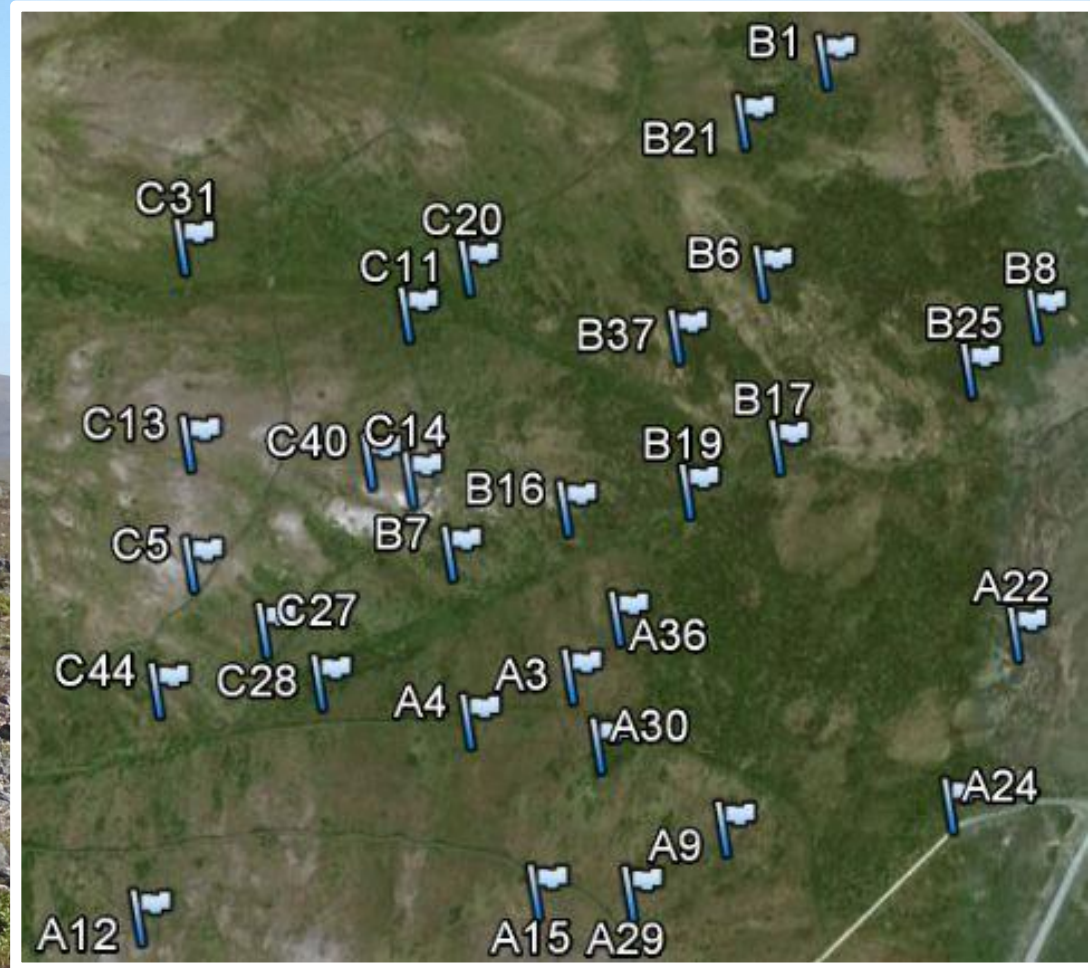


Photo credits: USGS Alaska Science Center, N. Paprocki, D.A. Walker, J. Beringer

Methods



1.2km² plot

30 randomly selected points

Insects collected 8 times from June 7th to July 26th

Methods: Analysis

1. Do the phenological patterns of arthropods vary by habitat type? By ecosystem role?

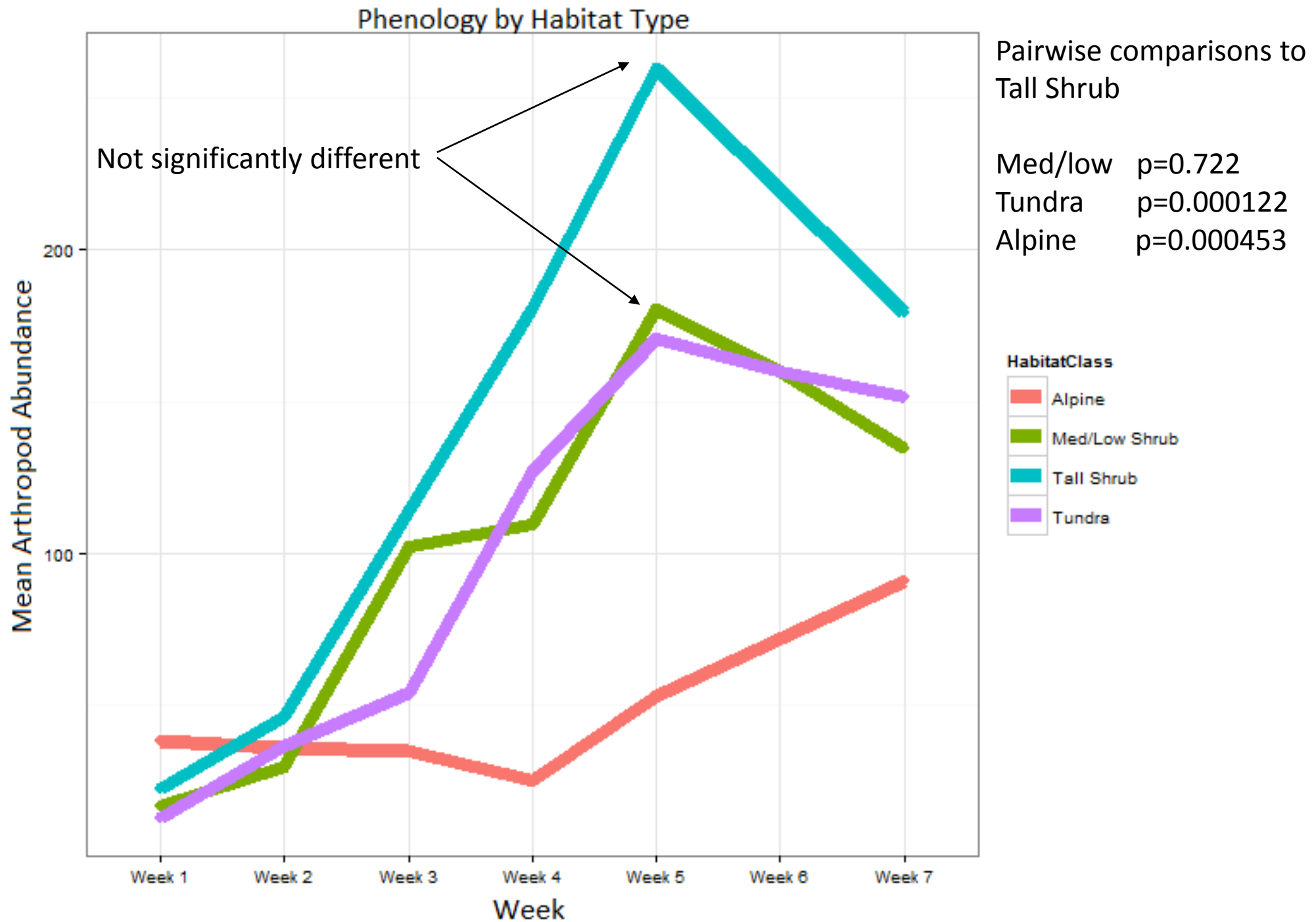
Poisson GLM (LRT to test significance of interaction terms)

Cumulative abundance ~ date * habitat type

MANOVA (Pillai's trace)

Date25 + Date50 + Date75 ~ Guild + Guild2 + Abundance

Results

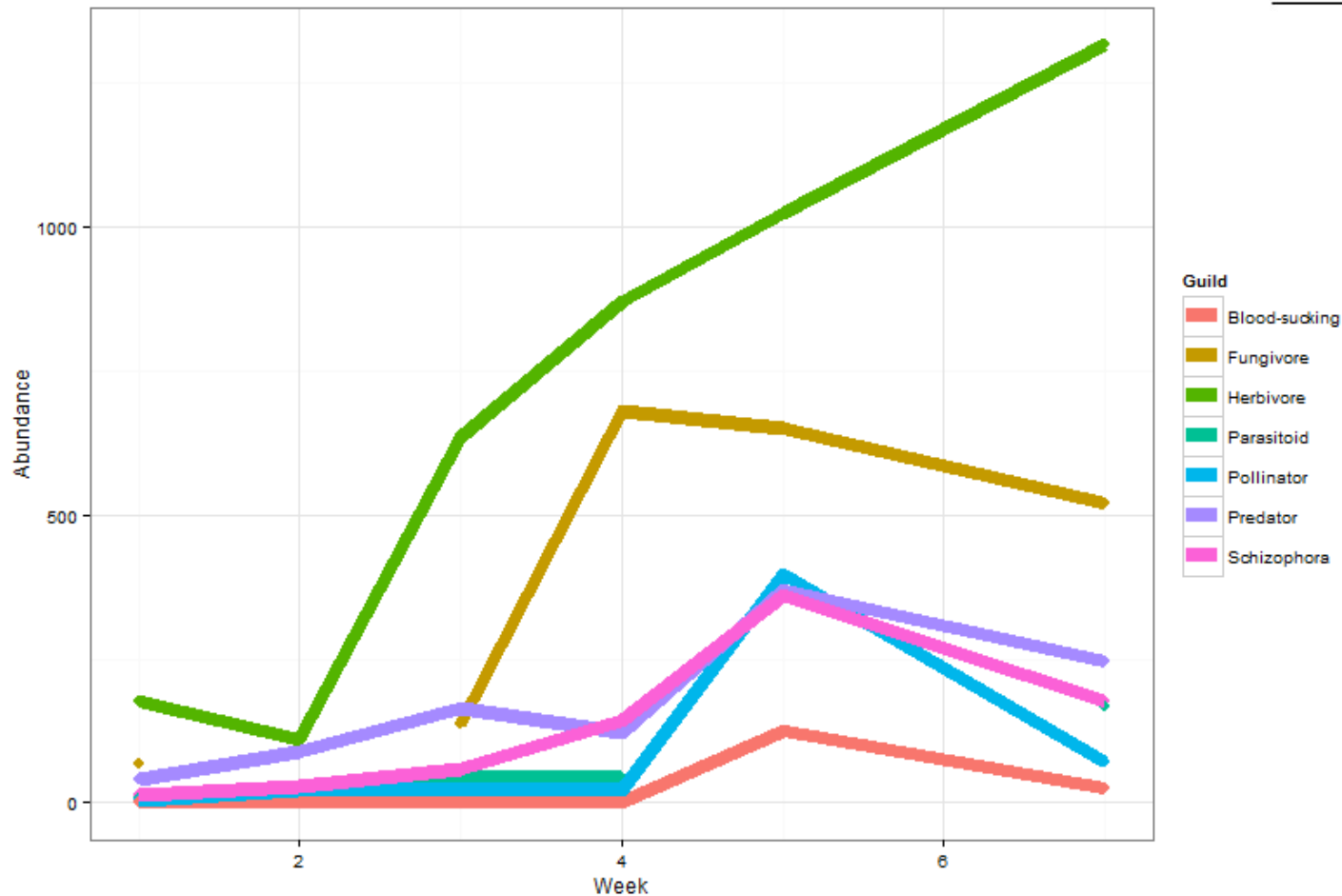


Results

MANOVA

Response: 25%, 50%, and 75% Day

Predictors	Pillai's trace	<i>P</i>
Guild	0.857	0.163
Guild2	0.21	0.151
Abundance	0.132	0.366



Discussion

1. Do the phenological patterns of arthropods vary by habitat type? By ecosystem role?

Most habitat types significantly different in phenology, except Tall Shrub and Med/Low Shrub. Contrary to expectation, Tundra and Alpine habitats appear to reach peak abundance later.

Guild a significant predictor of phenology in glm model, but contradictory results when tested with MANOVA - this may be due to small sample size or loss of information.

Weaknesses

Alpine and Tall Shrub habitats undersampled

Irregularities in sampling interval, had to throw out a whole week

One sampling method, biased towards canopy dwellers

Lack of taxonomic specificity made guild designations difficult or impossible in some cases

Methods: Analysis

2. Are **arthropod abundance and diversity** significantly different in shrubby and open habitats?

Linear & Mixed-effects models

Abundance ~ Elevation + Aspect + log(Heterogeneity) + PlantHeight + ShrubCover + Percent cover of many plant types

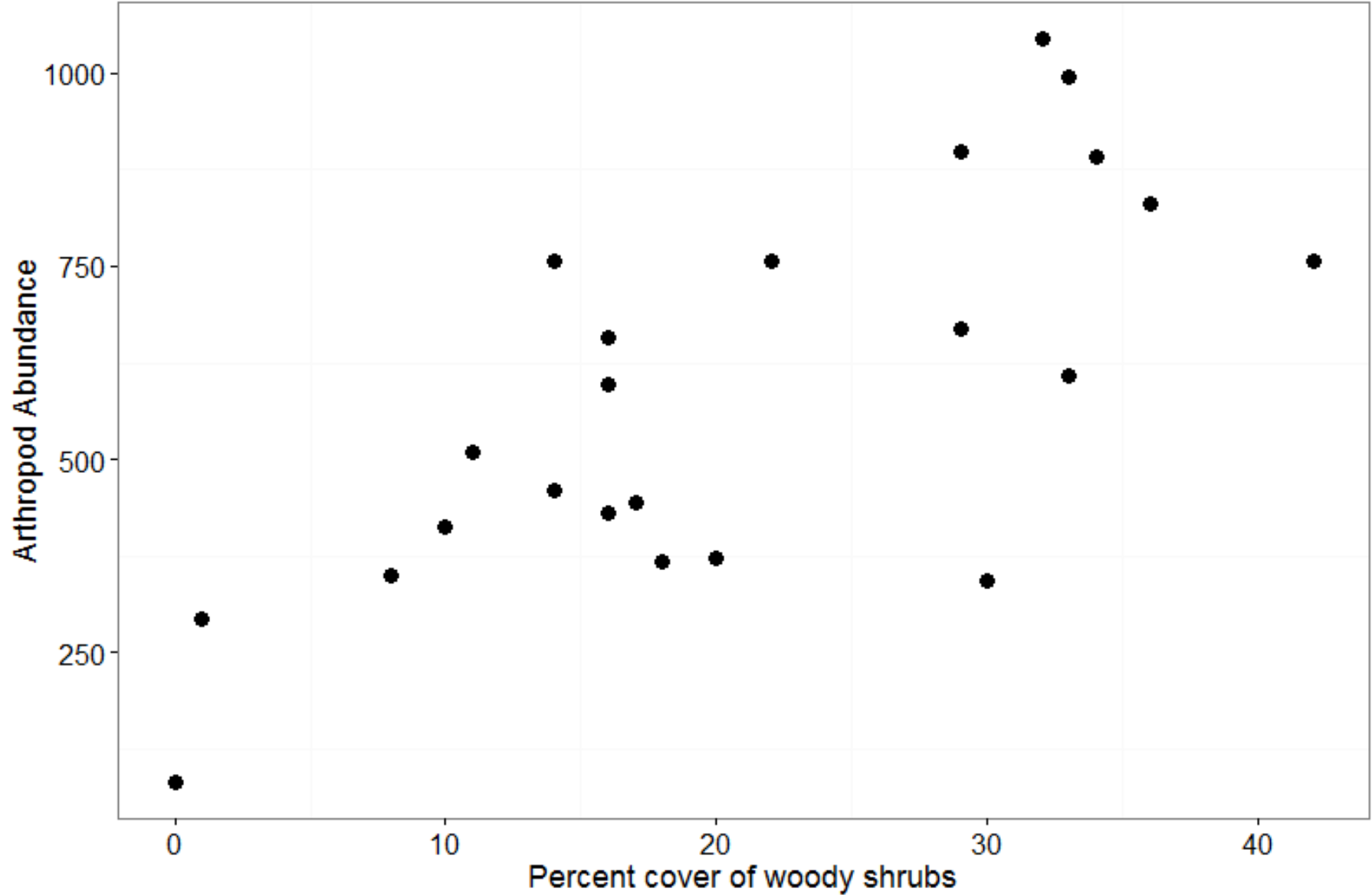
Plant Diversity ~ Elevation + Aspect + ShrubCover + (1 | Observer)

Arthropod Diversity ~ Elevation + log(Heterogeneity) + HabitatClass + Plant Diversity + MaxHt

Arthropod Richness ~ Elevation + log(Heterogeneity) + ShrubCover + Plant Diversity + MaxHt

Taxon accumulation curves to compare diversity between habitat types

Results



Shrub cover most significant predictor of arthropod abundance ($p = 6.4e-5$)

Results

Arthropod Diversity (Shannon-Weaver)

Predictors	AIC	adjusted R2
Elevation + log(Heterogeneity) + HabitatClass + PlantH + MaxHt	2.97	0.32
Elevation + log(Heterogeneity) + ShrubCover + PlantH + MaxHt	0.16	0.36
Elevation + log(Heterogeneity) + ShrubCover + MaxHt	-1.83	0.40
Elevation + log(Heterogeneity) + MaxHt	-3.33	0.42
<i>Elevation + log(Heterogeneity)</i>	-4.49	0.43
log(Heterogeneity)	-3.29	0.37

Coefficient(s) in best model

	Est.	SE	p
Elevation	-0.0034	0.0020	0.0995
<i>log(Heterogeneity)</i>	<i>0.1717</i>	<i>0.0482</i>	<i>0.0020</i>

Arthropod Richness

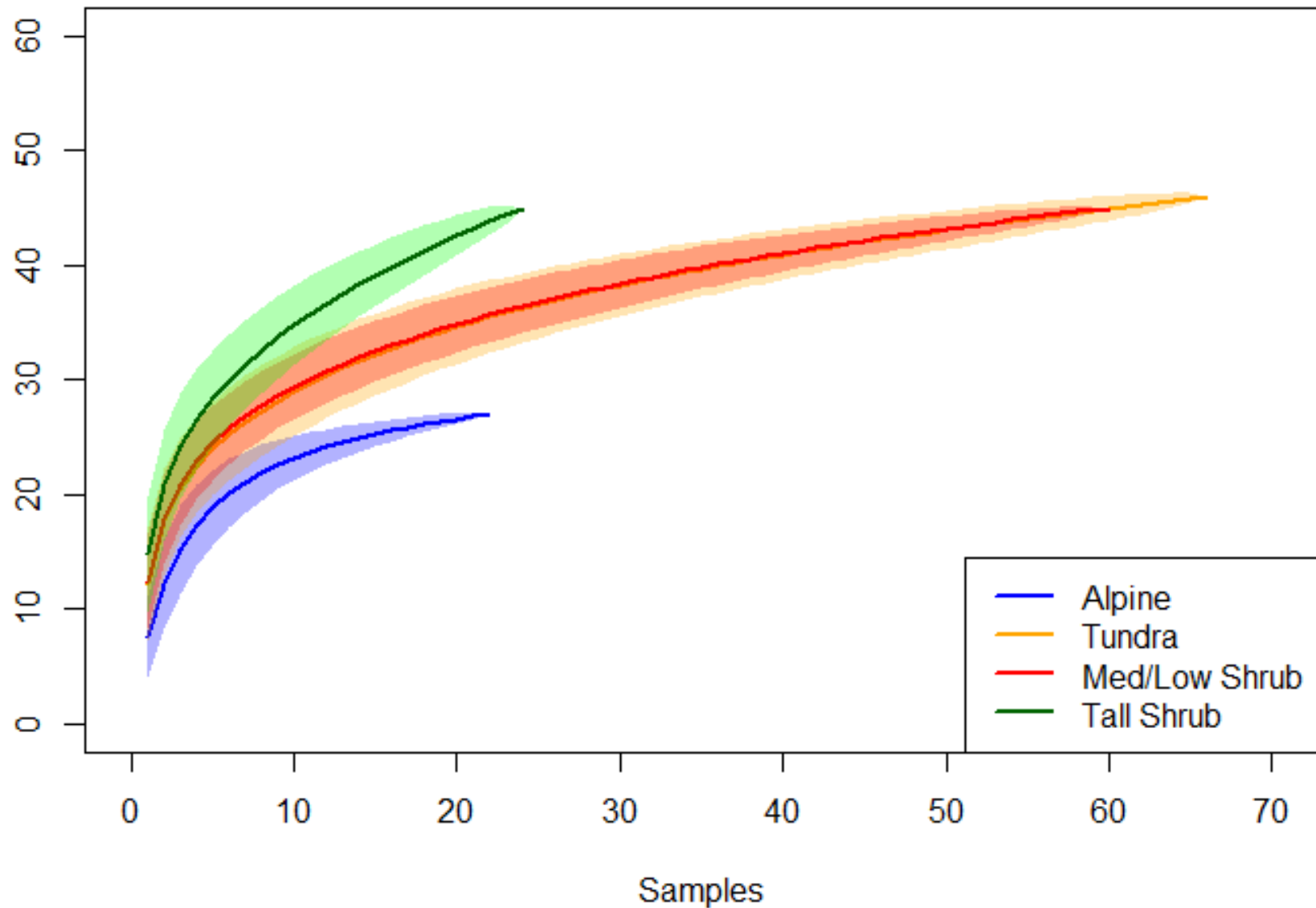
Predictors	AIC	adjusted R2
Elevation + log(Heterogeneity) + ShrubCover + HabitatClass	126.38	0.51
log(Heterogeneity) + ShrubCover + HabitatClass	124.40	0.54
<i>log(Heterogeneity) + ShrubCover</i>	120.39	0.58
log(Heterogeneity)	120.95	0.55

Coefficient(s) in best model

	Est.	SE	p
ShrubCover	0.1192	0.0779	0.1426
<i>log(Heterogeneity)</i>	<i>3.5597</i>	<i>1.0648</i>	<i>0.0034</i>

Results

Taxon Accumulation Curves



Discussion

2. Is arthropod diversity significantly different in shrubby and open habitats?

Arthropod abundance significantly predicted by shrub cover, highest in tall shrub habitats

Plant species diversity

- negatively correlated with percent shrub cover
- **not a strong predictor of arthropod diversity**

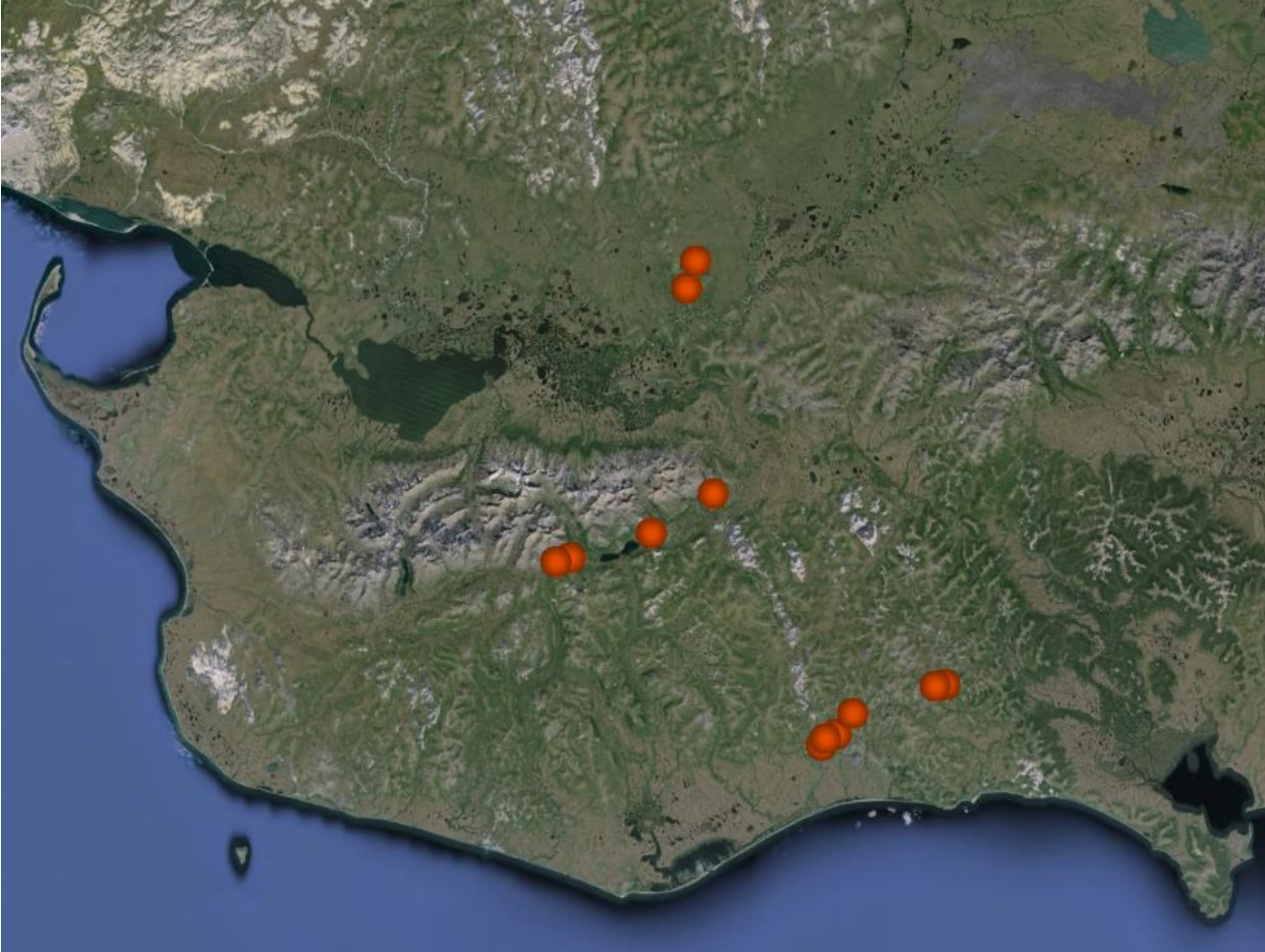
Plant height heterogeneity

- **significant predictor of arthropod diversity and richness**
- increased in shrub habitats.

Weaknesses

Alpine and Tall Shrub habitats undersampled
Irregularities in sampling interval, had to throw out a whole week
One sampling method, biased towards canopy dwellers
Lack of taxonomic specificity underrepresents diversity

Next Steps



Thanks!

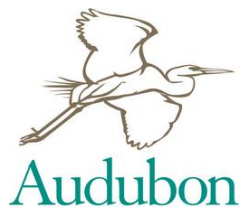


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& Field Support



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Questions?



Photo credit: Derek Sikes, UAM