Snow-melt and temperatures - but not sea-ice - explain variation in tundra spring plant phenology on Qikiqtaruk - Herschel Island

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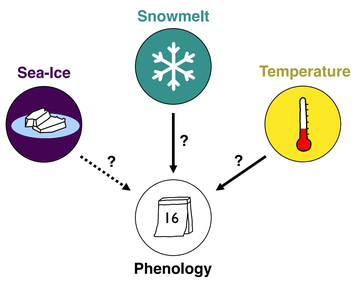
Background

Rapidly rising summer temperatures and expanding growing seasons are causing dramatic changes in Arctic vegetation phenology, productivity and community composition.

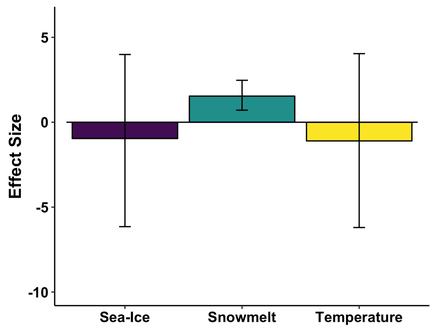
Long-term phenological observations in the biome are rare and the cues governing early-season tundra plant phenology remain poorly understood.

Some studies have shown strong correlations of regional and circum-polar sea-ice with plant phenology[3] and productivity[4], but a direct bio-logical mechanism linking phenology and growth to sea-ice is missing[5].

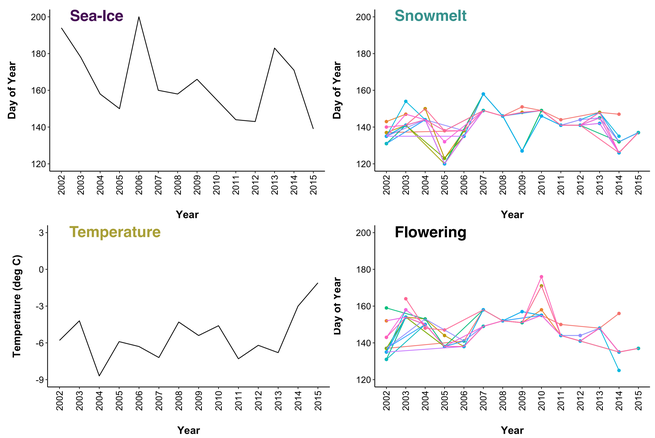
Here, we test the influence of snow-melt, early season temperatures and local sea-ice conditions on spring plant phenology at our focal research site Qikiqtaruk – Herschel Island.



Timing of snow-melt predicts tussock sedge flowering

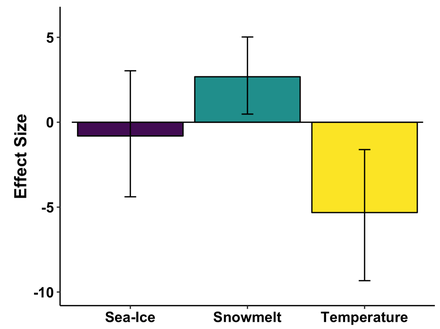


Scaled effect sizes and 95% CIs of environmental predictors for *Eriophorum vaginatum* flowering.

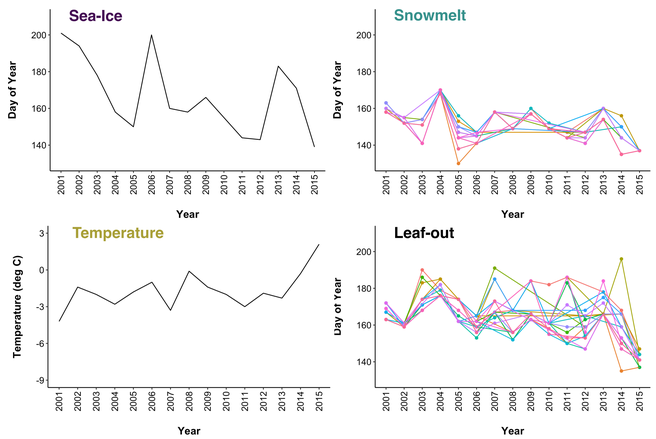


Inter-annual variation of environmental predictors and *Eriophorum vaginatum* individual flowering dates.

Snow-melt and temperature predict Arctic willow leaf-out



Scaled effect sizes and 95% CIs of environmental predictors for *Salix arctica* leaf-out.



Inter-annual variation of environmental predictors and *Salix arctica* individual leaf-out dates.

Methods

Scaled effect sizes from Bayesian mixed effect models (MCMCglmm).

Interval censored spring phenology: 20 individuals per species, monitored every 2-3 days. 2001-2015.

Onset of regional sea-ice melt: Passive microwave satellite records from NOAA/NSIDC.
500 km x 500 km bounding box.

Snow-melt date monitored for each individual.

Temperatures averaged from daily observations; Environment Canada. Weather station at ~ 1 km distance, gap-filled.

Period averaged: day-of-year 2 weeks prior mean snowmelt to day-of-year 75% of phenology observations occurring.

Conclusion

We found no evidence for a link between sea-ice and spring phenology on Qikitaruk – Herschel Island.
Snowmelt and temperature are best predictors, supporting a direct mechanism for tundra spring phenology.

Acknowledgements

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