The Influence of Ground Cover and Soil Conditions on Blueberry Productivity

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Introduction

- Berries are an important food source for animals and peoples across the Arctic, and climate change is influencing their pollination and fruit abundance[1].
- The ground cover surrounding *Vaccinium uliginosum* plants may influence the conditions for pollination and fruit set by changing the microclimate[2].
- Our study sought to investigate how ground cover and soil condition might influence the fruit production and seed set of bog blueberry (*Vaccinium uliginosum*).

Questions

Question 1: Does the species identity of ground cover influence Vaccinium uliginosum abundance and number of seeds per berry?
Question 2: Do soil conditions influence Vaccinium uliginosum berry abundance and number of seeds per berry?

Methods

Figure 1. *Eriophorum vaginatum,* tussock

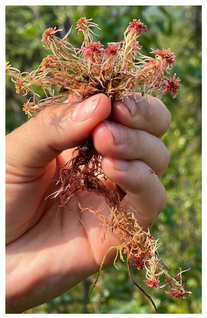

Figure 2. *Sphagnum* sp., peat moss

Figure 3. *Hylocomium splendens,* feather moss

- Sampled 9 plots with berry plants growing in three types of ground cover: Tussock (Fig. 1), Sphagnum moss (Fig. 2) and Feather moss (Fig. 3) for a total of 27 plots.
- Recorded the number of blueberries in 30cm x 30cm quadrats at each plot (Fig. 4).
- Collected blueberry samples, 3 berries from each plot where possible.
- Collected soil temperature, using a soil thermometer at 10 cm following the globe protocols.
- Determined depth to permafrost at each plot using a permafrost probe.
- Used an auger to get soil samples from each plot, which we brought back to the lab to measure gravimetric soil water content according to GLOBE protocols[3] (Fig. 5).
- Counted total seeds per berry sample under microscope (Fig. 6).

Figure 4. Counting total number of berries in a 30 x 30 cm quadrat.

Figure 5. Coring soils for soil moisture samples.

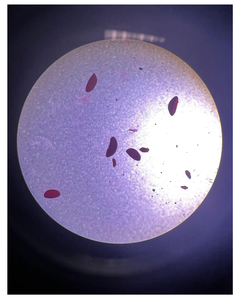

Figure 6. Counting number of seeds per berry.

Figure 7. Group photo. From left to right: Anahy Rivera, Dr. Elena Sparrow, Jedidiah Fincher, Abigail Rivera, Kendall Martinez.

Results

Question 1 : Does the species identity of ground cover influence *Vaccinium uliginosum* abundance and number of seeds per berry?

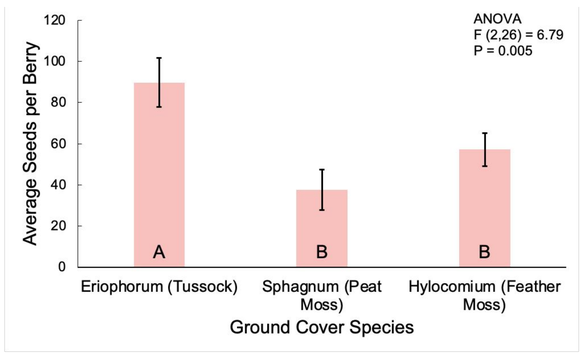

Figure 8. ANOVA calculation; evaluating the variance between ground cover and the average number of seeds per berry. Significant differences between soil cover groups is indicated by different letters.

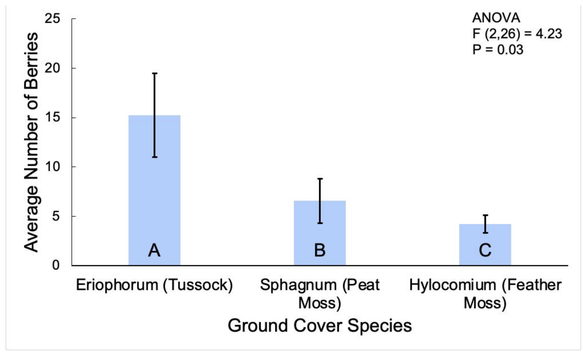

Figure 9. ANOVA calculation; evaluating the variance between ground cover and the average number of berries. Significant differences between soil cover groups is indicated by different letters.

Question 2: Do soil conditions influence *Vaccinium uliginosum* abundance and number of seeds per berry?

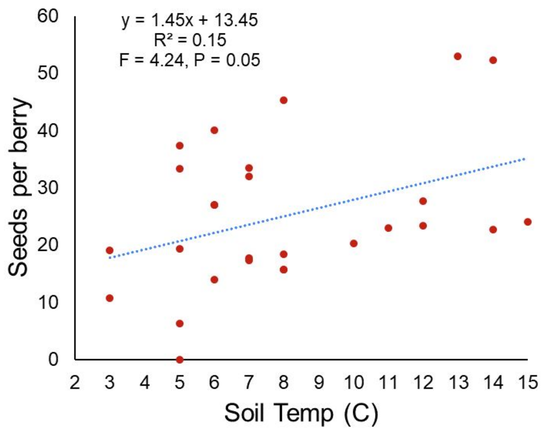

Figure 10. Regression calculation demonstrating the relationship between seeds per berry and soil temperature

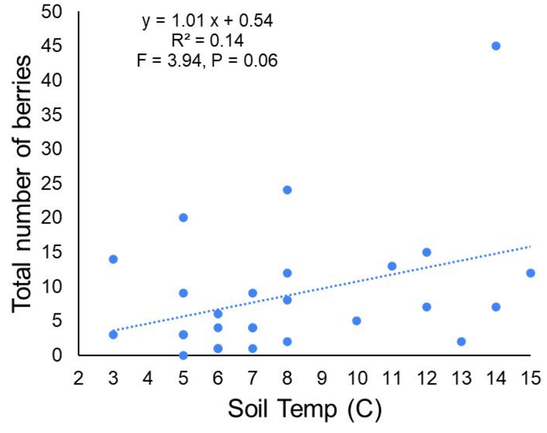

Figure 11. Regression calculation demonstrating the relationship between the total number of berries and soil temperature

Results Summary

Q1: Ground cover and berries

- The number of berries and the number of seeds per berry significantly increased when growing within Tussock grass, compared to the two mosses (Fig. 8,9).
- The amount of berries in the plot was significantly greater when growing in the *Sphagnum* moss plots compared to the *Hylocomium* plots (Fig. 9), but the number of seeds per berry did not differ between plants growing in the two types of mosses (Fig. 8).

Q2: Soil conditions and berries

- The number of blueberries in a plot and the number of seeds per berry increased as soil temperature increased (Fig. 10,11)
- The ground cover with the highest soil temperature was the Tussock grass.
- The depth to permafrost and the soil moisture did not influence berry abundance or number of seeds per berry ($p > 0.05$ for all regression tests).

Discussion

Our data suggest that the increased blueberry abundance and seeds per berry in tussock plots was primarily driven by warmer soil temperatures. The moss ground cover insulates the cool soil from the warm air temperature. Other studies have found a correlation between higher temperatures and overall blueberry plant growth. Though extreme temperatures have an inhibiting effect[4,5].

We think the difference in number of berries in plots with Sphagnum and Hylocomium could be due to the different colors of the mosses drawing pollinators or possible differences in microclimate caused by the difference in albedo and moisture of the mosses. Though further study would be required to determine the true cause of the differences.

We noted a marked difference in the flavor and size of the berries, as well as size of the plants, when growing in the Tussock sedges. The plants and berries tended to be larger and tasted sweeter. There was also a clear difference within the berry samples, in terms of the color of the juice when dissecting. We would be interested in investigating why this occurred and whether this is related to the ripening process or other environmental factors.

Citations

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(2) *Saelim, P., Ngo, M., Orellana, J. (2022) "Blueberry Abundance in the Caribou Poker Creek Boreal Forest," Poster presentation, Alaska Climate Research Intensive Symposium, Fairbanks, Alaska*[2].
(3) Global Learning and Observations to Benefit the Environment (GLOBE). (2014). GLOBE Program Protocol Guide[3]. www.globe.gov
(4) *Zheng, Y. & Li, R. & Sun, Y. & Xu, M. & Zhang, H. & Huang, L. & Zhu, Y. & Wang, H. & Li, G. & Liu, L. & Li, F. & Guo, L. & Zhang, X.. (2017). The optimal temperature for the growth of blueberry (Vaccinium corymbosum L.). Pakistan Journal of Botany. 49. 965-979*[4].
(5) *Support, Extension Web. "How Blueberry Plants Develop and Grow." OSU Extension Service, January 20, 2023. https://extension.oregonstate.edu/crop-production/berries/how-blueberry-plants-develop-grow.*
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