Research Report Yukon

Interim Report – May 2026

Project title: Boreal plant and pollinator change across latitudes

Yukon S&E License No.: 25-46S&E

PI: Isla Myers-Smith[1]
MSc: Rory MacNeil[1], Sarah Naughtin[1], Claire Ethier[1]
Research Staff: Anya Boardman[1], Pauline Deschodt[1]

[1] *University of British Columbia*

Research funding: CERC in Global Change Ecology of Northern Ecosystems (NSERC)
Discovery Grant (NSERC)

This interim report provides a summary of the research conducted by Dr. Isla Myers-Smith and her research group (Team Shrub) from the University of British Columbia in the Yukon over the summer of 2025 (for more information see https://teamshrub.com/).

In 2025, Team Shrub conducted research under the following Scientists and Explorers Act Licenses: 25-60S&E, 25-41S&E, 25-42S&E, 25-44S&S, 25-45S&E, 25-46S&E. See previous research reports (https://teamshrub.com/research-reports/).

Summary

Team Shrub has studied climate-driven vegetation change in Kluane and on Qikiqtaruk for over two decades. In 2025, our research efforts expanded beyond previously established sites to investigate plant and pollinator changes across a climate gradient encompassing nearly the entire Yukon at over 1000 km in length. We collected occurrence data (presence/absence) for selected shrub species and measured site-level moisture conditions at 50 sites across the Yukon. In addition, we conducted assessments of pollinator activity, shifts in berry plant flowering phenology and berry productivity at six sites in the Yukon, including five long-standing fixed berry productivity sites established by the Community Ecological Monitoring Program (https://open.yukon.ca/information/publications/plans-and-reports-ecosystems/resource/3f49d47c-eb51-44e3-af77-1c9a0a07e3cf). Pollinator activity was monitored using a combination of audio recorders, wildlife cameras, and in-person visual assessments. The aim of this research is to describe climate-driven shifts in vegetation and the implications of these changes for wildlife, pollinators and berry productivity.

Background

Vegetation composition of the boreal forest has shifted as species expand northwards, a process referred to as borealization[1]. Understory vegetation, especially shrubs, play a pivotal role in ecosystem functioning and demonstrate a rapid response to climate change[2,3]. Research indicates that climate warming is a key factor driving the latitudinal expansion of shrub species across northern ecosystems[4].

The movement of shrub distributions will be most pronounced in ecotones, the transition zones between ecosystems, where shrub growth sensitivity to climate is highest[5]. Despite improved knowledge of climate driven movement of vegetation, the trajectories of this movement cannot be accurately predicted without a comprehensive understanding of the climatic drivers controlling species establishment[5,6]. Temperature is a well-established primary driver of shrub distribution in tundra ecosystems, but moisture is also an important driver of shrub growth[7], and thus a potential determinant of rates of future shrub

range expansion. In boreal forest ecosystems, moisture limitation is potentially a more significant control on growth than warming. The Yukon includes three major ecosystem types, boreal forest, treeline, and tundra, that encompass many climate-responsive shrub species, making this an ideal location for capturing species movement across climate gradients.

Like pollinators elsewhere, Northern pollinators play significant roles within their ecosystems, enabling plant reproduction[8,9], and thus provisioning berries vital for both wildlife and communities[10–14]. Lengthened growing seasons have resulted in a shift in berry plant life histories (i.e., phenology), creating mismatches with the key life stages of pollinators and potentially impacting the pollination ecosystem service negatively[8,15,16]. A loss of berrying plants or decrease in berry yield resulting from modified pollination dynamics will directly impact wildlife foraging and Northern Indigenous berry picking practices. This is particularly impactful in Northern Canada, where food security is inextricably connected to country foods, their availability and ease of access[17]. For Northern Indigenous communities and cultures, berry picking transcends foraging for foods and medicines, representing a significant cultural activity closely tied to notions of spirituality, well-being and relationship building[18–21].

Previous assessments of berry production in the Yukon have described the influence of climate shifts on berry yield, but have maintained that integration of pollinator metrics within modelling approaches may help to explain variable berry yields across regions and time[22].

Projects:

1. **Quantifying boreal forest vegetation change and its drivers across latitude**

Objective: Quantify shrub species distribution across the Yukon to predict species distribution change under climate change scenarios

Field surveys were conducted across 41 sites in the Yukon during the 2025 field season and documented understory shrub presence and absence data spanning boreal forest, treeline and tundra ecosystems (Figure 1). We conducted fieldwork throughout the Yukon Territory from June 29 - August 9. Of the species we were looking for in our vegetation surveys these were the ones we found present: *Alnus alnobetula, Betula gladulosa, Empetrum nigrum, Juniperus communis, Salix alaxensis, Salix arbusculoides Salix bebbiana, Salix glauca, Salix myrtillifolia, Salix pulchra, Salix reticulata, Salix richardsonii, Vaccinium uliginosum, Vaccinium vitis-idaea*.

Combining these field observations with circumboreal occurrence records from Global Biodiversity Information Facility (GBIF) (n = 19,255), we conducted a principal component analysis (PCA), a type of ordination analysis that looks at the climates where these shrubs are found. We modelled the climate niche space across 19 bioclimatic variables which revealed distinct but partially overlapping climate niches among three focal species, explaining 71.7% of total variance (Figure 2).

Preliminary species distribution models generated from this dataset produced habitat suitability surfaces across the Yukon for *Betula glandulosa*, *Salix glauca*, and *Vaccinium vitis-idaea*, illustrating clear spatial differentiation in predicted suitable habitat (Figure 3). These initial results suggest that the three species occupy distinct climate spaces, providing a foundation for evaluating the relative contributions of temperature and moisture to current shrub distributions and projecting range shifts under future climate scenarios. This research is ongoing and will be completed over 2026-2027.

Figure 1. Map indicating the 41 field sites we visited in the 2025 field season (the white points). The other coloured points indicate the recorded occurrences of three different shrub species we looked at from GBIF (Global Biodiversity Information Facility).

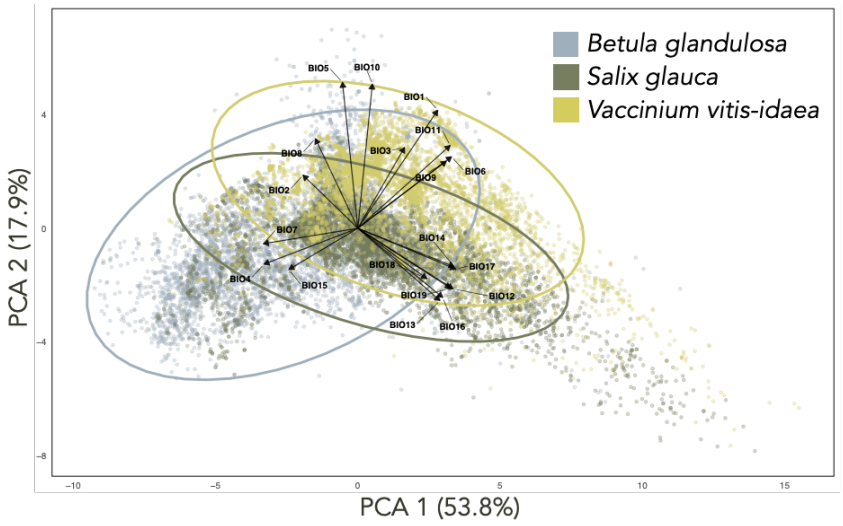

Figure 2. Principal component analysis (PCA) of climate niches for three boreal shrubs. PCA using recorded occurrences from field surveys along with GBIF (n=19,255) and 19 bioclimatic variables. Ellipses show 95% confidence intervals. Arrows indicate variable loadings (71.7% variance explained).

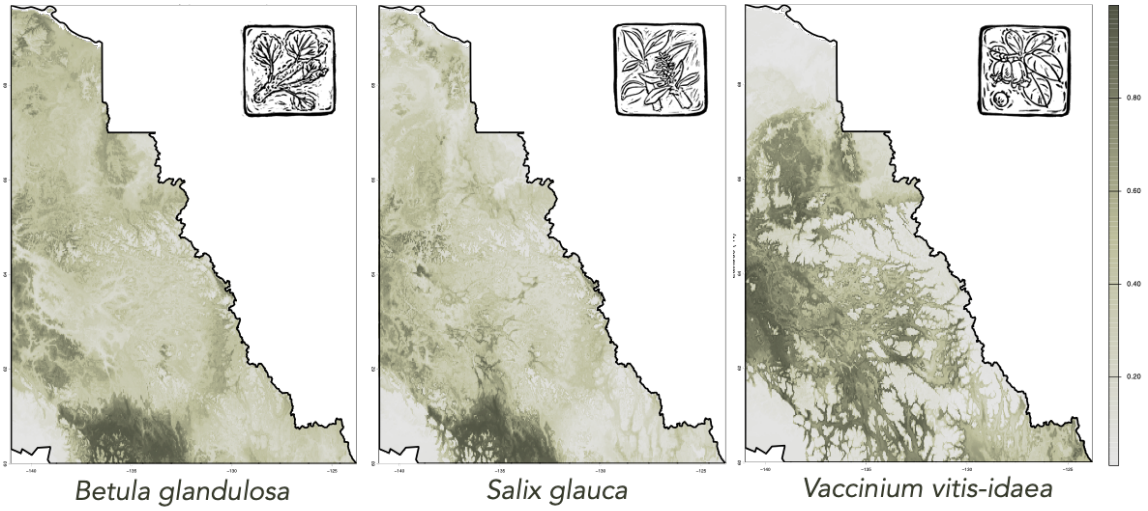

Figure 3. Preliminary species distributions for three boreal shrubs (*Betula glandulosa, Salix glauca, Vaccinium vitis-idaea*). Habitat suitability is on a scale from 0-1, 0 being unsuitable (light gray) and 1 being suitable (dark green).

2. Monitoring pollinator activity and berry plant productivity using cameras and audio recorders

Objective: Monitor pollinator activity using acoustic recording units and cameras to compare with records of plant phenology and berry productivity

Field surveys were conducted across six sites in the Yukon between June and August 2025 to document pollinator activity and phenology in relation to environmental conditions and lingonberry (*Vaccinium vitis-idaea*) phenology (Figure 4). Although initial permit applications covered seven sites or regions, summer 2025 wildfire conditions impeded access to projected sites in Mayo and Tombstone Territorial Park. As such, additional equipment was deployed in the Kluane region of the Yukon.

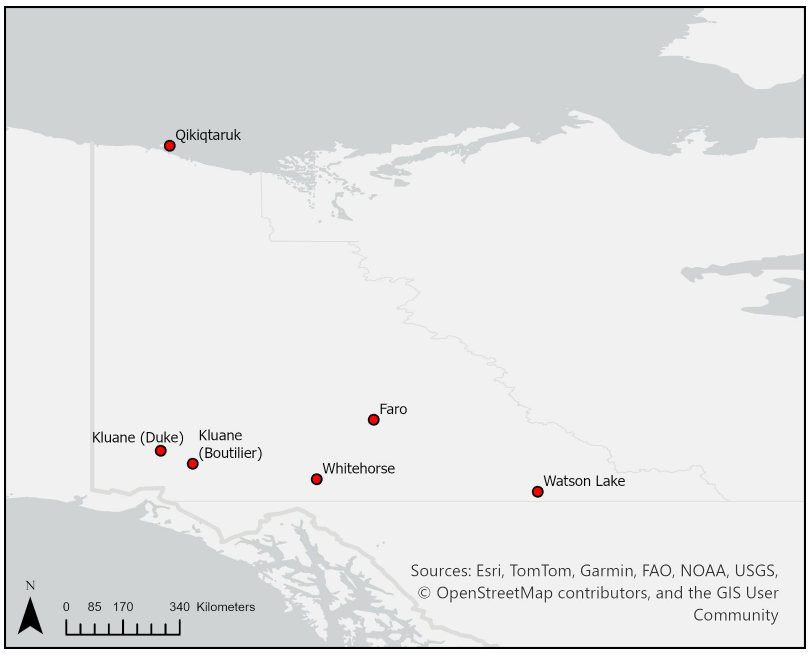

Figure 4. Locations of all pollinator activity and berry productivity sites across the Yukon.

Wildlife cameras and autonomous recording units were deployed to monitor pollinator activity over the course of the deployment period. Additionally, climate data loggers passively recorded environmental conditions at fifteen-minute intervals throughout the deployment window. Collectively across all sites, autonomous units were deployed for 361 site-days and recorded 185 site-days of lingonberry flowering.

All project activities were non-invasive and resulted in no lasting disturbance to vegetation, habitat, or wildlife. Site access was limited to existing trails and low-impact foot travel across previously established berry research sites, except on Qikiqtaruk where a new site was established among other research deployments. No environmental damage or adverse impacts were observed during the course of this research.

Pollinator activity was successfully observed across regions, and lingonberry fruit production was documented at all sites. Preliminary observations indicate variability in lingonberry yields between sites, with yields generally higher in areas of greater lingonberry cover, higher nearby plant species richness, and cooler environmental conditions. Lower yields were observed in areas with higher densities of nearby flowering plants. Further analysis is ongoing to better understand the ecological and climatic factors contributing to these patterns. No specimens were collected beyond permit allowances and all work was completed in accordance with permit conditions.

Data collected during this field season are currently being analyzed and will contribute to ongoing research examining pollinator phenology, berry production and climate relationships in northern ecosystems. This research is ongoing and will be completed over 2026-2027.

References

1. Roland, C., Schmidt, J., Stehn, S., Hampton-Miller, C. & Nicklen, F. Borealization and its discontents: drivers of regional variation in plant diversity across scales in interior Alaska. *Ecosphere* https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.3485 (2021).
2. Nilsson, M.-C. & Wardle, D. A. Understory vegetation as a forest ecosystem driver: evidence from the northern Swedish boreal forest. *Front. Ecol. Environ.* **3**, 421–428 (2005).
3. Ropars, P. & Boudreau, S. Shrub expansion at the forest–tundra ecotone: spatial heterogeneity linked to local topography. *Environ. Res. Lett.* **7**, 015501 (2012).
4. Myers-Smith, I. H. & Hik, D. S. Climate warming as a driver of tundra shrubline advance. *J. Ecol.* **106**, 547–560 (2018).
5. Sundqvist, M. K., Björk, R. G. & Molau, U. Establishment of boreal forest species in alpine dwarf-shrub heath in subarctic Sweden. *Plant Ecol. Divers.* **1**, 67–75 (2008).
6. Lloyd, A. H., Rupp, T. S., Fastie, C. L. & Starfield, A. M. Patterns and dynamics of treeline advance on the Seward Peninsula, Alaska. *J. Geophys. Res. Atmospheres* **107**, ALT 2-1-ALT 2-15 (2002).
7. Myers-Smith, I. H. *et al.* Shrub expansion in tundra ecosystems: dynamics, impacts and research priorities. *Environ. Res. Lett.* **6**, 045509 (2011).
8. Memmott, J., Craze, P. G., Waser, N. M. & Price, M. V. Global warming and the disruption of plant–pollinator interactions. *Ecol. Lett.* **10**, 710–717 (2007).
9. Koch. Pollinator dependence but no pollen limitation for eight plants occurring north of the Arctic Circle - Koch - 2020 - Ecology and Evolution - Wiley Online Library. https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.6884 (2020).
10. Inouye, D. W. Climate change and phenology. *WIREs Clim. Change* **13**, e764 (2022).

11. Bartomeus, I. *et al.* Climate-associated phenological advances in bee pollinators and bee-pollinated plants. *Proc. Natl. Acad. Sci.* **108**, 20645–20649 (2011).

12. Høye, T. T., Post, E., Schmidt, N. M., Trøjelsgaard, K. & Forchhammer, M. C. Shorter flowering seasons and declining abundance of flower visitors in a warmer Arctic. *Nat. Clim. Change* **3**, 759–763 (2013).

13. Kudo, G. & Cooper, E. J. When spring ephemerals fail to meet pollinators: mechanism of phenological mismatch and its impact on plant reproduction. *Proc. R. Soc. B Biol. Sci.* **286**, 20190573 (2019).

14. Krebs, C. J. *et al.* The Community Ecological Monitoring Program Annual Data Report 2023.

15. Tiusanen, M., Kankaanpää, T., Schmidt, N. M. & Roslin, T. Heated rivalries: Phenological variation modifies competition for pollinators among arctic plants. *Glob. Change Biol.* **26**, 6313–6325 (2020).

16. Memmott, J., Waser, N. M. & Price, M. V. Tolerance of pollination networks to species extinctions. *Proc. R. Soc. Lond. B Biol. Sci.* **271**, 2605–2611 (2004).

17. Sallans, A. Country Foods in Schools: Incorporating Student Preferences in the Inuvialuit Settlement Region, NWT. https://doi.org/10.20381/RUOR-30486 (2024) doi:10.20381/RUOR-30486.

18. Boulanger-Lapointe, N. *et al.* Berry Plants and Berry Picking in Inuit Nunangat: Traditions in a Changing Socio-Ecological Landscape | Human Ecology. *Hum. Ecol.* **47**, 81–93 (2019).

19. Boulanger-Lapointe, N. *et al.* Climate and environmental drivers of berry productivity from the forest–tundra ecotone to the high Arctic in Canada. *Arct. Sci.* **6**, 529–544 (2020).

20. Parlee, B., Berkes, F. & Gwich'in, T. Health of the Land, Health of the People: A Case Study on Gwich'in Berry Harvesting in Northern Canada. *EcoHealth* **2**, 127–137 (2005).

21. Teetl'it Gwich'in Renewable Resources Council, Parlee, B., Berkes, F., & Teetl'it Gwich'in Renewable Resources Council. Indigenous Knowledge of Ecological Variability and Commons Management: A Case Study on Berry Harvesting from Northern Canada. *Hum. Ecol.* **34**, 515–528 (2006).

22. Krebs, C. J. *et al.* Long-term monitoring in the boreal forest reveals high spatio-temporal variability among primary ecosystem constituents. *Front. Ecol. Evol.* **11**, 1187222 (2023).