Long-term decomposition of *Betula glandulosa* and *Carex aquatilis* under the framework of climate-induced shifts in vegetation (shrubification) in tundra ecosystems

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Shrubification of the tundra

What is happening?: In the wake of climatic warming, widespread shrub encroachment (shrubification) has been reported in tundra ecosystems of the circumpolar north[a].

Consequences: Shrubification may impact carbon cycling due to changes in rates of liter decomposition, but few long term litter bag decomposition studies have taken place in permafrost regions[b].

Specific case: *Betula glandulosa* (shrubs) have increased in abundance in tundra ecosystems near Churchill, Manitoba as a response to climatic warming and permafrost thawing[a].

Effects on carbon storage?

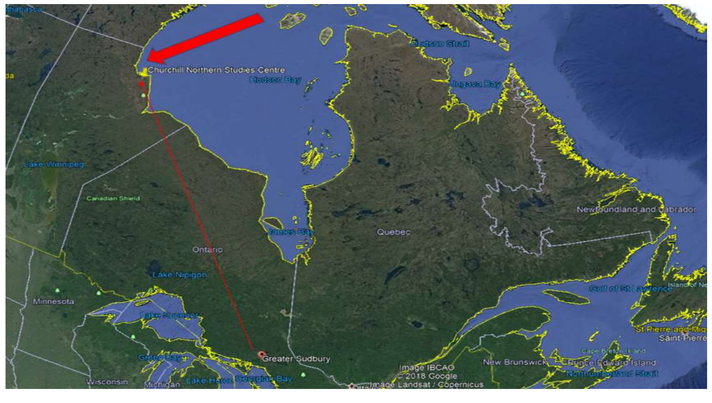
Question and hypothesis:

- Do shrubs leaves decompose at the same rate as sedges in a tundra area affected by shrubification near Churchill, MB?
- We hypothesize that shrub leaves decomposes slower than sedge litter in an area dominated by sedges and in a nearby area affected by shrubification.

Objective: Compare the long-term decomposition rates (over 10 years) for *Betula glandulosa* (shrubs) and *Carex aquatilis* (sedge) leaves in two different vegetation communities common to the arctic in Churchill, Manitoba.

Churchill, Manitoba: Study Area

- 1 km East of the Churchill Northern Studies Centre, MB.
- Included 2 dominant vegetation communities.



Litterbag decomposition

Step 1: Litter collection and litter bag assembly


Live *Betula glandulosa*


Carex aquatilis litte

Step 2: Field setup in 2009


Sedge site


Shrub site

Step 3: Sampling

Note: One last set of litter bags remain in the field and will be collected in summer 2019, year 10 of the study.

Shrub leaves decompose slower than sedge leaves

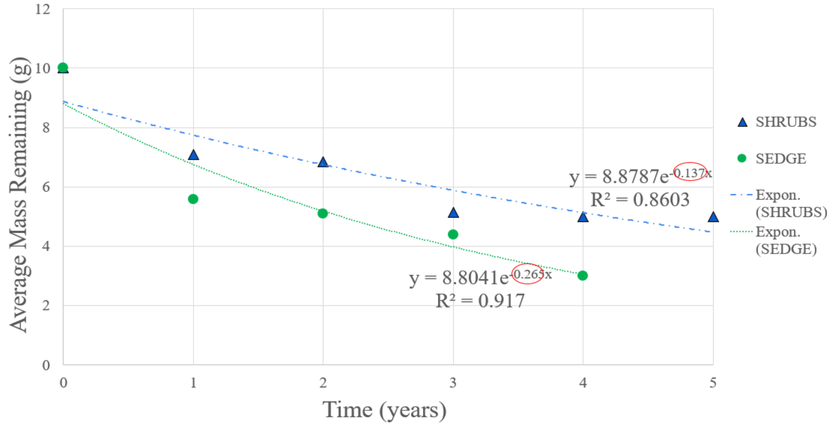


Figure 1. Exponential decay of the shrub and sedge litter

Things to consider

- Results indicate that hypothesis was correct. Increased carbon storage in woody material and leaf litter may constitute a negative feedback to climatic warming. However shrubs also trap snow and may accelerate permafrost thaw, which would constitute a positive feed-back to warming.

Relevance of the study:

- Understanding the interactions between the positive and negative feedbacks to climatic warming are important for effectively predicting the future landscape in dynamic northern ecosystems and carbon budget.

What's next?

Future work (MSc. thesis) will focus on:

- Assessing patterns of shrub encroachment near Churchill, Manitoba, using sequential analysis of Landsat imagery.
- Comparing long-term decomposition and nutrient release rates (over 10 years) for *B. glandulosa* (shrubs) and *C. aquatilis* (sedges) using litter bags.
- Elemental analysis to assess nutrient cycling.
- Soil microbial community characterization.

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