Three years of community-based assessment of berry productivity across the Canadian Arctic

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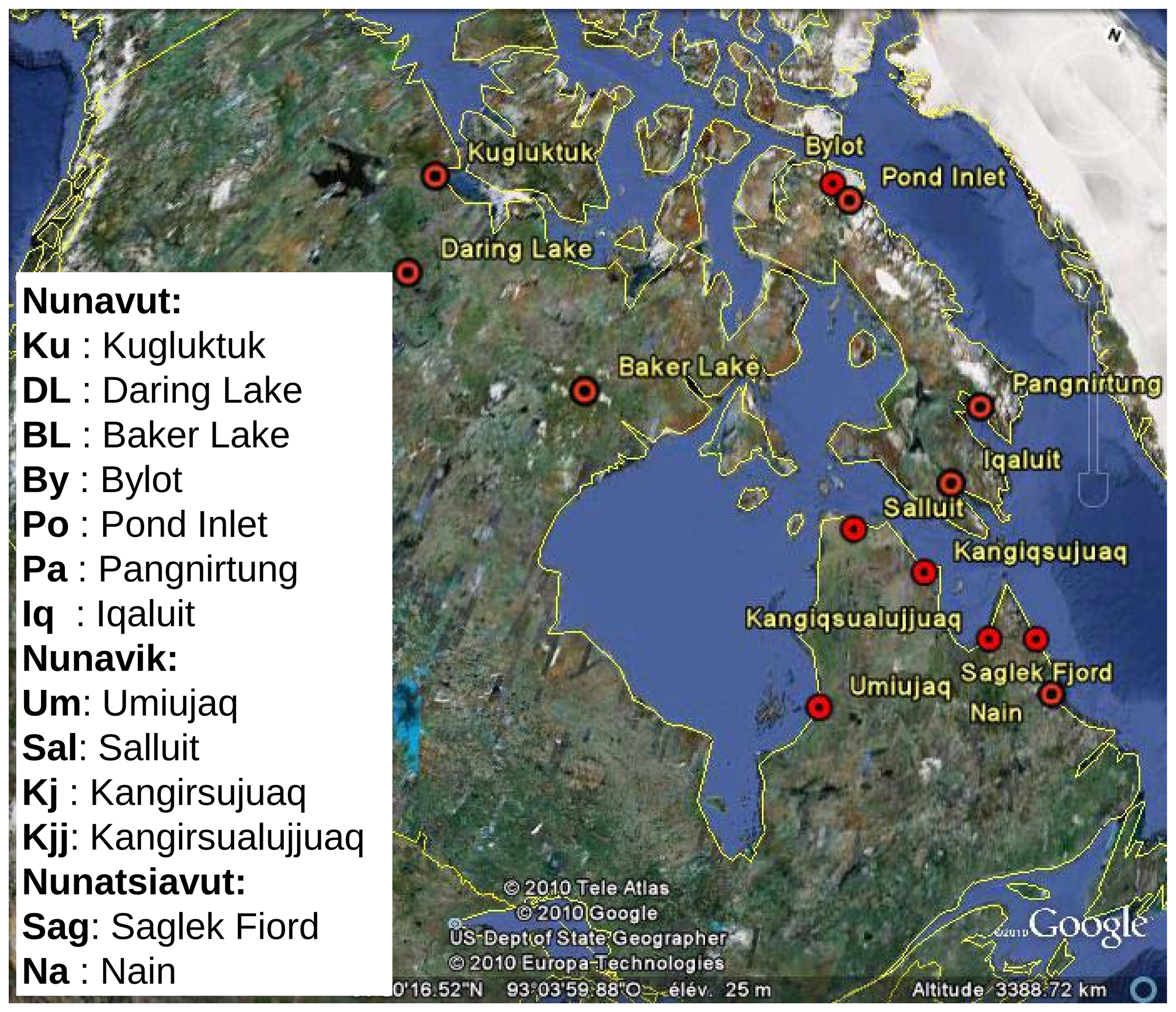
INTRODUCTION

- Northern communities are concerned about changes in berry shrub growth and productivity because of the importance of berries in tundra ecosystems to wildlife, human health and indigenous culture and identity.
- To evaluate the natural variability in berry productivity across the Canadian Arctic, we developed a simple monitoring approach to help understand changes in berry productivity over the coming decades, develop a community-based monitoring program and stimulate student interest in science.

STUDY SITES

- Similarly located at low elevations adjacent to water (coasts or large lakes, bays and inlets), the 13 sites ranged from 56°N to 73°N and from 61°W to 115°W.
- Annual precipitation ranged from 200 to 900mm/year, and summer rainfall from 75 to 220mm, based on long-term (1971-2000) averages.
- Based on 2008-2010, average TDDs ranged from a high of 1686 deg-days at Umiujaq (57°N) to 498 deg-days at Bylot Island (73°N). Interannual variability in TDD at individual sites ranged from less than 5 per cent to over 40 per cent.



METHODS

- Permanent plots (≈ 20m x 20m) were selected in typical berry picking areas. One to six plots were selected at each site to assess variability, for a total of 33 plots since the initiation of the project in 2007.
- Plant cover was evaluated in 25 plots, either by on site visual estimates, analysis of vertical photography or point framing data.
- Berry productivity was measured for the three most common species in 20 to 40 random quadrats (25cm x 25cm) inside permanent plots. All berries were collected, counted by ripeness stage and weighed, fresh or frozen.
- Antioxidant content analyses are in progress.

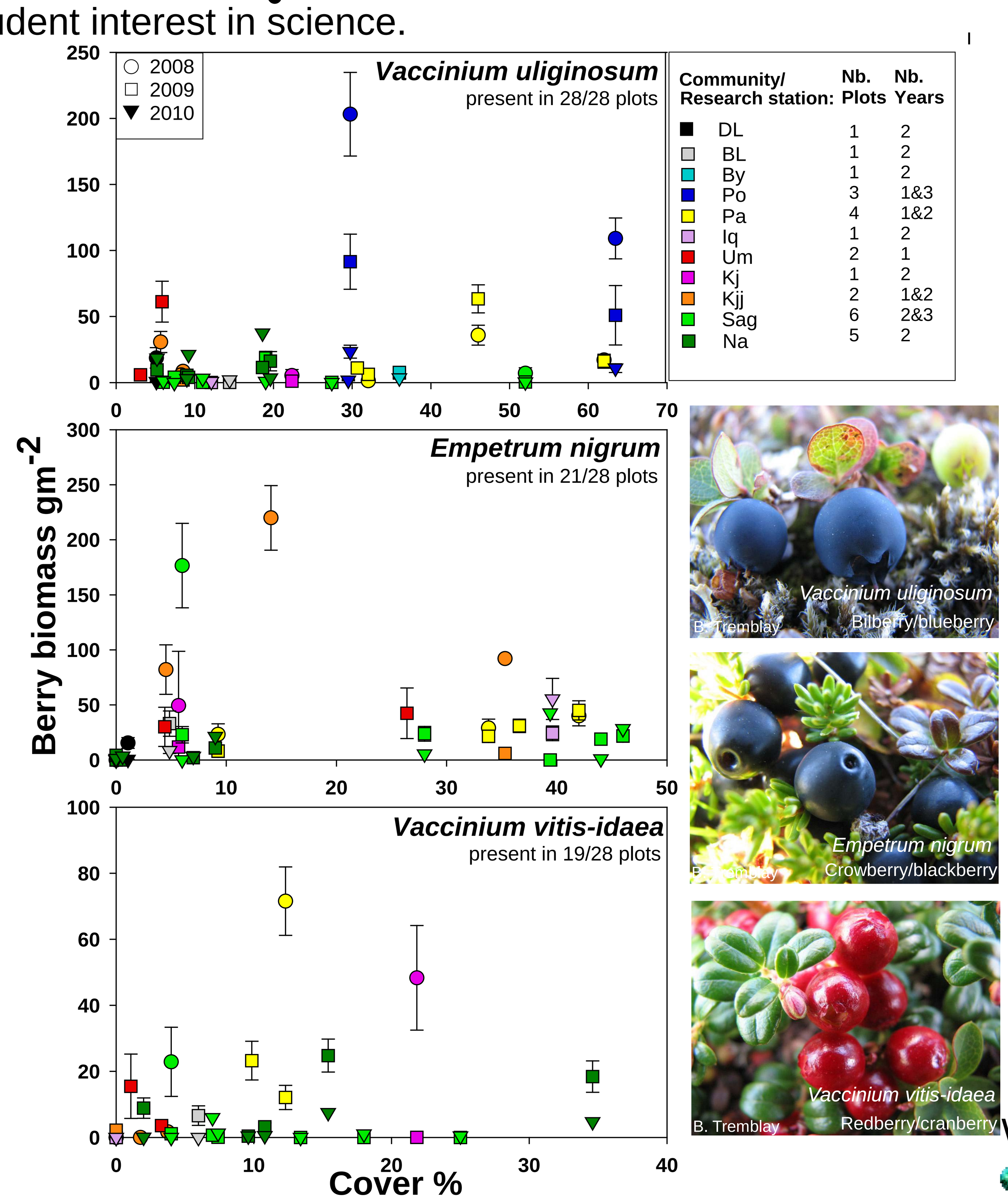


Figure 1: Berry biomass (g/m²), in relation to their respective plant cover (%), for 28 permanent plots across 11 Canadian arctic communities/research stations. Total number of plots sampled: 11 in 2008; 24 in 2009 and 18 in 2010.

RESULTS

- Variable within and among sites, berry productivity varied most among years (Fig. 1).
- Surprisingly across this broad gradient, berry productivity tended to be synchronous. It was highest in 2008, decreased in 2009 and again in 2010, the least productive year.
- High plant cover did not necessarily support high berry productivity and TDD from current (Fig. 2) and previous year (not shown) was not a good predictor of berry productivity.
- For 2008 and 2009, Blueberry had the highest productivity in Pond Inlet, a cold high arctic site where it is the only berry species available.
- Cranberry was more abundant in south-eastern locations. It was generally less productive (< 30g/m²) than other species but 2008 was an exceptional productive year in Pangnirtung.

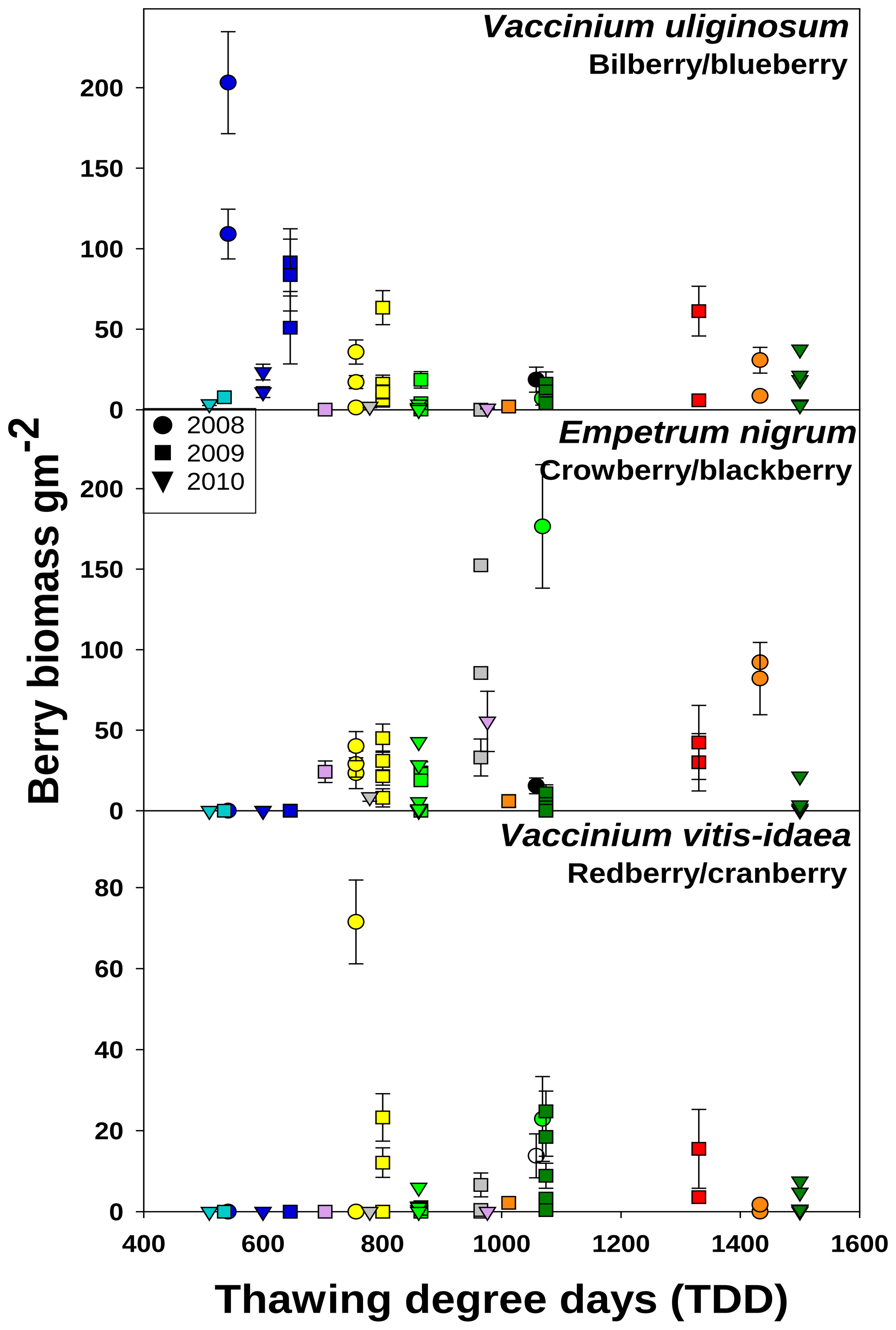


Figure 2 : Berry productivity (g/m²) in 2008, 2009 and 2010, in relation to site thawing degree days (TDD) at ten sites across a west-east gradient. Total number of plots sampled: 10 in 2008; 26 in 2009 and 17 in 2010.

WHAT TO EXPECT IN THE FUTURE?

- More factors (climatic and environmental) need to be investigated and longer time series are essential to understand such naturally variable systems and even more so to detect changing trends and predict berry productivity.
- Berry production and insect activity are influenced by spring and summer rainfalls and by seasonal temperatures that contribute to the timing of thawing and growing degree days.
- Predicted climate warming will influence berry productivity but not in a uniform way, depending of species' ecology (*e.g.* shade-tolerant species, pollination), substrate characteristics and availability, pollinators, herbivores' presence as well as local climatic conditions, topography and perturbations.
- Collaboration with community members greatly enhances our ability to understand northern environments while contributing to local capacity building.

CONSTRAINTS AND NEW CHALLENGES

- Following our 3 year experience and despite community interest, it appears that without the involvement of northern authorities, it is rather difficult to sustain such monitoring program because of several constraints such as teacher's turnover, distance, high travel costs and weather factors.
- Commissioners of Kativik School Board in Nunavik have voted to support the development of hands-on scientific learning activities integrating a community-based environmental monitoring program in the High School Science and Technology cursus, in collaboration with members of our team and other scientists.

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