From galleries to gruits, blogs to botanical gardens:

the many facets of public engagement on Arctic biodiversity research at the Canadian Museum of Nature

Paul C. Sokoloff, Jeffery M. Saarela, Lynn J. Gillespie, R. Troy McMullin, Roger D. Bull,
Jennifer Doubt, Jillian Steele, Cynthia Iburg, Elizabeth McCrea, Laurel McIvor, Caroline Lanthier, Katherine Day

@paul_sokoloff

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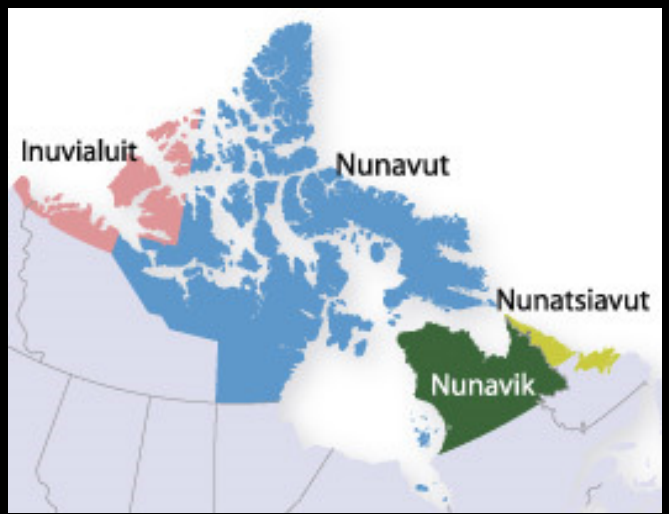
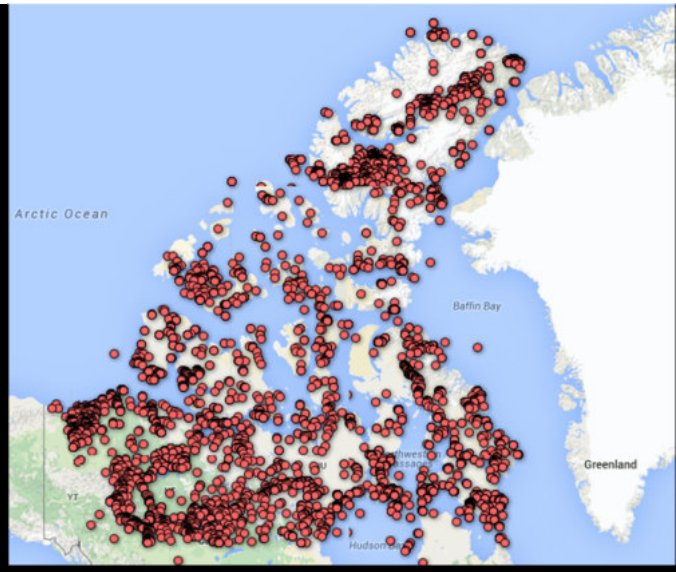
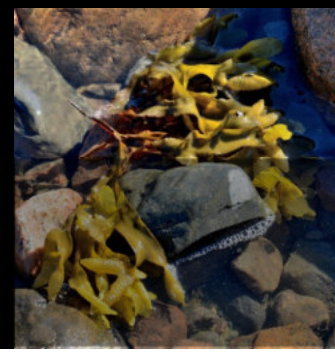


Sokoloff





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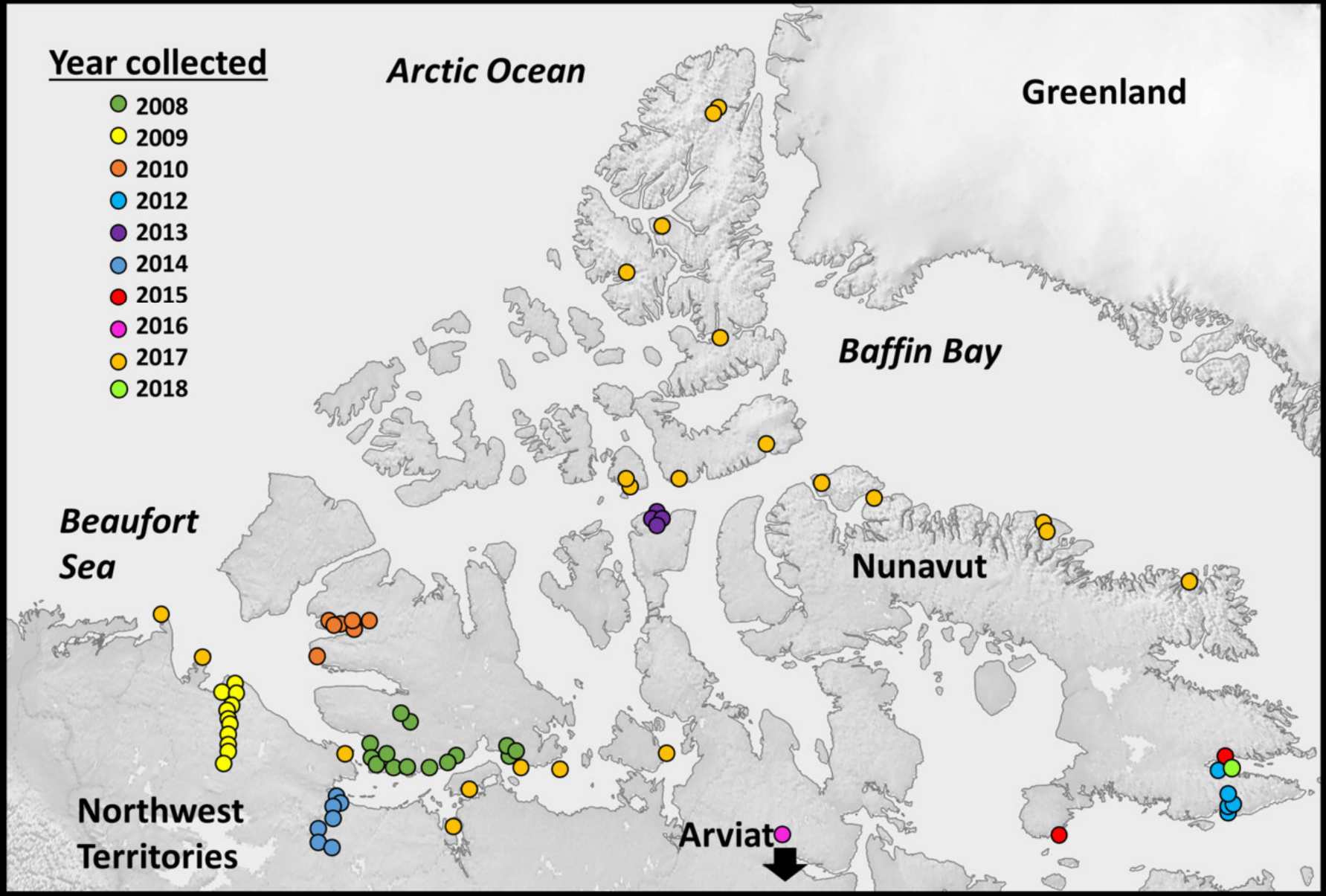

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The Arctic Flora of Canada and Alaska project aims to produce a new flora for all vascular plants in the Arctic ecozone in Canada and northern Alaska. We are using this Scratchpad website to move the Flora beyond traditional standards, and to produce a treatment that is digital and interactive, taking full advantage of current (and future) web and database technologies. The Arctic Flora will eventually serve as the reference for anybody who requires accurate and up-to-date information on Arctic plant species, needs or wants to identify Arctic plants in the field or herbarium, or wants to know a little bit more about the amazing plant biodiversity in one of North America's most climate-threatened ecosystems. This site will be updated with Flora content on an ongoing basis.

The Arctic Flora of Canada and Alaska is led by the:

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Anemone parviflora. Tuktut Nogait National Park, NT, 27 June 2009. Credit: Jeffery M. Saarela.

http://arcticplants.myspecies.info/

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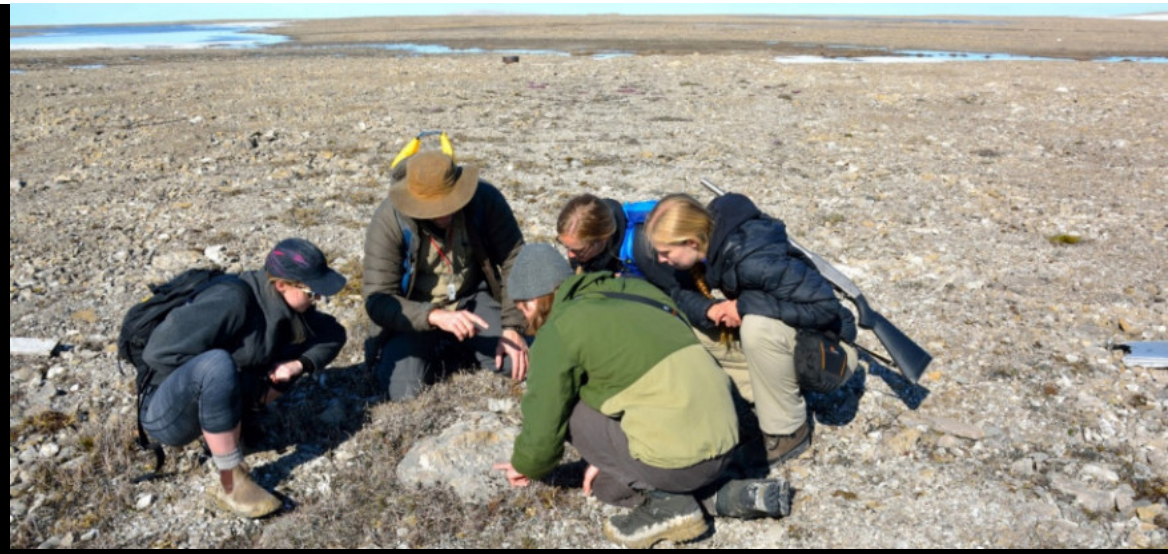

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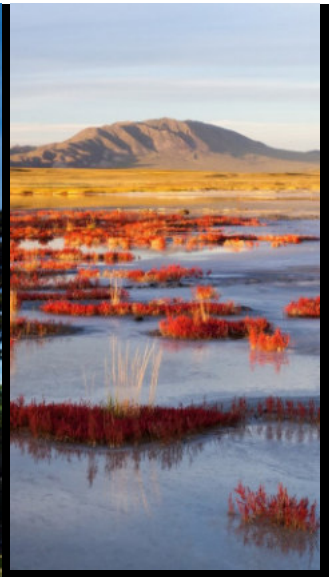
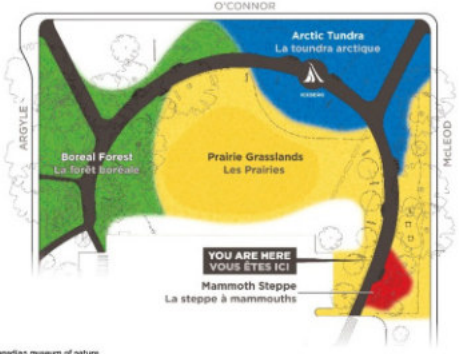


LANDSCAPES of CANADA GARDENS | LES JARDINS DES PAYSAGES du CANADA

Mammoth Steppe
La steppe à mammouths
Arctic Tundra
La toundra arctique
Prairie Grasslands
Les Prairies
Boreal Forest
La forêt boréale



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Mammoth Steppe:
The Vanished Ecosystem of the Woolly Mammoth

The mammoth steppe developed as a distinctive ecological zone along the edge of the northern hemisphere's glaciers during the Ice Age (approximately 120,000 to 12,000 years ago). By the height of the Ice Age it was the largest terrestrial environment on Earth, stretching across Eurasia and into North America.

The mammoth steppe supported a complex mosaic of plant life: over 250 species grew in an ecosystem that combined modern grasslands, rocky tundra and dry scrublands. In prehistoric Canada, it was mostly found in the Yukon, and supported large populations of mammoths and other extinct animals. Many of the plant species found on the mammoth steppe still grow today in parts of the circumpolar Arctic and boreal regions.

La steppe à mammouths :
L'écosystème disparu du mammouth laineux

La steppe à mammouths formait une zone écologique distincte en bordure des glaciers de l'hémisphère Nord pendant l'ère glaciaire (il y a de 120 000 à 12 000 ans environ). À l'apogée de l'ère glaciaire, cet écosystème représentait le plus vaste environnement terrestre de la planète : il s'étirait à travers toute l'Eurasie et l'Amérique du Nord.

La steppe à mammouths abritait une mosaïque complexe de plantes : plus de 250 espèces prospéraient dans cet écosystème qui combinait des milieux comparables à nos actuelles prairies, toundras rocheuses et arbustaies. Aux temps préhistoriques, cette steppe se rencontrait surtout au Yukon, où vivaient d'immenses populations de mammouths et d'autres animaux aujourd'hui disparus. Beaucoup des plantes de cette ancienne steppe existent encore aujourd'hui dans des régions boréales et circumpolaires.

LANDSCAPES of CANADA GARDENS | LES JARDINS DES PAYSAGES du CANADA

Prairie Grasslands

During the Ice Age, receding glaciers deposited nutrients and sediment over a large part of central Canada, leaving behind rich soils that became the foundation of today's prairie grasslands. Today, most of the Canadian prairie has been converted to farmland. The prairie has three grassland types: tall, mixed, and short, each made up of a different combination of plants.

The tallgrass prairie, re-created here thanks to the Living Prairie Museum in Winnipeg, Manitoba, is one of the most threatened plant communities in North America.

Big bluestem (*Andropogon gerardii*) gives the tallgrass prairie its name. Growing 1 to 3 metres on average, its shade hinders competing plants. Large patches of big bluestem indicate a mature tallgrass prairie ecosystem.

Le **barbon de Gérard** (*Andropogon gerardii*) caractérise la prairie à herbes hautes. Avec ses tiges hautes de 1 à 3 mètres en moyenne, cette plante crée une ombre qui entrave le développement des espèces concurrentes. De vastes parcelles de barbons de Gérard indiquent que l'écosystème de prairie à hautes herbes est parvenu à maturité.

Les prairies

Au cours de l'ère glaciaire, les glaciers ont laissé derrière eux des dépôts de nutriments et de sédiments sur une grande partie du Canada central, formant les sols fertiles qui ont fait la richesse des prairies d'aujourd'hui. De nos jours, la majeure partie des prairies canadiennes est cultivée. Il en existe trois types : la prairie à herbes hautes, la prairie à herbes courtes et la prairie mixte, chacune abritant une combinaison de plantes propre.

La prairie à herbes hautes, reconstituée ici par les bons soins du Living Prairie Museum de Winnipeg, au Manitoba, est l'une des communautés végétales les plus menacées en Amérique du Nord.

LANDSCAPES of CANADA GARDENS | LES JARDINS DES PAYSAGES du CANADA

Arctic Tundra

The Canadian Arctic includes all the land north of the treeline. It makes up over a third of Canada's landmass and, due to climate change, is our most rapidly changing ecosystem.

Far from an empty, snow-covered desert, the Arctic tundra hosts a wide variety of habitats: wetlands, meadows, rocky expanses, polar deserts, and even lush valleys. It is home to myriad mosses and lichens, and over 800 species of vascular plants.

Go almost anywhere in the Arctic and you'll find the **Arctic willow** (*Salix arctica*). This tough woody plant is a vital food source for many Arctic animals. The white downy fluff that surrounds its seeds is used as the wick for the qulliq, the Inuit oil lamp.

Où que vous alliez dans l'Arctique, vous rencontrerez le **saule arctique** (*Salix arctica*). Cette plante ligneuse robuste est une source alimentaire essentielle à de nombreux animaux arctiques. Les Inuits se servent des duvets blancs dont s'entourent ses graines pour confectionner les mèches de leur qulliq, leur lampe à l'huile.

La toundra arctique

Englobant tout le territoire au nord de la limite forestière, l'Arctique canadien représente plus du tiers des terres émergées du pays. En raison des changements climatiques, c'est aussi l'écosystème qui se transforme le plus rapidement au Canada.

Loin d'être un désert sans vie et couvert de neige, la toundra arctique offre une grande variété d'habitats : des terres humides, des prairies, des zones rocheuses, des déserts polaires et même de verdoyantes vallées. Elle abrite une myriade de mousses et de lichens, ainsi que plus de 800 espèces de plantes vasculaires.

LANDSCAPES of CANADA GARDENS | LES JARDINS DES PAYSAGES du CANADA

Boreal Forest

The boreal forest is Canada's longest ecosystem, running unbroken through nearly every province and territory. Native trees include: pine, spruce, tamarack, trembling aspen, white birch and balsam poplar. Mosses and lichens are found across the forest. Their health can quickly tell us if the climate or conditions of the forest are changing.

The boreal forest regenerates through disturbance, such as fire, taking 100-200 years to mature. Forest fires create the conditions for growth for sun-loving species, such as birch or aspen. Slower-growing conifers re-appear later, and the cycle repeats.

Jack Pine (*Pinus banksiana*) is a common boreal forest species. The cones of this evergreen tree are serotinous: they need high temperatures to release their seeds.

Le **pin gris** (*Pinus banksiana*) est une espèce commune. Les cônes de ce conifère sont sérotineux : il leur faut des températures très élevées pour libérer leurs graines.

La forêt boréale

La forêt boréale est l'écosystème le plus long du Canada, puisqu'il traverse sans interruption presque toutes les provinces et les territoires du pays. Elle comporte les arbres indigènes suivants notamment : le pin, l'épinette, le mélèze, le tremble, le bouleau blanc et le peuplier baumier. Les mousses et les lichens se rencontrent sur toute son aire de répartition et leur état nous renseigne sur les changements de climat ou de conditions que connaît la forêt.

La forêt boréale se régénère grâce à des perturbations, comme des incendies, et prend un siècle ou deux pour parvenir à maturité. Les feux de forêt créent des conditions favorables à la croissance des espèces qui affectionnent le soleil, comme le bouleau et le tremble. Les conifères, à croissance plus lente, apparaissent plus tard et le cycle se répète.


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Jeff Saarela @jmsaarela 17 Jul 12
Today was beautiful, sunny hot (20 C) day in low arctic, after rainy paddling yesterday #arcticflora @museumofnature dlor.me/BSPZ3VR
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Jeff Saarela @jmsaarela 17 Jul 12
Now camped at Soper Falls, the end of the Soper River. Thurs we paddle across Soper Lake #arcticflora @museumofnature dlor.me/SEAAHKB
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Jeff Saarela @jmsaarela 14 Jul 12
Woke today to sunshine :-) Much needed after days & days & days of overcast skies. #arcticflora @museumofnature dlor.me/YZKC7JR
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Jeff Saarela @jmsaarela 14 Jul 12
Named our boats The Dewey Soper & The Erling Porsild, important arctic nature explorers #arcticflora @museumofnature dlor.me/H5RB4NZ
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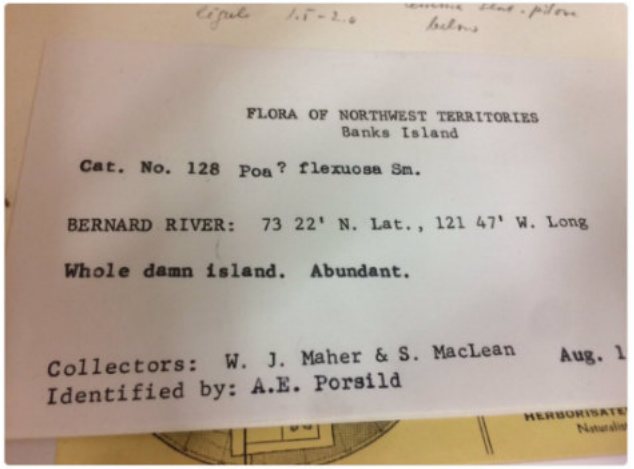
Paul Sokoloff
@paul_sokoloff

Best #herbarium label locality description I've seen in a long while.



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Collecting lichens in Canada's High Arctic
October 30, 2017
Arctic Fireweed (Chamaenerion latifolium) grows in the sands around Lake Hazen. Paul C. Sokoloff © Canadian Museum of Nature
It's 1:36 in the morning on July 16, 2017, and in the orange tent-tinged midnight sun, I'm face to face with a curious wolf, who has muzzled into my vestibule trying to figure out just what's this strange fluorescent bubble.
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HEALTH & SCIENCE SCIENCE
Flat Plants from a Flat Land
October 28, 2016
Would you believe me if I told you that a plant in the coffee family grows wild on the expansive tundra outside Arviat, Nunavut, or that pale green, mosquito-pollinated orchids can be found right on the doorsteps of Arviamiut?
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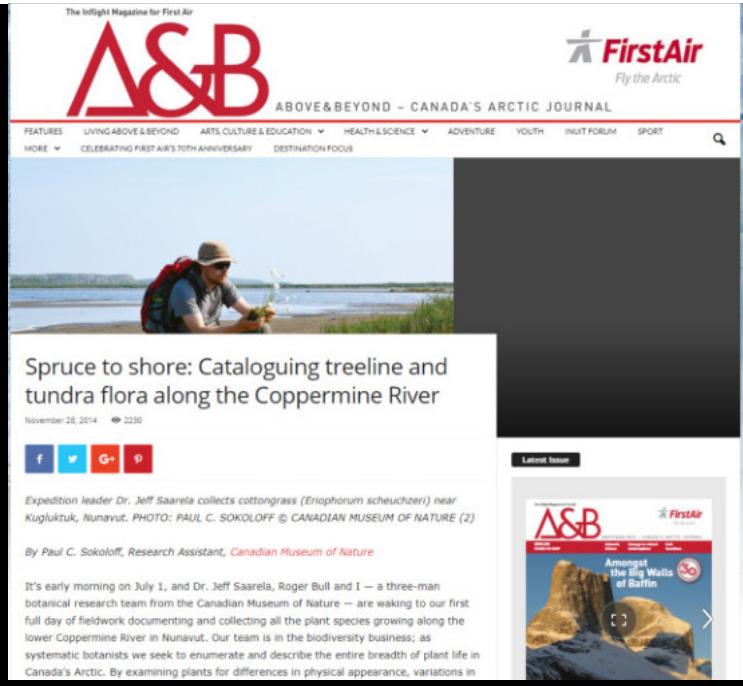
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Spruce to shore: Cataloguing treeline and tundra flora along the Coppermine River
November 28, 2014
Expedition leader Dr. Jeff Saarela collects cottongrass (Eriophorum scheuchzeri) near Kugluktuk, Nunavut. PHOTO: PAUL C. SOKOLOFF © CANADIAN MUSEUM OF NATURE (2)
By Paul C. Sokoloff, Research Assistant, Canadian Museum of Nature
It's early morning on July 1, and Dr. Jeff Saarela, Roger Bull and I — a three-man botanical research team from the Canadian Museum of Nature — are waking to our first full day of fieldwork documenting and collecting all the plant species growing along the lower Coppermine River in Nunavut. Our team is in the biodiversity business; as systematic botanists we seek to enumerate and describe the entire breadth of plant life in Canada's Arctic. By examining plants for differences in physical appearance, variations in
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Amongst the Big Walls of Baffin


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Paul Sokoloff April 15, 2015

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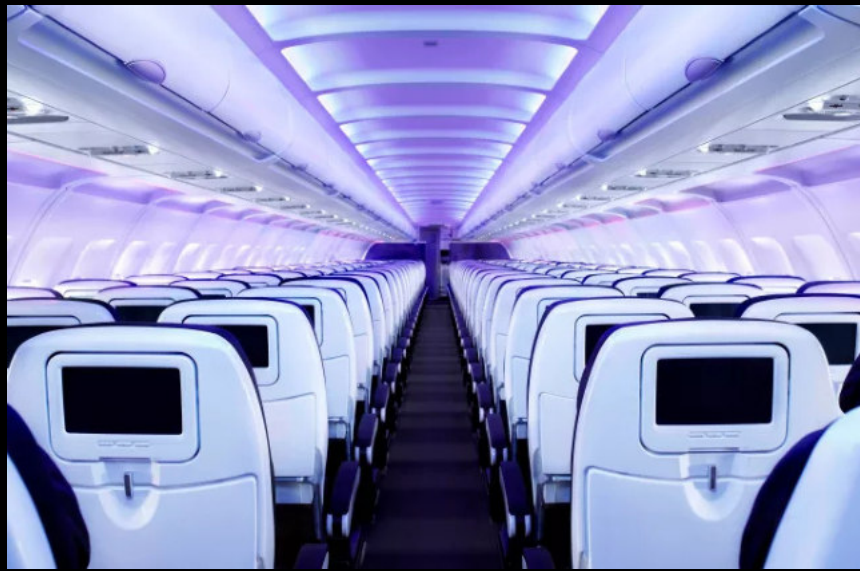

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Taxonomy of *Astragalus robbinsii* var. *fernaldii* (Fabaceae): molecular and morphological analyses support transfer to *Astragalus eucosmus*

Paul C. Sokoloff and Lynn J. Gillespie

Abstract: *Astragalus robbinsii* var. *fernaldii*, Fernald's milkvetch, is a taxon of conservation concern currently due for reassessment of its provincial and federal conservation status. Restricted to a narrow region spanning Newfoundland and Labrador and Quebec, its taxonomic position with respect to two congeners, *Astragalus eucosmus* and *Astragalus robbinsii* var. *minor*, is poorly understood. To clarify the taxonomy of Fernald's milkvetch, we studied variation in the *ycf6–trnC* and *trnC–rpoB* chloroplast DNA (cpDNA) spacers, generated amplified fragment length polymorphism (AFLP) genotypes, and conducted a morphometric analysis. Parsimony and Bayesian analysis of the cpDNA data distinguished *A. robbinsii* var. *minor* from *A. eucosmus* and the majority of Fernald's milkvetch samples; both cpDNA and AFLP analysis were highly suggestive of gene flow between taxa and populations. Morphometric analysis indicates that Fernald's milkvetch is closer to *A. eucosmus* than to *A. robbinsii* var. *minor* in overall form and stipe length, while pubescence was not taxonomically informative. Based on these results, the recognition of Fernald's milkvetch is unwarranted; we recommend that the taxon be transferred to *A. eucosmus*.

Key words: Astragalus, *Astragalus eucosmus*, *Astragalus robbinsii* var. *minor*, *Astragalus robbinsii* var. *fernaldii*, AFLPs, morphometrics, *ycf6–trnC*, *trnC–rpoB*.

Résumé : L'*Astragalus robbinsii* var. *fernaldii* – astragale de Fernald – constitue un taxon présentant actuellement un souci de conservation, compte tenu de la réévaluation de son statut de conservation à l'échelle provinciale et nationale. Restreint à une étroite bande couvrant Terre-Neuve, le Labrador et le Québec, on comprend mal sa position taxonomique par rapport à deux congénères, l'*Astragalus eucosmus* et l'*Astragalus robbinsii* var. *minor*. Pour clarifier la taxonomie de l'astragale de Fernald, l'auteur a étudié la variation des espaceurs de l'ADN chloroplastique *ycf6–trnC* et du *trnC–rpoB*, générés par les génotypes, et il a conduit une analyse morphométrique. L'analyse bayésienne et en parcimonie des ADNcp distingue l'*A. robbinsii* var. *minor* de l'*A. eucosmus* et de la majorité des spécimens de l'astragale de Fernald; les analyses de l'ADNcp et de l'AFLP suggèrent toutes les deux l'existence d'un flux génétique entre les taxons et les populations. Les analyses morphométriques indiquent que l'astragale de Fernald est plus apparentée à l'*A. eucosmus* qu'à l'*A. robbinsii* var. *minor*, pour la forme en général et la longueur du stipe, alors que la pubescence ne donne pas d'information taxonomique valable. À partir de ces résultats, on ne peut garantir la reconnaissance de l'astragale de Fernald; l'auteur recommande de transférer ce taxon à l'*A. eucosmus*.

Mots-clés : Astragalus, *Astragalus eucosmus*, *Astragalus robbinsii* var. *minor*, *Astragalus robbinsii* var. *fernaldii*, AFLPs, morphométrie, *ycf6–trnC*, *trnC–rpoB*.

[Traduit par la Rédaction]

Introduction

Astragalus L. is a genus within the legume subfamily Papilionoideae, consisting of over 2500 species that have diversified across the temperate zones of North and South America and Eurasia (Gray 1862; Kazempour Osaloo et al. 2003; Scherson et al. 2008). *Astragalus robbinsii* (Oakes) A. Gray var. *fernaldii* (Rydb.) Barneby, Fernald's milkvetch, is a narrow endemic native to five populations within the Straits of Belle Isle region of Newfoundland and Labrador and Quebec, Canada. Provincially, this taxon is classified as vulnerable in Newfoundland and Labrador, and "menacé" in Quebec (Morisset 1997; Hanel and Keeping 2006). Fernald's milkvetch is currently due for reassessment of its federal conservation status of "special concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Morisset 1997).

Fernald's milkvetch co-occurs with two congeneric taxa: *Astragalus eucosmus* B.L. Rob. — Elegant milkvetch — and *Astragalus robbinsii* (Oakes) A. Gray var. *minor* (Hook.) Barneby — Robbins' milkvetch. These three taxa are closely related and are thought to constitute a local species complex (Barneby 1964; Wojciechowski et al. 1993). Together, *A. eu-*

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Corresponding author: Paul Sokoloff (e-mail: psokoloff@mus-nature.ca).

← Small World, Teeny Dolphin

700 000 + 900 = A Herbarium That Grows with Each Expedition →

It's All Fun and Games Until Someone Puts an Oxytropis on Their Head

Posted on August 31, 2012 by Paul Sokoloff

The 2012 Arctic Botany Expedition came back from the Arctic a few weeks ago. Paul Sokoloff fills us in on the adventures faced by the four intrepid botanists paddling the Soper River on Baffin Island, Nunavut.

Pre-flight photo-op with the expedition team. Left to right: Lynn Gillespie, Roger Bull, Jeff Saarela and Paul Sokoloff. Image: Paul Sokoloff © Canadian Museum of Nature

The capacity for the human body to adapt never ceases to amaze me. By our second full day in Arctic, on the tundra in Katannilik Territorial Park, I had already adjusted to the not-

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4 Responses to *Anywhere Is Walking Distance If You've Got the Time…*

John Gilbert *says:*
November 18, 2011 at 2:18 pm

Interesting picture of the willow stand. Can you pick relatively large items, such as these, out of satellite photos? The National Geographic studies of Northern Mongolia are identifying quite small structures from satellite photos. They make the point that once a potential site of interest has been identified they can then make better use of (in their case) horses and vehicles to view the site of greater potential interest.

Reply

Paul Sokoloff *says:*
November 18, 2011 at 2:41 pm

Hi John, oftentimes we can see these large stands in satellite photos, dependent on the season the photo was taken. Some of the willow stands we explored in 2010 were first spotted using aerial photography, and followed up on in the 1980's. Using satellite images, we were able to compare known stands to potential sites. Of course, you're right, the only way to know for sure is to "groud-truth" the data for ourselves, but that's the really fun part.

Reply

John Gilbert *says:*
November 21, 2011 at 10:40 am

I am envious of your opportunities to walk in the North. In 1956, as a 19-year old, I arrived in Eureka for a two-year sojourn. Back in 1948 Eureka Station had burned down. It was rebuilt and a hut erected several Km away at Eastwind Lake to be used in any future emergency. It had to be checked periodically and I hiked out there one glorious spring day in the bitter cold and stayed overnight in the hut. Enroute we saw wolves, muskoxen, Arctic hare, lemmings and many birds. I have a photo of a knot's egg in an Arctic "tree". That summer the late Dalton Muir of the NFB did the filming for his movies of Ellesmere Island, based out of Eureka.

Reply


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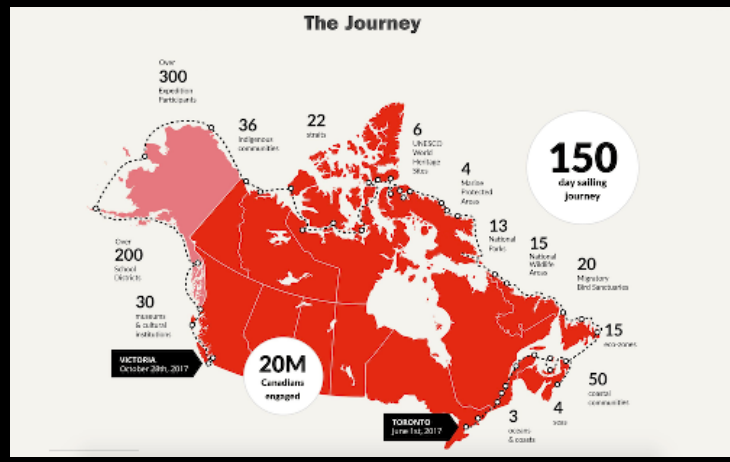
POLAR PRINCE
CANADA C3
COAST TO COAST TO COAST
TROIS CÔTES · UN VOYAGE


The Journey
Over 300 Expedition Participants
36 Indigenous communities
22 visits
6 UNESCO World Heritage Sites
4 Marine Protected Areas
150 day sailing journey
13 National Parks
15 National Wildlife Areas
20 Migratory Bird Sanctuaries
Over 200 School Districts
30 museums & cultural institutions
15 eco-zones
50 coastal communities
3 oceans & coasts
4 seas
VICTORIA October 20th, 2017
20M Canadians engaged
TORONTO June 1st, 2017


SAVEURS
nature
TASTES
BEAU'S
canadian museum of nature
nature
musée canadien de la nature


saveurs
nature
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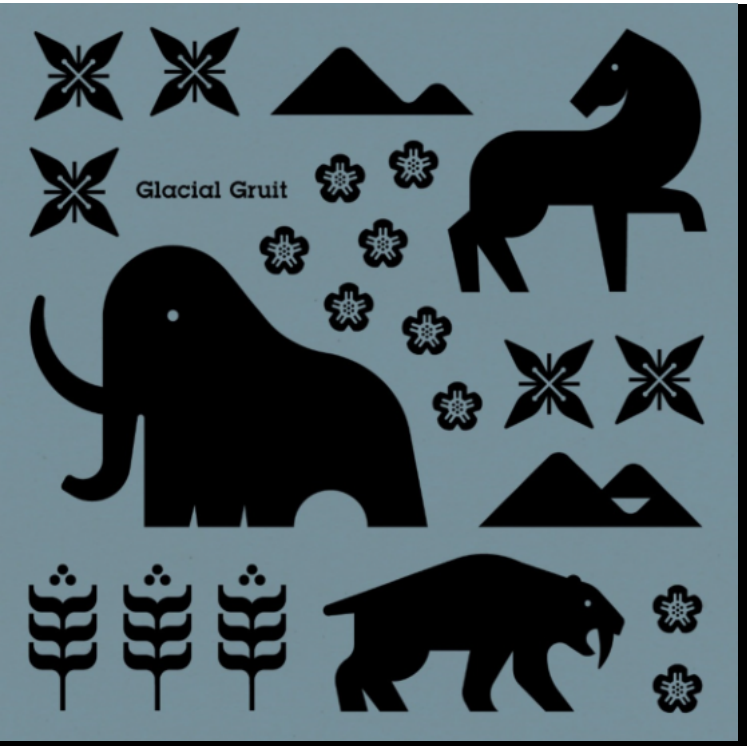
BEAU'S



brief communications

Ice-age steppe vegetation in east Beringia

Tiny plant fossils indicate how this frozen region once sustained huge herds of mammals.

The landmass known as Beringia is an extensive region that existed during the Pleistocene epoch and included the land bridge between present-day Siberia and Alaska, now submerged beneath the Bering Strait. It must have been covered with vegetation even during the coldest part of the most recent ice age (some 24,000 years ago) because it supported large populations of woolly mammoth, horses, bison and other mammals during a time of extensive Northern Hemisphere glaciation, although the nature of this vegetation has not been determined[1–3]. Here we report the discovery of macrofossils of prairie sage (*Artemisia frigida*), bunch-grasses and forbs that are representative of ice-age steppe vegetation associated with Pleistocene mammals in eastern Beringia. This vegetation was unlike that found in modern Arctic tundra, which can sustain relatively few mammals, but was instead a productive ecosystem of dry grassland that resembled extant subarctic steppe communities[4,5].

Spectra of fossil pollens indicate that there was a high proportion of sage (*Artemisia*) and grass (Poaceae) in eastern Beringia[4], suggesting that this region might have contained an arid but productive,

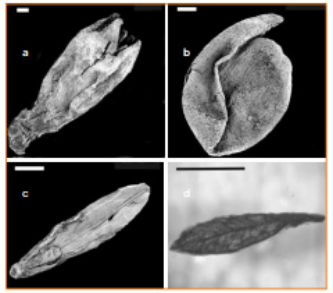


Figure 1 Late-Pleistocene plant macrofossils from Yukon Territory, Canada. **a**, Sage (*Artemisia*) flower; **b**, mustard (*Draba*) seed; **c**, wild-rye grass (*Elymus*) seed; **d**, prairie sage (*Artemisia frigida*) leaf. Fossils were identified by comparison with herbarium specimens. Scale bars: **a**, **b**, 0.1 mm; **c**, 1 mm; **d**, 2 mm.

Abundant sage (*Artemisia frigida*) leaves, flowers from *Artemisia* sp., and seeds of bluegrass (*Poa*), wild-rye grass (*Elymus*), sedge (*Carex*) and rushes (*Juncus*/*Luzula*) support this interpretation. Seeds of cinquefoil (*Potentilla*), goosefoot (*Chenopodium*), buttercup (*Ranunculus*), mustard (*Draba*),

drained soils, deep active layers and high net insolation[8,10]. Regional full-glacial climatic aridity[6] provided similar conditions that favoured the widespread establishment of upland steppe flora in eastern Beringia. We conclude that our macrofossils are evidence of the co-occurrence of local steppe vegeta-

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Thanks for your attention!

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