

What's Not to Lichen?

The importance of lichen in the Arctic tundra.



Crustose



Fruticose



Foliose



Squamulose

What are Lichens?

Fungus + Cyanobacteria = Lichen

Fungus + Algae + Cyanobacteria = Lichen

Fungus + Algae = Lichen

LICHENS ARE COMPOSITE ORGANISMS.

A composite organism is made up of two or more independent organisms. Lichens are comprised of a fungus containing algae and/or cyanobacteria living with the fungal filaments. The algae and cyanobacteria provide nutrients to fungi in the form of carbohydrates. In return, they receive protection and nutrients from the fungi, making this a mutually beneficial relationship.

An association with cyanobacteria also benefits fungi in another way: the cyanobacteria take nitrogen from the atmosphere and convert it into a form that fungi need for essential life functions.

LICHENS ARE ABSORBENT.

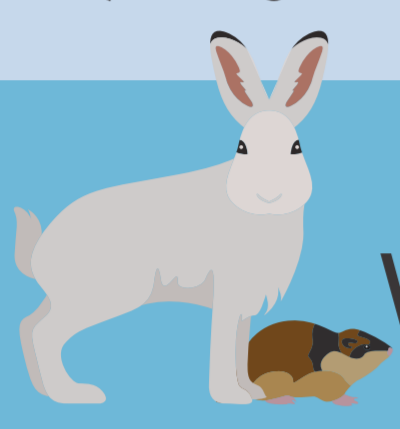
They do not contain roots, stems, leaves or vascular tissues. These components are typically required for obtaining water and nutrients from the surrounding environment. Instead, lichens absorb water and nutrients from the atmosphere.

LICHENS ARE EXTREMOPHILES.

Many species of lichens are very good at living in extreme environments like the Arctic tundra.

LICHENS ARE INDICATOR ORGANISMS.

Lichens will absorb everything that is present within the atmosphere and cannot differentiate between nutrients and non-nutrient particles. This makes them extremely sensitive to harmful toxins and pollutants. They can signal a decline in an ecosystem's condition.



Why are Lichens Important?

Lichens are...

KEystone ORGANISMS.

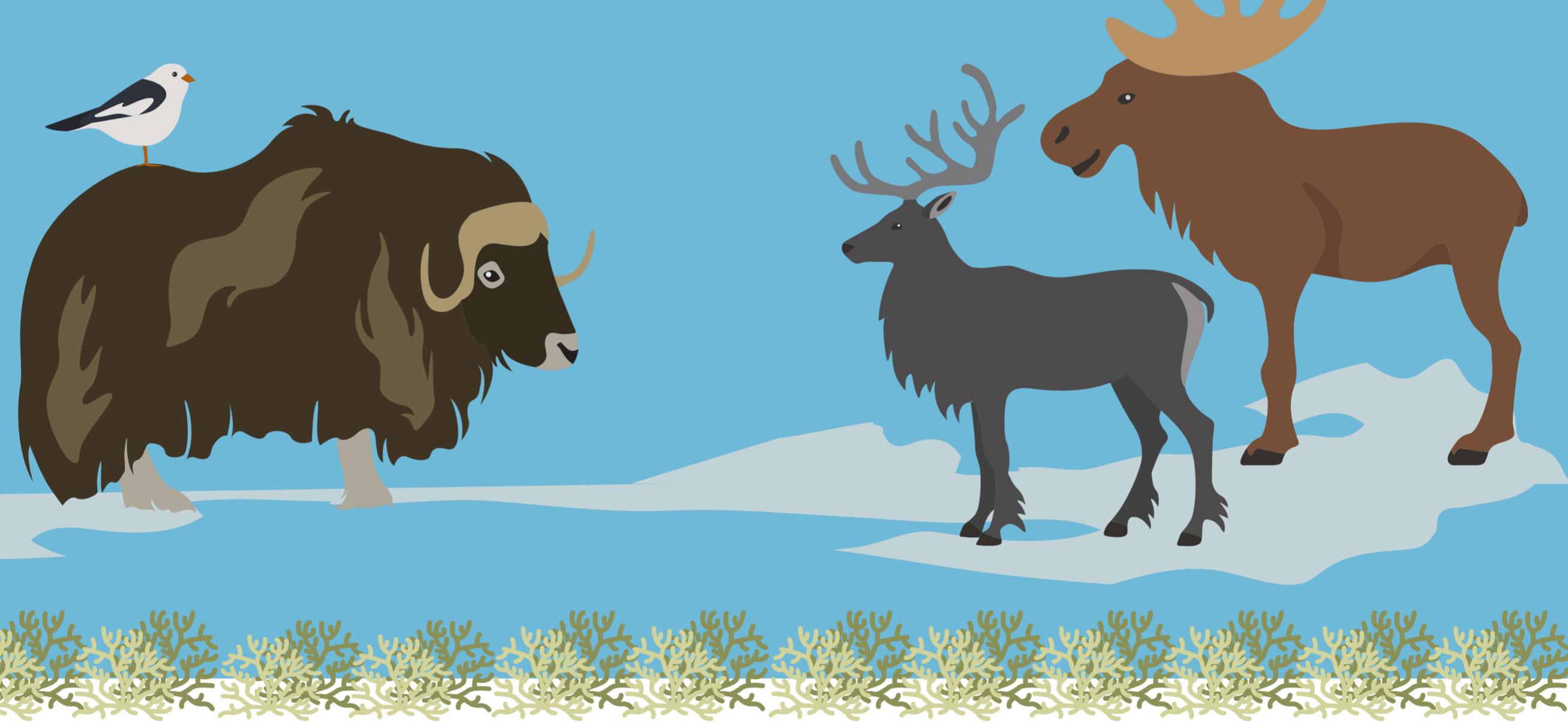
They are essential components of ecosystems, with ecosystems depending on them for their continued survival. There are about 1600 lichen species in the Arctic out of a total of about 13,000 worldwide.

VITAL FOOD & HABITAT SOURCES.

Many herbivores are dependent upon lichen. This includes wildlife such as lemmings, musk oxen, arctic hares, caribou, and moose. Birds use lichens to build their nests, and other animals use lichen for shelter or camouflage.

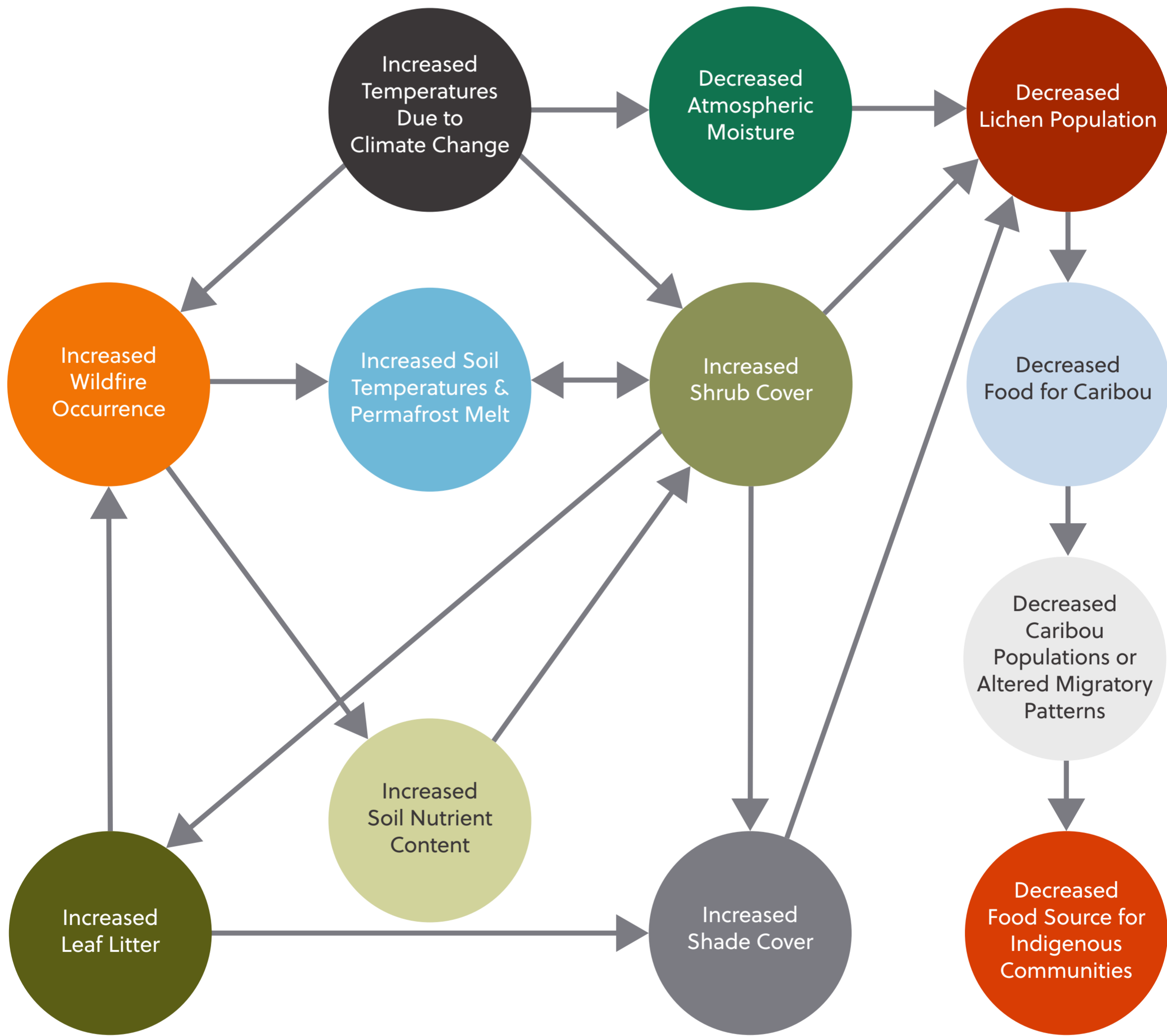
ENVIRONMENTAL SUPERSTARS.

Lichens are monitors of air quality currently being used by governmental agencies as indicators of atmospheric pollution. Lichens aid in the physical and chemical weathering of rocks, regulate water flow and prevent erosion, and provide nitrogen and carbon fixation.



Lichen Declines in the Arctic

The warming climate has impacted the lichen population. An increase in plant temperature as little as 1-3°C has resulted in taller vegetation and an overall increase in shrub cover. This has decreased lichen cover and diversity.



Ways We can Take Action

REDUCE GLOBAL GREENHOUSE EMISSIONS.

Limit the impacts of climate change, which disproportionately affect the Arctic. Follow the Paris Agreement to prevent the global average temperature from rising 1.5°C above pre-industrial levels.

SUPPORT A PANARCTIC LICHEN MONITORING SERVICE.

Use a service that uses Traditional Ecological Knowledge (TEK) and data from local people, scientists, and satellites. This would help people like Indigenous caribou hunters and reindeer herders, policy makers, and land managers make better-informed decisions. The data could be shared and updated by users with an app that is available in all Arctic Indigenous and non-Indigenous languages.

References & Further Information

Cornelissen, J., Hans C., et al. "Global change and arctic ecosystems: is lichen decline a function of increases in vascular plant biomass?" *Journal of Ecology* 89.6 (2001): 984-994.

Elmendorf, S.C., et al. "Global assessment of experimental climate warming on tundra vegetation: heterogeneity over space and time." *Ecology Letters* 15.2 (2012): 164-175.

Elmendorf, S.C., et al. "Plot-scale evidence of tundra vegetation change and links to recent summer warming." *Nature Climate Change* 2.6 (2012): 453.

Jandt, R.R., Meyers C.R., and Cole M.J. "Western Arctic Caribou Herd Winter Habitat Monitoring and Utilization." (2003).

Jandt, R.R., et al. "Slow recovery of lichen on burned caribou winter range in Alaska tundra: potential influences of climate warming and other disturbance factors." *Arctic, Antarctic, and Alpine Research* 40.1 (2008): 89-95.

Joly, K., and Matthew D. Cameron. "Early fall and late winter diets of migratory caribou in northwest Alaska." *Rangifer* 38.1 (2018): 27-38.

Joly, K., Jandt, R.R., and Klein, D.R. "Decrease of lichens in Arctic ecosystems: the role of wildfire, caribou, reindeer, competition and climate in north-western Alaska." *Polar Research* 28.3 (2009): 433-442.

Kenny, T., et al. "Dietary sources of energy and nutrients in the contemporary diet of Inuit adults: results from the 2007-08 Inuit Health Survey." *Public health nutrition* 21.7 (2018): 1319-1331.

Kristinsson, H., M. Zhurbenko, and E.S. Hansen. "Panarctic checklist of lichens and lichenicolous fungi." CAFF Technical Report No. 20, CAFF International Secretariat, Akureyri, Iceland, (2010).

Lang, S.L., et al. "Arctic warming on two continents has consistent negative effects on lichen diversity and mixed effects on bryophyte diversity." *Global Change Biology* 18.3 (2012): 1096-1107.

Walker, D.A. and M.K. Raynolds. "An International Arctic Vegetation Database: A foundation for panarctic biodiversity studies." Concept Paper. CAFF Strategy Series Report No. 5, CAFF International Secretariat, Akureyri, Iceland, (2011).

Walker, M.D., et al. "Plant community responses to experimental warming across the tundra biome." *Proceedings of the National Academy of Sciences* 103.5 (2006): 1342-1346.

Young, A.M., et al. "Climatic thresholds shape northern high-latitude fire regimes and imply vulnerability to future climate change." *Ecography* 40.5 (2017): 606-617.

Zedda, L., and Rambold G., "The diversity of lichenised fungi: ecosystem functions and ecosystem services." *Recent advances in Lichenology*. Springer, New Delhi, 2015. 121-145.

Credits

Lichen research by Nina Joffe
Infographic design created by Metamorphik Design - www.metamorphikdesign.com
Pixabay: Fruticose lichen image by Marc Pascual, Foliose lichen image by Jerzy Górecki, Crustose lichen image by Hans Braxmeier, Squamulose lichen image by Image Foto-Rabe



THE ARCTIC INSTITUTE