



SP^{pecies} Spotlight

Moose

Alces alces

If you live in northern North America you have likely uttered the words “eater of twigs” in another language many times without knowing it. For that is the translation of the Algonquian Indian word “moose.” All Native American tribes from the region were familiar with this impressive beast. Not only was it vital as a source of food, clothing, and tools, it was, and still is, revered. Though its symbolism varies across tribes, for many it is a sacred animal that represents strength, wisdom, courage, and resilience.

Awesome Antlers and Dangling Dewlaps

When observing a male moose, or bull, one can't help but notice their impressive rack of antlers and the appendage of skin and hair that hangs below their heads known as a dewlap. Fully grown antlers can span 6-feet and weigh 60 or more pounds. Antler size is a visual signal of health to females during mating season, and are used for sparring with other males for dominance. Biologists still ponder a dewlaps function however, though there are theories ranging from heat regulation to mating rituals. Larger on males than females, they are longest on males in the 3 to 5 year-old range, and may signal health and virility much in the same way antlers do. Dewlaps may also play a part in mating rituals by helping spread the scent (from urine and saliva) of a bull when it rubs a cow with its chin.

Moose, Mycorrhizae, and Meadows

Moose play an integral part in the ecology of the northwoods in many ways. One such way is how they interact with beavers and voles to create and sustain the natural phenomenon known as beaver meadows. The process goes something like this: beavers topple aspens to access the nutritious branches and twigs. Re-sprouting aspen are heavily browsed by moose, suppressing their regrowth and freeing understory spruce and fir to grow. Eventually a thickly shaded wall of spruce and fir predominates the pond's perimeter. No longer able to easily access aspen, beavers move on, their dams degrade, and the pond drains creating a 'beaver meadow' of sedges, irises, and grasses. These natural features can persist for decades without trees moving in. But how? Spruce and fir seedlings that do manage to pop up last only a couple years at most before withering. The reason conifers struggle to grow in beaver meadows is the underlying soils lack a vital component: mycorrhizae - a symbiotic fungal network that intertwines with tree roots. The fungi receive carbohydrates from the tree, which it supplies with nitrogen and phosphorus. This vital mycorrhizal network is smothered by the beaver pond, and thus spruce and fir cannot immediately move in when it eventually drains. But why,

even after a few decades, don't the fungi recolonize the meadow? A recent University of Minnesota study suggests that it comes down to a couple tiny rodents: two separate species of voles. The forest based red-backed vole eats the fruiting bodies of underground mycorrhizal fungi, and their spores are spread by the vole's pellets. Red-backed voles tend to stay out of beaver meadows, severely stalling the spread of mycorrhizal fungi into them. It appears the presence of a close relative, the appropriately named meadow vole, holds them at bay as they are very aggressive towards each other. Thusly, beaver meadows persist.

Cold Comfort for Change

Moose experience stress in hot weather. This is not surprising when considering they are a product of the Pleistocene (ice age) epoch. The modern moose likely evolved no earlier than the late-middle part of the most recent ice age about 500,000 years ago. Their large body mass, long legs, and thick insulating fur make moose well adapted for deep snow and cold conditions.

Today, as the Anthropocene global climate continues to warm, moose populations are suffering. Overheating, disease, and tick infestations are all on the rise. Negative impacts to the moose herd are especially harsh across the southern edge of its territory. New Hampshire populations



Dewlaps tend to be longest on younger bulls. They can freeze and partially break off in very cold weather. Ed Sharron photo



Beaver meadows can persist for decades after a pond drains. Beavers, moose, mycorrhizae and voles all play a part in keeping them open.

are down over 40% since 2014, Vermont over 50% since 2005, Maine, which has the largest moose population in the lower 48, is down 22% since 2012, and Minnesota 58% between 2006 and 2017. Too-high moose densities in some areas lead in part to this pull back. The other primary culprits are heat stress, and a couple of tiny terrors that weigh less than a gram that are reaping the benefits of warmer, shorter winters.

And the Worms Ate into its Brain.

Full size, healthy adult moose don't have many predators. Especially bulls, which can weigh near 1500 lbs in their Alaska range. A face-full of antlers or hooves is usually enough to deter predators like bears and wolves. The larger the moose, the more likely it is to stand its ground when facing a threat. This stubbornness contributes to high rates of vehicle collisions which can end badly for both moose and driver. But even the biggest bull can't fend off a couple of the most dangerous foes to moose health: winter ticks and parasitic brainworms.

White-tailed deer and moose historically do not share habitat. With their relatively short legs and thin fur, deer are ill-suited for the deep snow and subzero temperatures that moose revel in. But warmer winters mean snow comes later, is less deep, and melts faster than before, and deer have moved north into traditional moose territory. Unfortunately for moose, they've brought a hitchhiker: parasitic brainworms. White-tailed deer are natural carriers of brainworms, which rarely affect them adversely even though they burrow into their brains. The parasite is spread through deer droppings that infect land snails and slugs, which are then inadvertently swallowed by moose foraging on vegetation. Once inside a moose, the worm's larvae travel to the brain and spinal cord. Along the way, they seek the same interior geography of deer, and in doing so, cause severe neurological damage. Infected moose eventually succumb to the patently unpleasant sounding nervous system disease known as cerebrospinal nematodiasis. Symptoms include weakness, fearlessness, lack of coordination, circling, deafness, impaired vision, and paralysis, and usually leads to the death of the animal.

Ticking Away the Moments that Make up a Bull's Day.

Another direct effect of warmer winters is that tick populations, specifically - the winter tick, have had a boom

in population. With the development of ideal moose habitat (especially in parts of Maine and northern New Hampshire) from regrowth following logging operations, dense moose populations made it easy for larval ticks to find a new host.

Though relatively poor groomers compared to deer, some moose will try to rub ticks off resulting in large bare patches on their bodies and making them vulnerable to exposure. In what can only be described as a nightmare scenario, biologists have encountered moose with 40,000, 75,000, even up to 90,000 ticks feeding on them. Each adult female winter tick can remove one milliliter of blood, which adds up to almost 24 gallons for 90K ticks. This leaves moose severely weakened, and many die of anemia. High tick loads also cause fewer moose cows to carry pregnancies to full term. In spring, the ticks drop off to reproduce and by fall, larvae are "questing" for a new host. Where moose populations are dense, this is easy, and the tick population increases even more. Deep snow or a prolonged cold snap can kill questing ticks before they find a host, but with warming winters across northern areas (Maine sees about 2-weeks less winter than it did a century ago), this is becoming less common.

One solution that several states in the Northeast are currently experimenting with is to reduce moose populations where they are the most dense through strategic hunting permit allocation. It is not lost on state biologists that killing moose to save them may seem counterintuitive. But research suggests that reducing the density of moose hosts on the landscape, a sort-of forced moose social distancing, reduces the abundance and impact of winter ticks.

A supplemental approach is to reduce tick numbers using naturally occurring fungal spores found in New England soils. Currently, the U.S. Fish and Wildlife Service is supporting a University of Vermont research project looking at this control method. Spores can be spread using oil-based substances, solid granules, or powders. Once on a tick, the microbial fungi penetrate its body and produce killing chemicals.

For more information

- Learn more about the ways the [University of Vermont](https://www.uvm.edu/extension/conservation/) is researching tick control.