Numa Fen is north of and above Bowman Lake

Photos courtesy of Peter Lesica

Montana Peat Mosses

By Joe Elliott, Conservation Biology Research Corporation

Species of the genus Sphagnum, commonly called peat moss, are the most ecologically and economically important group of bryophytes. Their role in acidifying wetlands, thereby influencing the species composition of other plants [what other plants grow there], has been well established, and their potential role as indicators of climate change warrants looking closely at their distribution, species diversity, ecology, and conservation status.

The Montana Natural Heritage Program (MNHP) evaluates and tracks the status of plants and animals that are of elevated conservation concern. Twenty species of Sphagnum have been reported for Montana, of which 11 have been designated as Species of Concern (SOC) by the MNHP. The conservation status of SOC is based on factors such as rarity, restricted distribution, threats to populations, or losses in habitat.

Sphagnum, a mostly circumboreal genus, is restricted to cool, wet habitats of fens and other wetlands worldwide. In Montana, Sphagnum habitats include wetlands that accumulate peat (fens) and wet sites at margins of streams, springs, lakes, swamps, and marshes. Peat consists of partially decomposed plants that grow in Montana fens, where cold groundwater seeps to the surface. When biomass production of grasses, sedges, mosses, and other plants exceeds the rate of decomposition, peat accumulates at the rate of a few millimeters per year. Fens in Montana can have peat deposits more than five feet thick, indicating that they are thousands of years old. Peatlands are crucial habitat for many rare plants and animals (bog lemmings, for example) and are important globally as a factor in climate warming associated with the release of methane, a greenhouse gas. In Idaho, an estimated 10 to 15 percent of the state's rare flora is restricted to peatlands.

Habitats in Montana that support Sphagnum occupy a relatively tiny area of the landscape, with soils, vegetation, and hydrological conditions that differ from the surrounding forest or treeless alpine areas. In contrast, the arctic and northern boreal landscapes have extensive bogs and fens underlain by permafrost that support a diversity of peat moss species. About one-third of the forested areas of neighboring Alberta are covered by peatland. Centers of distribution of many Montana species are in the more northerly latitudes, with most of the Montana Sphagnum species near the southern extent of their range.

Sphagnum species are found in a range of wetland habitats; however, habitats with the greatest species richness of Sphagnum are fens. These wetlands harbor rare plants, including numerous mosses in addition to Sphagnum, and have complex ecologies associated with mineral nutrition, hydrology, and substrate chemistry. Studies have found that the occurrence of Sphagnum species is correlated with specific types of peatlands, based on nutrient gradients, pH, and hydrology. Sphagnum has the capacity to acidify the substrate by releasing hydrogen ions in exchange for calcium, magnesium, potassium, sodium and other cations. The spatial distribution of Sphagnum in peatlands is directed by gradients within the wetland environment, with many species occupying microsites along wet-to-dry gradients, nutrient gradients (closely correlated with pH), and the degree of exposure to sunlight.

Through modification of the pH of the wetland substrate, Sphagnum directs ecological succession in peatlands and affects the species composition of vascular plants and other mosses. Nutrient, pH, and moisture gradients associated with the micro-relief of peatland substrates contribute to the habitat diversity and

species richness of fen-growing vascular plants and other mosses, which often form unique plant communities.

Although Sphagnum is present at wetland sites other than fens, the most species-rich sites for Sphagnum are peatland habitats. The most species-rich Montana fens have eight species of Sphagnum. The peat mat at Fish Lake in Glacier National Park and the Purcell Fen, in the Purcell Mountains of extreme northwestern Montana, each has eight Sphagnum species.

Montana Sphagnum species, with the exception of *S. medocinum*, are circumboreal, occurring over a broad geographic range in North America and Eurasia. Because of the widespread distribution of most Montana species, there are few that are rare or imperiled on a global basis. Conversely, species considered narrow or regional endemics are at greater risk from threats to population viability. The only Montana Sphagnum that is a regional endemic is *S. mendocinum*. This species has been most frequently collected in Washington, Oregon, and British Columbia, with a few locations in Idaho and Montana.

Cody Lake Fen in the Salish Range

Needles Fen near Mount Edith in the Belt Mountains

Conservation rankings of Sphagnum may have increasing relevance in the context of climate change. Because most Montana Sphagnum species are at the southern edge of their distribution range, increases in temperature could stress populations, particularly at lower elevation, warmer habitats. Sites where Sphagnum currently grows likely will become drier and warmer, resulting in moisture stress and increased vulnerability to fire. Fire could directly and indirectly affect Sphagnum habitat.

Sphagnum species demonstrate habitat specificity, mostly being restricted to cool, moist fens and other wetlands that make up a very small part of the natural landscape. Increased temperatures associated with climate change would have the potential to melt mountain snow earlier in the season, increase evapotranspiration, and increase the incidence and severity of fires. Although fires do not usually severely burn the wet substrates of wetlands harboring Sphagnum, they reduce vegetation cover and litter on slopes, increasing erosion and mass soil movement. Because fens and other wetlands often occupy the lower topographic positions on the landscape, they have the potential to collect runoff and sediment resulting from fires. This could smother the herbaceous layers of fens and other wetlands and substantially alter the substrate and water chemistry of Sphagnum habitats, rendering them unsuitable for some species.

Historically, large, high-intensity wildfires and logging have had the most potential to affect the quality of Sphagnum habitat by altering the overstory canopy and site hydrology. Roads built to facilitate access to timber, dating from the early 1900s, typically were constructed in drainage bottoms, in or adjacent to wetland habitats that harbor Sphagnum and associated vascular plant species. Currently there are few roads being built and most timber harvest is associated with salvage after fires. Although traditional logging from stands of unburned timber has declined over recent decades, it is likely that timber harvest associated with fire will continue to become more common and widespread. Salvage logging operations that take place on burned areas vulnerable to soil erosion and mass movement would likely increase the potential for downslope movement of water with high concentrations of suspended sediments and ash, and thus would have the potential to adversely affect Sphagnum and other wetland species.

Joe Elliott is a retired ecological consultant with more than forty years' experience working on projects that affect natural resources in the western United States, Canada, Kenya, Ghana, Peru, and Bolivia. His work has been to gather and analyze biological information in compliance with environmental laws that address wetlands, endangered species, biodiversity, and environmental policy. He has studied with some renowned moss men and continues to be an aspiring bryologist.