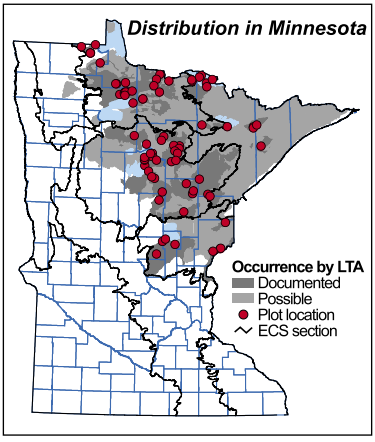
Northern Spruce Bog

Black spruce–dominated peatlands on deep peat. Canopy is often sparse, with stunted trees. Understory is dominated by ericaceous shrubs and fine-leaved graminoids on high Sphagnum *hummocks.*

Vegetation Structure & Composition

Description is based on summary of vascular plant data from 84 plots (relevés) and bryophyte data from 17 plots.



- **Moss layer** consists of a carpet of *Sphagnum* with moderately high hummocks, usually surrounding tree bases, and weakly developed hollows. *S. magellanicum* dominates hummocks, with *S. angustifolium* present in hollows. High hummocks of *S. fuscum* may be present, although they are less frequent than in open bogs and poor fens. *Pleurozium schreberi* is often very abundant and forms large mats covering drier mounds in shaded sites. *Dicranum* species are commonly interspersed within the *Pleurozium* mats.
- **Forb** cover is minimal, and may include three-leaved false Solomon's seal *(Smilacina trifolia)* and round-leaved sundew *(Drosera rotundifolia).*
- **Graminoid** cover is 5-25%. Fine-leaved graminoids are most important and include three-fruited bog sedge *(Carex trisperma)* and tussock cottongrass *(Eriophorum vaginatum).*
- **Low-shrub layer** is prominent and dominated by ericaceous shrubs, particularly Labrador tea *(Ledum groenlandicum),* which often has >25% cover. Other ericads include bog laurel *(Kalmia polifolia)*, small cranberry *(Vaccinium oxycoccos)*, and leatherleaf *(Chamaedaphne calyculata).* Understory trees are limited to scattered black spruce.
- **Canopy** is dominated by black spruce. Trees are usually stunted (<30ft [10m] tall) with 25-75% cover . Some sites have scattered tamaracks in addition to black spruce. Canopy can be dense and taller than 30ft on well-developed crests of raised bogs, where surface peat is elevated above the water table and tree roots are better aerated.
- **Notes**: Vegetation is composed only of bog species (see Appendix D); minerotrophic species are absent or present only as single individuals or single clones. Overall species diversity is low. In recently developed bogs, isolated minerotrophic species whose roots still have access to underlying minerotrophic groundwater may be present for a short period until overwhelmed by *Sphagnum* development. When upland seed sources are present nearby, seedlings of deciduous tree species (especially red maple, northern red oak, or paper birch) may be present on *Sphagnum* hummocks but do not survive to become saplings or trees.

Landscape Setting & Soils

APn80 is most extensive and best developed in peatlands on the eastern Agassiz, Aitkin, and Upham glacial lake plains, where underlying impermeable clay layers minimize groundwater movement through the peat. APn80 also occurs in peat-filled basins on nutrient-poor outwash plains, in scoured bedrock terrain, and on non-calcareous till. On these landforms, the basins are in small watersheds and receive minimal surface water input. APn80 can also occur on floating mats bordering low-alkalinity lakes and ponds. Soils are typically deep peat (>40in [1m]), although peat depth can be less in scoured bedrock landscapes or on nutrient-poor sand plains. The upper peat layer is poorly decomposed (fibric) peat formed from *Sphagnum*. It may be underlain by more

decomposed peat of variable origin. Surface water is very acidic (pH <4.2), and mineral concentrations, particularly Ca^{++}, are extremely low. Water table is usually at or near the surface but can drop during periods of drought.

Natural History

APn80 occurs where buildup of peat causes the peat surface to become isolated from mineral-rich runoff or subsurface flow so that all mineral inputs come from precipitation. In areas with continental climates, including Minnesota, raised bogs such as APn80 are best developed in large peatlands. They are characterized by linear crests with subtly sloping concave sides. In these peatlands, a characteristic pattern of black spruce radiating from the central crest is evident on aerial photos. This pattern may not be present in more recently developed bogs and in bogs in small basins. In all cases, however, the bogs have a surface that is well aerated because of fast vertical growth of *Sphagnum* (which causes the upper peat layer or acrotelm to be low in density) and because the water table typically is below the peat surface in summer. This allows black spruce and other bog species that are sensitive to high water levels to become established in the peat. Although usually stunted, black spruce trees provide enough of a canopy to create conditions favorable for shade-tolerant species, particularly at the bases of trees, that are uncommon in open peatland communities.

Although fires can occur in spruce bogs, they are not very common, perhaps because of the tendency of the community to occupy the centers of peatland basins. An analysis of Public Land Survey (PLS) records indicates that the historic rotation of catastrophic fires in APn80 was in excess of 1,000 years. Superficial fires appear to have been more common, occurring about every 120 years. Such fires can kill black spruce trees and favor nearly continuous cover of leatherleaf, which resprouts from roots protected by moist peat. Following these lighter fires, some of the characteristic shade-tolerant understory species usually remain at the site. Severe, catastrophic fires can result in conversion of the peatland to an open bog community dominated by bog wire grass *(Carex oligosperma);* if sufficient nutrients are released into surface waters by burning of peat and vegetation, the bog may be converted to a poor fen. Recovery to forested conditions may take decades in these peatlands. The ability of black spruce to send up new stems, or layer, from branches buried by peat has been interpreted as an adaptive trait for surviving windthrow. There is, however, little direct evidence that windthrow has a significant impact on spruce bogs. The PLS records suggest the historic rotation of catastrophic windthrow in APn80 was about 700 years. Trees in APn80 are somewhat susceptible to windthrow because of structurally weak peat soils and shallow root systems, but this seems to be offset by short height (<30ft [10m]), sparse crowns, root-grafting, and branch-layering.

Similar Native Plant Community Classes

● APn90 Northern Open Bog

APn90 can have a canopy of stunted black spruce that overlaps in cover with the sparse canopy typically present in the Semi-Treed Subtype of APn80 (see APn80a2 below).

► ***APn90***—Canopy cover is typically <25%. More likely to have light-requiring species such as small cranberry, bog rosemary *(Andromeda glaucophylla),* and bog wiregrass sedge *(Carex oligosperma).* High hummocks of *Sphagnum fuscum* are frequently present. Moss mats of *Pleurozium schreberi* are rare.

► ***APn80***—Canopy cover is >25%. More likely to have shade-tolerant species such as lingonberry *(Vaccinium vitis-idaea)*, creeping snowberry *(Gaultheria hispidula),* stemless lady's slipper *(Cypripedium acaule),* three-fruited bog sedge *(Carex trisperma),* poor sedge *(C. paupercula),* and the moss *Pleurozium schreberi.* (Burned or mistletoe-infested occurrences of APn80a2 may have greatly reduced canopies and become dominated by leatherleaf or bog wiregrass sedge *[C. oligosperma],* but shade-tolerant species often remain for decades.) *Sphagnum fuscum* hummocks are scattered and small. Extensive *Pleurozium schreberi* mats are evident underneath the black-spruce canopy.

● **APn81 Northern Poor Conifer Swamp**

Northern Poor Conifer Swamps are *Sphagnum*-dominated peatlands with stunted black spruce trees and can appear similar to APn80, but are not completely isolated from mineral-rich groundwater and as a result support minerotrophic indicator species.

▶ ***APn81***—One or more minerotrophic indicator species are present, including bog birch *(Betula pumila),* speckled alder *(Alnus incana),* creeping sedge *(Carex chordorrhiza),* or bluejoint *(Calamagrostis canadensis)*. *Sphagnum* carpets are usually restricted to low hummocks and areas around bases of trees. Brown mosses, such as *Calliergon cordifolium,* are present in hollows.

▶ ***APn80***—Vegetation is composed mainly of bog species (see Appendix D); minerotrophic species are absent. Most hollows are covered by *Sphagnum angustifolium* carpets.

Native Plant Community Types in Class

Only one plant community type is recognized in this class. It is divided into two subtypes along a continuum from well-developed to sparse tree canopies.

● **APn80a Black Spruce Bog**

○ *APn80a1 Treed Subtype*

Canopy is variable but typically has >50% cover of black spruce. Tree cover is sufficient to provide conditions for a relatively high number and cover of shade-tolerant species, including lingonberry (*Vaccinium vitis-idaea*), Indian pipe (*Monotropa uniflora*), velvet-leaved blueberry *(V. myrtilloides)*, and lowbush blueberry *(V. angustifolium)*. APn80a1 is best developed on upper portions of raised bog crests, where drainage is more suitable for tree growth than in APn80a2. Description is based on summary of vegetation data from 28 plots.

○ *APn80a2 Semi-Treed Subtype*

Canopy is relatively open because of water tables high enough to limit tree development. Canopy trees are stunted and patchy, with <50% cover. Species with greater light requirements are more common and more abundant in APn80a2 than in APn80a1, including tamarack, few-fruited sedge *(Carex pauciflora)*, pitcher plant (*Sarracenia purpurea*), and tussock cottongrass *(Eriophorum vaginatum)*. APn80a2 occurs in incipient bog drains and at the bases of bog crests. Description is based on summary of vegetation data from 46 plots.

photo by J.A. Janssens

Sphagnum capillifolium