



Mineral-enriched Swamps (including Seepage Swamps)

Mineral-enriched (minerotrophic) swamps are forested wetlands where minerals in the bedrock or soil have leached into the water and resulted in relatively high mineral levels. The most common source of mineral enrichment is groundwater seepage, but enrichment can also occur when near-surface groundwater flows through certain soils or bedrock types before entering the swamp. The plants that help identify these areas include some species that are indicative of seepage conditions, and some that are indicative of mineral-enriched, but not necessarily seepage, conditions (see below).



Red maple (*Acer rubrum*) is the predominant tree species in mineral-enriched swamps in central and southern New Hampshire. Northern white cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), and red spruce (*Picea rubens*) are found further north. Other plants commonly found in mineral-enriched swamps include yellow birch (*Betula alleghaniensis*), highbush blueberry (*Vaccinium corymbosum*), and winterberry (*Ilex* spp.). Swamps with the greatest degree of mineral enrichment occur in calcium-rich areas and support additional rare species such as bulbous bitter-cress (*Cardamine bulbosa*), Loesel's twayblade (*Liparis loeselii*), and tufted loosestrife (*Lysimachia thyrsiflora*).

In some swamps, groundwater seepage emerges as pronounced springs actively welling up out of the ground and draining into brooks. In other swamps, seepage may only be present underground in the root zone. If the groundwater source is perennial, seasonal water level fluctuations tend to be reduced and conditions remain saturated all year long. The mineral-enriched swamps described here do not include those that occur next to rivers and streams and thus are strongly influenced by seasonal floods (e.g., floodplain forests and streamside swamps).

Mineral-enriched (minerotrophic) indicator species:

foamflower (*Tiarella cordifolia*)
jack in the pulpit (*Arisaema triphyllum*)
jewelweed (*Impatiens capensis*)
sensitive fern (*Onoclea sensibilis*)
skunk cabbage (*Symplocarpus foetidus*)
speckled alder (*Alnus incana* var. *americana*)
tussock sedge, non-tussock form of (*Carex stricta*)
violets (*Viola* spp.)
white turtlehead (*Chelone glabra*)

Seepage indicator species:

black ash (*Fraxinus nigra*)
common water pennywort (*Hydrocotyle americana*)
golden saxifrage (*Chrysosplenium americanum*)
lily-leaved twayblade (*Listera convallarioides*)*
marsh marigold (*Caltha palustris*)
northern spicebush (*Lindera benzoin*)
purple avens (*Geum rivale*)
swamp saxifrage (*Saxifraga pensylvanica*)

* rare species

Where Are They Found?

Mineral-enriched swamps are usually found in headwater portions of drainages and along the borders of larger swamp systems. They can be on sloping or level ground and occur where water below the surface is forced upward by an impervious bedrock or soil layer, such as hardpan or a layer of clay or silt.





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Types: Red maple/sensitive fern-tussock sedge basin/seepage swamp; Red maple-black ash/swamp saxifrage seepage swamp; Red maple/lake sedge streamside/seepage swamp; Swamp white oak basin swamp; Circumneutral/basic seepage swamp; Northern hardwood-black ash-conifer seepage swamp; Northern white cedar-balsam fir seepage swamp; Seasonally saturated northern white cedar seepage forest; Northern white cedar-hemlock-red maple swamp; Red spruce/cinnamon fern-three seeded sedge/Sphagnum swamp; and forest seeps.

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Communities: Floodplain forests along major and minor rivers; streamside swamps.

Conservation status: Large, undisturbed examples of mineral-enriched swamps are quite uncommon in New Hampshire. Several mineral-enriched swamp communities have been described but more field study is needed to discover and fully assess the composition and rarity of each type.

Conservation Considerations:

Mineral-enriched swamps are unusual forested wetlands that provide important plant and wildlife habitat for a diverse array of species. When undisturbed these wetlands also help to buffer surrounding lands from stormwater flooding as well as helping to maintain water quality.

Since groundwater temperatures are nearly constant, swamps with significant groundwater seepage tend to have a narrow range of water temperatures. This temperature moderation can keep portions of these wetlands from completely freezing over, thus providing a crucial source of water and food to many animals during the winter months.

Mineral-enriched swamps are not very resilient to human disturbance. Logging in or next to them increases light and nutrient levels, favoring more competitive species. It can also make canopy trees more vulnerable to windthrow. Any kind of physical disturbance to the soil in the wetland or along its upland edges can also allow the introduction of invasive non-native species. Changes to the wetland's hydrology, through damming, increased drainage, or increased inflow of nutrients and pollutants in upland runoff, are also damaging.

Narrow vegetated upland buffers are ineffective at removing certain pollutants such as salts and heavy metals, and still allow impacts from domestic animal predation or light pollution from nearby development. A *minimum* buffer of 100 feet is recommended, and wider buffers (e.g., 300 or more feet) would provide more effective protection.

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