



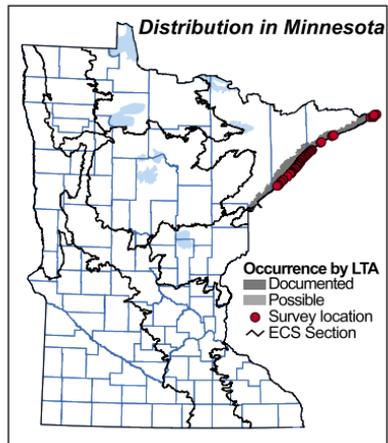
Lake Superior Cliff

Open plant communities on dry or, rarely, moist cliffs on the immediate shoreline of Lake Superior. Vascular plants are largely restricted to crevices and ledges.

Vegetation Structure & Composition

Description is based on summary of plant species lists and field notes from 82 cliffs.

- **Lichen, bryophyte, and algal cover** is high. Exposed bedrock on cliff face is dominated by lichens, with mosses, liverworts, and algae much less abundant except on cliffs sheltered from scouring by waves and ice (see CTu22c Sheltered Mafic Cliff below). Orange lichens (*Xanthoria* spp.) are often abundant.
- **Herbaceous plant cover** most often is very sparse and restricted to the uppermost crevices and ledges. CTu22 is characterized by several boreal and arctic or alpine species that in Minnesota are mostly restricted to the Lake Superior shoreline. These species include spike trisetum (*Trisetum spicatum*), Arabian whitlow grass (*Draba arabisans*), and Hudson Bay eyebright (*Euphrasia hudsoniana*). Herbaceous plants can be dense on sheltered cliffs.
- **Tree and shrub cover** on cliff face is absent or very sparse, although trees such as white cedar and heart-leaved birch at top of cliff may shade parts of the cliff face. Shrubby cinquefoil (*Potentilla fruticosa*) and ninebark (*Physocarpus opulifolius*) are often present on upper ledges; creeping juniper (*Juniperus horizontalis*) is present infrequently.



Landscape Setting & Soils

CTu22 is common along much of the Lake Superior shoreline, most frequently on basalt and rhyolite, and less frequently on anorthosite, diabase, andesite, granite, ferrodiorite, gabbro, and Rove Formation shale, siltstone, and graywacke. Cliff face is sometimes composed of multiple rock layers, especially from successive basalt flows. Veins of nutrient-rich calcite or other intrusive rock are also often present. True soil development is minimal, consisting of thin organic deposits from decomposing plant and animal remains, and is confined to crevices and ledges, which themselves are constantly eroded and periodically scoured by ice and waves. Cliffs sheltered from waves and ice have greater soil accumulation and much lower rates of erosion than typical occurrences of the community.

Natural History

Species in cliff communities are subjected to greater environmental extremes than species in surrounding terrestrial communities, including rapid fluctuations in substrate temperature, limited nutrient availability, and extreme stresses on plants growing outward from vertical surfaces. High desiccation rates because of low substrate moisture-holding capacity and exposure to strong winds are another major stress on cliff species, although desiccation is mitigated somewhat in CTu22 by the relatively cool and moist climate along Lake Superior. The absence of soil on much of the cliff limits opportunities for colonization by vascular plants, which are generally restricted to crevices or small patches of soil that have accumulated on ledges. Erosion triggered by repeated wave abrasion at the bases of cliffs is a major and ongoing event that can disrupt cliff communities along Lake Superior and set back succession. Compared to most inland cliff communities, CTu22 has a paucity of vascular plants, largely due to



relatively high rates of erosion on cliffs along Lake Superior and repeated scouring by ice and waves.

Similar Native Plant Community Classes

The upper portions of cliff faces are generally dry, regardless of aspect; the classification of any cliff should be based more on conditions on the lower two-thirds of the cliff face than on the upper third.

● **CTn11 Northern Dry Cliff**

CTn11 is similar to the most common types of CTu22, which occur on dry, south- to east-facing cliffs exposed to scouring by waves and ice (see CTu22a and CTu22b below). Both classes are dominated by lichens and appear barren, rarely having much if any tree or shrub cover and at most sparse herbaceous vascular plant and bryophyte cover.

► **CTn11**—More likely to have red pine, especially at top of cliff. Talus slope is usually present below cliff.

► **CTu22**—Characterized by species rarely present away from the immediate shore of Lake Superior, including Hudson Bay eyebright, spike trisetum, ninebark (*Physocarpus opulifolius*), and shrubby cinquefoil (*Potentilla fruticosa*). Talus slope is rarely present below cliff because of removal of talus by wave action.

● **CTn32 Northern Mesic Cliff**

CTn32 is similar to CTu22 in the rare instances where CTu22 is on shaded, north- to east-facing cliffs sheltered from scouring waves and ice (see CTu22c below.) By definition, however, all cliff communities along the immediate shore of Lake Superior are classified as CTu22.

► **CTn32**—Present on sites away from the shore of Lake Superior. More likely to have firmosses (*Huperzia* spp.). Lichens are important or dominant on rock surfaces; moss and algal mats are absent or poorly developed. Talus slope is usually present below cliff.

► **CTu22**—Present along the immediate shore of Lake Superior. More likely to have Hudson Bay eyebright, spike trisetum, ninebark, and shrubby cinquefoil, which are rarely present away from Lake Superior. Because of the cool, moist microclimate along Lake Superior, mosses and algae are abundant, typically forming thick mats. Talus slope is rarely present below cliff because of removal of talus by wave action.

● **CTn42 Northern Wet Cliff**

CTn42 occurs in cool, moist river gorges along the North Shore of Lake Superior and can be very similar to CTu22 when CTu22 is on shaded, north- to east-facing cliffs sheltered from scouring waves and ice (see CTu22c below). Both communities are characterized by moist, moss- and algae-covered cliff faces, both commonly support rare plants, and both usually do not have talus slopes below. Differentiating between the two is problematic mainly at the mouths of rivers that empty into Lake Superior. As a guideline in these situations, if the base of a cliff is in the lake or on the immediate shoreline, it is classified as CTu22; if the base of a cliff is inland along a stream or river, it is classified as CTn42.

► **CTn42**—Present in deep, narrow river gorges or other sites away from the immediate shore of Lake Superior.

► **CTu22**—Present along the immediate shore of Lake Superior. More likely to have Hudson Bay eyebright (*Euphrasia hudsoniana*), spike trisetum, ninebark, encrusted saxifrage (*Saxifraga aizoon*), and shrubby cinquefoil, which are rarely found away from the shore of Lake Superior.

Native Plant Community Types in Class

Plant species composition has not been systematically sampled across the range of CTu22, but evidence suggests that composition varies most strongly with exposure to scouring by waves and ice and secondarily to pH and nutrient availability. Therefore, the community types in CTu22 at present are based on degree of exposure to waves and ice, and on broad bedrock categories reflecting bedrock pH and nutrient properties.

● **CTu22a Exposed Mafic Cliff (Lake Superior)**

Open communities on dry, circumneutral to moderately alkaline cliffs composed of basalt, andesite, diabase, or anorthosite. CTu22a is exposed to scouring by waves and ice, which keeps the cliff face largely free of vascular plants, with crustose lichens often the only vegetation present. Orange lichens (*Xanthoria* spp.) are abundant. Shrubby cinquefoil is often present on upper ledges of the highest cliffs. CTu22a is the most



common cliff type along Lake Superior in Minnesota.

● **CTu22b Exposed Felsic Cliff (Lake Superior)**

Open communities on dry, weakly to moderately acidic cliffs composed of rhyolite, granite, or granophyre. CTu22b is exposed to scouring by waves and ice, which keeps the cliff face largely free of vascular plants, with crustose lichens often the only vegetation present. CTu22b is occasional along the North Shore of Lake Superior.

● **CTu22c Sheltered Mafic Cliff (Lake Superior)**

Open communities on moist, circumneutral to moderately alkaline cliffs composed of basalt or ferrodiorite on sites protected from wave- and ice-scouring by small, near-shore islands or bedrock points. Unlike CTu22a and CTu22b, which are largely devoid of vascular plants, CTu22c is covered by lush growth of mosses and vascular plants, which root in thick mossy mats as well as in crevices and on ledges, and almost invariably contains arctic-alpine or boreal plant species, including encrusted saxifrage, butterwort (*Pinguicula vulgaris*), birds-eye primrose (*Primula mistassinica*), and intermediate sedge (*Carex media*). CTu22c has been documented at less than a dozen sites in Minnesota.



photo by W.R. Smith MN DNR

Butterwort (*Pinguicula vulgaris*)