

SURVEY FOR BOTRYCHIUM MORMO AND OTHER RARE PLANTS ON SPIRIT MOUNTAIN

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INTRODUCTION

This is a report of the findings made during a rare plant survey of a proposed golf course site on Spirit Mountain in Duluth, Minnesota in July and August 2001. One Minnesota state-listed Special Concern Status species (Torrey's Manna Grass) was found, populations of two state-listed Special Concern Status species (Moschatel and Clustered Bur-reed) found during a survey in 1998 were relocated, a new site for Clustered Bur-reed was found, and additional populations of a state-listed Tracked species (White Baneberry) were found. No populations of a state-listed Endangered Status species (Pale Sedge) were found on the proposed project site and no new ones were found near it. No *Botrychium* ferns with state-listing or of conservation concern found.

PURPOSE AND SCOPE OF RARE PLANT SURVEY

The purpose of the survey was to locate populations of three Minnesota state-listed *Botrychium* fern species believed present and a state-listed species of sedge (*Carex*) recently found in the area. These species are:

- 1) Goblin Fern (*Botrychium mormo*, Special Concern Status)
- 2) Triangle-leaved Moonwort (*B. lanceolatum*, Threatened Status)
- 3) Blunt-lobed Grapefern (*B. oneidense*, Threatened Status)
- 4) Pale Sedge (*Carex pallescens*, Endangered Status)

BACKGROUND LEADING TO THIS NEW SURVEY

A proposed golf course on Spirit Mountain will, if constructed, impact the structure and natural functioning of an old-growth sugar maple/basswood forest (also known as the northern hardwoods association) as well as various types of forested and non-forested wetlands and the plant and animal species that use these natural communities. A rare plant survey was conducted by me (for the developer) on Spirit Mountain in 1998. Its scope was limited to three state-listed species:

- 1) Canada Hemlock (*Tsuga canadensis*, Special Concern Status),
- 2) Carolina Spring Beauty (*Claytonia caroliniana*, Special Concern Status)
- 3) Moschatel (*Adoxa moschatellina*, Special Concern Status)

These species, and no others, were targeted for surveys in 1998 by the Minnesota Department of Natural Resources Natural Heritage Program (MDNR-NHP). MDNR-NHP chose these species because they were historically known from similar habitat in sugar maple/basswood forests nearby. MDNR-NHP recommended looking for these species in the spring season. It surprised me that the MDNR-NHP did not recommend additional rare plant surveys be conducted throughout the summer for other species such as various types of *Botrychium* ferns. Old-growth sugar maple/basswood forest has been known for some time as suitable habitat for certain rare *Botrychium*. Anticipating the need for a summer survey, I prepared and submitted to the developer's environmental consultant a proposal to search for Goblin Fern (*Botrychium mormo*). Goblin Fern, a Minnesota Special Concern species, grows exclusively in mature and old growth sugar maple/basswood forest habitats. It is most likely to be found from late July to early September.

In the proposal I submitted to the developer's environmental consultant for a spring survey, I indicated that other rare species besides the three suggested the MDNR-NHP might be present. I did not specify which species these were. The spring survey was completed on schedule during late May and early June in 1998, but my summer survey proposal was never accepted. In 1999 when I was asked by a consultant hired by the developer to give an opinion

on logging of Spirit Mountain in preparation for golf course construction, my concerns for additional rare species surveys were brought up again.

The 1998 spring survey located populations of two of the MDNR-NHP's targeted species and populations of two others also considered rare or uncommon in Minnesota. One of these species, Carolina Spring Beauty, covers acres of the forest at Spirit Mountain and may be one of the largest populations anywhere in the state. The other species are more sporadic in their occurrences. The rare species found in 1998 are:

- 1) Carolina Spring Beauty (*Claytonia caroliniana*, Special Concern Status)
- 2) Moschatel (*Adoxa moschatellina*, Special Concern Status)
- 3) Clustered Bur-reed (*Sparganium glomeratum*, Special Concern Status)
- 4) White Baneberry (*Actaea pachypoda*, Tracked Species)

Clustered Bur-reed and White Baneberry were not on the MDNR-NHP's target list although it seems that at least White Baneberry should have been. Clustered Bur-reed is an aquatic plant that is most easily identified in mid-summer after it has set fruit. My identifications were based on fragments of fruiting clusters found floating in shallow ephemeral pools during the spring survey. In one case, I based my identification on sterile shoots and appropriate habitat. As a side note, I should add here that all of the Clustered Bur-reed identifications were confirmed in 2001 when I found mature plants at these same sites in late July while searching for Goblin Fern.

WHY GOBLIN FERN IS TO BE EXPECTED AT SPIRIT MOUNTAIN

Botrychium mormo Wagner, Jr. (Goblin Fern, listed as a "Special Concern" species in Minnesota) is a small (4 inches tall maximum, usually around 1.5 inches), fleshy fern in the moonwort subgenus of the genus *Botrychium* (Grapeferns), Family Ophioglossaceae (Adder's Tongue Ferns). There are at least 13 different species of moonwort ferns known from the Great Lakes Region. Nationwide about 20 or so species have been described. Several moonwort species are rare endemics known from only a few places although a few are widely distributed. For some species, habitat requirements appear to be broad. For example, the Daisy-leaf Moonwort (*B. matricariifolium*) may be found in a variety of disparate habitats such as grassy meadows and cool shaded forests or even gravel along railroad grades. Others are more limited and appear to need specific soil, light, and moisture conditions. Goblin Fern is one of the rare endemic moonworts with very strict habitat requirements. With approximately 60-70 known populations it is sparsely distributed across northern Michigan, Wisconsin, and Minnesota. It is not known from anywhere else other than these three states. Goblin Fern has been found exclusively in rich, moist soil of mature and old growth sugar maple/basswood forests. When it has been found on unforested sites it turns out that these sites had been recently logged and that the population extended into uncut forest. Mature and old growth sugar maple/basswood forests exist on Spirit Mountain in Duluth, Minnesota, including the areas where the proposed golf course is being sited. Given habitat and several other factors it is entirely possible that Goblin Fern occurs on Spirit Mountain.

Habitat at Spirit Mountain is similar to habitat in places where Goblin Fern has been found before. These sites are upland with thick leaf litter and an open forest floor. The dominant tree species is sugar maple with some basswood. Red oak, yellow and paper birch, and quaking aspen are also reported as important forest components. Herbaceous species are also similar to those on Spirit Mountain and include Spring Beauty (*Claytonia caroliniana*), Bloodroot (*Sanguinaria canadensis*), Bellwort (*Uvularia grandiflora*), Rattlesnake Fern (*Botrychium virginianum*), Starflower (*Trientalis borealis*), Blue Cohosh (*Caulophyllum thalictroides*), Baneberry (*Actaea pachypoda*), Trillium (*Trillium grandiflorum*), and seedlings of sugar maple. In fact, most of the associated species found with Spring Beauty on Spirit Mountain during the 1998 rare plant spring survey are the same as those found with Goblin Fern at sites in Michigan, Minnesota, and Wisconsin.

Spirit Mountain is situated between known populations of Goblin Fern in Minnesota and Wisconsin. There is a rich Goblin Fern population center in the Chippewa National Forest. The predominant forest type is sugar maple with basswood, aspen, and birch. In Crandon, Wisconsin, it occurs in habitat similar to that found in the Chippewa

National Forest. The one known St. Louis County, Minnesota, site is also an upland sugar maple forest. Several populations have been found in upland sugar maple forests in Aitkin County near the town of McGregor, Minnesota.

Weather conditions from 1997 to 1999 may not have been ideal for Goblin Fern. Low rainfall seems to inhibit the fern from sending up shoots. To complicate matters, growth patterns of Goblin Fern are extremely erratic. It may appear in abundance at a particular site one year and seem to be completely absent the following year. This makes the chances of missing this plant during a one-time-only survey very good. Repeated surveys over two or more years are needed to properly document its presence or absence. In 2000 and 2001 rainfall had begun to approach normal levels so it appeared searches for Goblin Fern on Spirit Mountain might be successful.

OTHER RARE PLANT SPECIES SUSPECTED AT SPIRIT MOUNTAIN

Recent (late summer of 1998 to mid-summer of 2001) discoveries in the Duluth area of several other rare species of *Botrychium* ferns include three species that could occur on Spirit Mountain. Mingan Moonwort (*B. minganense*, Special Concern Status) was found in Morgan Park in Duluth under quaking aspen trees in late June of 1998 and 1999. This population is just a few miles from Spirit Mountain. Triangle Moonwort (*B. lanceolatum*, Threatened Status) was found by Amity Creek in East Duluth under mature sugar maple and quaking aspen in 1998, also in late June. Both of these moonwort ferns might occur on Spirit Mountain. Blunt-lobed Grapefern (*B. oneidense*, Threatened Status) has been recently found in Jay Cooke State Park in adjoining Carlton County. Plants resembling *B. oneidense* were found in a green ash swamp on Minnesota Point in September 1998. In 2001, the rare Pale Sedge (*Carex pallescens*, Endangered Status) was found at three different locations on Spirit Mountain near the site of the proposed golf course and it was added to the new target list.

RESULTS OF THE 2001 RARE PLANT SURVEY

Using volunteers, about 80 in all, over a 5-day period all proposed golf links Spirit Mountain east of Russell Road were surveyed. The survey dates were July 27, 28, 29, and 30 and August 3, and 4. Populations of Clustered Bur-reed and Moschatel found in 1998 were relocated. Several additional populations of White Baneberry were found. Also found is what appears to be a hybrid between Red Baneberry (*Actaea rubra*) and White Baneberry. A new population of Clustered Bur-reed was found in a marshy wetland near proposed link 18. A listed species of grass (Pale Manna Grass, *Torreyochloa pallida*, Special Concern Status) was found at two previously documented Clustered Bur-reed sites. Pale Manna Grass is a very delicate plant and would be impossible to identify any earlier than late July. Unlike Clustered Bur-reed, which produces a hard nut-like fruit that can survive intact through the winter, Pale Manna Grass quickly deteriorates in the fall. In the spring before it flowers it can easily be overlooked, as it resembles any number of fine-leaved aquatic grasses such as *Poa palustris* or *Glyceria striata*. No new populations of Moschatel were found. Pale Sedge was not found in any areas that would be directly affected by the proposed golf course although one population was within the forest on Spirit Mountain. No populations of any listed *Botrychium* ferns were found, including the three species on the target list were found. In addition, the species checklist from the 1998 survey was increased by 36 species for a total of 151 plant species.

Pale Manna Grass Sites (both were found at previously known sites of Clustered Bur-reed)

N 46 Deg. 42.659 Minutes

W 92 Deg. 14.031 Minutes

In an ephemeral pool with Clustered Bur-reed, *Sium suave*, *Bidens* sp., *Carex tuckermanii*. Found on July 29, 2001.

N 46 Deg. 43.838 Minutes

W 92 Deg. 13.848 Minutes

In an ephemeral pool with Clustered Bur-reed. Found on July 29, 2001

New Clustered Bur-reed Site

N 46 Deg. 43.176 Minutes

W 92 Deg. 14.106 Minutes

About 15 fruiting stems and numerous sterile stems in marshy area, full sun to part shade, growing in shallow channels with mucky soil. Associates include *Eleocharis smallii*, *Scirpus* sp., *Bidens frondosa*, *Carex retrorsa*. Found on July 30, 2001.

CONCLUSIONS

Moisture and rainfall in the early part of the 2001 summer season seemed promising for the growth of Goblin Fern and other *Botrychium* species. However, a prolonged dry period with high temperatures beginning in late June and lasting until August quickly evaporated much of the soil moisture. If Goblin Fern is present on Spirit Mountain, 2001 was not the best year to conduct a survey for it. Ideally, any rare plant survey should cover more than one growing season especially when searching for small plants with very strict soil and moisture needs. Given the tremendous changes to the forest's ecosystem following any large-scale human caused disturbance on Spirit Mountain it would seem prudent to do a complete and exhaustive biotic inventory before any construction activities are undertaken.

GENERAL SPECIES CHECKLIST

Below is a list of all species identified during the 1998 spring survey plus additions made during the 2001 survey (indicated by *) bringing the current total to 151 species. This list is not a complete or exhaustive inventory of the plant species that occur at Spirit Mountain. Plants are divided by major groups and listed alphabetically by scientific name with common names for convenience.

FERNS AND FERN ALLIES

Athyrium angustum- Lady's Fern
Botrychium virginianum- Rattlesnake Fern
Dryopteris carthusiana- Shield Fern
Dryopteris intermedia- Shield Fern
Equisetum arvense- Field Horsetail
Equisetum arvense forma *campestre*-
A Variation of Field Horsetail
Equisetum pratense- Meadow Horsetail
Equisetum sylvaticum- Woodland Horsetail

Gymnocarpum dryopteris- Oakleaf Fern
Lycopodium annotinum-Bristly Clubmoss*
Lycopodium clavatum- Running Clubmoss
Lycopodium dendroideum- Clubmoss
Matteuccia struthiopteris- Ostrich Fern
Onoclea sensibilis- Sensitive Fern
Osmunda cinnamomea- Cinnamon Fern
Osmunda claytoniana- Interrupted Fern
Thelypteris phegopteris- Beech Fern

CONIFERS

Abies balsamea- Balsam Fir
Larix laricina- Tamarack
Picea glauca-White Spruce

P. mariana- Black Spruce*
Pinus strobus- White Pine
Thuja occidentalis- White Cedar

MONOCOTS

Allium tricoccum- Wild Leek
Arisaema triphyllum- Jack-in-the-Pulpit
Brachyelytrum erectum- Shorthusk Grass*
Bromus ciliatus- Fringed Brome Grass*
Calamagrostis canadensis- Bluejoint Grass
Calla palustris- Water Arum
Carex assiniboinensis- Sedge
Carex communis-Sedge
Carex crinita- Comb Sedge*
Carex diandra- Sedge
Carex disperma- Two-seeded Sedge
Carex gracillima- Sedge*
Carex leptalea- Sedge*
Carex leptonevia- Sedge
Carex pallescens- Pale Sedge*
Carex pedunculata- Sedge
Carex projecta- Pointed Sedge*
Carex retrorsa- Sedge*
Carex rosea- Sedge*
Carex stipata- Sedge*
Carex tuckermanii- Sedge*
Cinna latifolia- Woodreed Grass
Clintonia borealis- Bluebead Lily
Eleocharis smallii- Spikerush*

Glyceria grandis- Manna Grass
Glyceria striata- Manna Grass
Hierchloe odorata- Sweet Grass
Iris versicolor- Wild Iris
Lemna minor- Duckweed
Maianthemum canadense- Canada Mayflower
Milium effusum- Woodreed*
Oryzopsis asperifolia- Rough-leaved Rice Grass*
Phleum pratense- Timothy Grass*
Platanthera lacera- Fringed Orchid*
Polygonatum pubescens- Solomon's Seal
Scirpus cyperinus- Woolrush
Scirpus rubrotinctus- Red-stemmed Rush*
Scirpus sp.- Rush*
Smilacina racemosa- Solomon's Seal
Sparganium glomeratum- Clustered Burreed
Streptopus roseus- Twisted Stalk
Trillium cernuum- Nodding Trillium
Trillium grandiflorum- Giant Trillium
Torreyochloa pallida- Pale Manna Grass*
Typha latifolia- Cattail
Uvularia grandiflora- Yellow Bellwort
Uvularia sessilifolia- White Bellwort

DICOTS

Acer rubrum- Red Maple
Acer saccharum Sugar Maple
Acer spicatum- Mountain Maple
Actaea pachypoda- White Baneberry
Actaea rubra- Red Baneberry
Adoxa moschatellina- Moschatel
Alnus incana- Tag Alder
Amelanchier spp.- Juneberries
Anemone quinquefolia- Wood Anemone
Apocynum androsaemifolium- Dogbane
Aralia nudicaulis- Sarsaparilla
Asarum canadense- Wild Ginger
Aster lateriflorus- Calico Aster*
Aster macrophyllus- Bigleaf Aster
Aster puniceus- Rough-stemmed Aster
Aster umbellatus- Flat-top Aster
Betula lutea- Yellow Birch
Betula papyrifera- Paper Birch
Bidens frondosa- Beggar's Ticks*
Bidens sp.- Beggar's Ticks
Caltha palustris- Marsh Marigold
Cardamine laciniata- Toothwort
Caulophyllum thalictroides- Blue Cohosh
Chrysosplenium americanum- Golden Saxifrage
Circea alpina- Enchanter's Nightshade*
Claytonia caroliniana- Carolina Spring Beauty
Cornus alternifolia- Pagoda Dogwood
Cornus canadensis- Bunchberry
Corylus cornuta- Hazelnut
Dicentra cucullaria- Dutchman's Breeches
Diervilla lonicera- Yellow Jessamine
Epilobium coloratum- Willow Herb
Fragaria virginiana- Strawberry
Fraxinus nigra- Black Ash
Galeopsis tetrahit- Horse Nettle*
Galium asprellum- Woodruff*
Galium triflorum- Woodruff*
Geum canadense- White Avens*
Hieracium aurantiacum- Hawkweed
Impatiens capensis- Touch-me-not
Hepatica triloba- Hepatica
Lactuca biennis- Wild Lettuce*
Laportea canadense- Nettle*
Lonicera canadensis- Honeysuckle
Lonicera hirsuta- Honeysuckle*
Mentha arvensis- Field Mint
Mertensia paniculata- Bluebells
Mitella nuda- Bishop's Cap
Monotropa uniflora- Ghost Pipes
Ostrya virginiana- Hornbeam
Panax trifolium- Three-leaved Ginseng
Populus balsamifera- Balsam Poplar
Populus grandidentata- Bigtooth Aspen*
Populus tremuloides- Quaking Aspen
Prenthes alba- Rattlesnake Lettuce*
Prunus virginiana- Chokecherry
Pyrola asarifolia- Pink-flowered Shinleaf
Pyrola elliptica- Shinleaf
Quercus rubra- Red Oak
Ranunculus acris- Buttercup*
Ranunculus abortivus- Buttercup
Ranunculus hispidus- Buttercup*
Ribes cynosbati- Gooseberry
Ribes hirtellum- Gooseberry
Ribes triste- Currant
Rubus parviflorus- Thimbleberry
Rubus pubescens- Dewberry
Rubus strigosus- Raspberry
Trientalis borealis- Starflower
Sambucus pubens- Red Elderberry
Sanguinaria canadense- Bloodroot
Saxifraga pensylvanica- Swamp Saxifrage
Sium suave- Cow Parsnip
Solidago flexicaulis- Zigzag Goldenrod
Taraxacum officinale- Dandelion
Tilia americana- American Basswood
Vaccinium sp.- Blueberry*
Viola cucullata- Blue Swamp Violet
Viola incognita- White Violet
Viola novae-angliae- New England Violet
Viola pubescens- Yellow Violet