CN 132

REGIONAL COPPER-NICKEL STUDY

RARE PLANTS

Minnesota Environmental Quality Board

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July 18,1978

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Abstract

Rare species are those whose ability to perpetuate themselves is in jeopardy either because of small population size, human exploitation, limited habitat, habitat destruction, or other reasons. Even when species are abundant in some geographic areas, loss of isolated and outlying populations reduces the genetic variability of the species.

Legislation affecting rare plant species is relatively recent and is mainly aimed at the prevention of exploitation of the species itself. Measures aimed at the protection of individual species need to be strengthened by legislation that also protects their habitat.

No exhaustive field inventory of rare plant species in the RCNSA was attempted. Regional Copper Nickel Study field records of rare and protected plants are those encountered during the course of collecting vegetation data. These records were augmented by a review of all previous stations (collection sites) on record at the University of Minnesota herbarium. This review covered all species in Lake and St. Louis Counties recommended by the Smithsonian Institution (1975) for national listing as threatened or endangered species, recognized as rare in Minnesota (Morley, 1972) or protected by Minnesota Statute 17.23. Maps and lists of all previous locations in Lake and St. Louis Counties are provided in the figures and Appendices to this report.

RARE PLANTS

Introduction

I. Reasons for documenting the presence of rare plants

Rare plant species are often found together in the same area. Traditionally botanists have explained such joint occurrences on an historical basis (Fernald, 1925). More current literature suggests that it is more likely that such locations are places where rare species are less subject to competition from more aggressive plants (Griggs, 1940; Stebbins, 1942; Drury, 1974). It is suggested that rare plants are more homogeneous genetically, but are adapted to survive in areas unfavorable to more heterogeneous species. The presence of one or more rare species in a locality may recommend it for preservation from further habitat modification. Stations of several rare species are good candidates for designated natural areas.

It is an advantage to the scientific community to have documentation of all stations (locations) where rare plants are found. Records are customarily kept in the form of herbarium specimens, and these records are used to compile range maps and floras. Specific locations of isolated populations of rarer plants may become increasingly important in the future if breeding programs for rare species become more widely accepted. Although the Smithsonian Institution (1975) recommends preservation of separate populations in their natural habitats, it appears that another

sound procedure for maintaining the genetic variability of a rare species may be transplantation and cross-breeding of individuals from widely separated populations (Drury, 1974). Although federal protection does not include species that are rare in one state and common elsewhere, preservation of isolated or marginal populations of non-endangered species is important if their full range of genetic variability is to be preserved.

II. Concepts of rareness

From a purely biological standpoint a rare species is one whose ability to perpetuate itself is jeopardized. This ability may or may not correspond to apparent population size or the distribution of localities in which it grows (Griggs, 1940; Drury, 1974). From an empirical standpoint, not enough is known about the life history of plants to allow judgments about their fitness when their populations appear small, scattered, or local. For this reason distribution information is more commonly used to compile lists of rare plants. In a paper proposing criteria for selection of "rare" species DuMond (1973) suggests the inclusion of disjunctions, range extensions, indicators of restricted habitats, species occurring out of their normal phytosociological context, and "relict" species.

Inventories of rare plants have been compiled for at least thirty states (Smithsonian Institution, 1975). Such lists are usually compiled from herbarium records and submitted to botanists within the state for review. Criteria for inclusion on such lists vary

from state to state. The Wisconsin list (Read, 1976) of 269 vascular plant species requires that a plant be native and recorded from three or less stations (localities) within the state. This report includes discussions of range extensions, phytosociological affinities, endemism, and disjunct patterns. The list published by the Minnesota Department of Natural Resources (MDNR) (1975) includes only one endangered plant, the Minnesota Trout Lily (Erythronium propullans). "Endangered" species are defined as "Those in danger of extinction in Minnesota in the immediate future." Only seven other plants are listed as "species of special interest" and the MDNR report does not explain the criteria by which they were chosen. A more comprehensive list of 256 vascular plants represented by four or fewer collections in the University of Minnesota herbarium was compiled by Dr. Thomas Morley in 1972.

Such state lists are used as an aid in compiling federal and international lists, but plants rare in one political subdivision and common in others are excluded. It is probable that the finalized federal list and international Red Book inventory will be comprised mainly of isolated endemic species with small populations and species subject to heavy commercial exploitation.

III. Legislation affecting rare plants

A. Federal protection

The Endangered Species Act of 1973 (P.L. 93-205) was the first federal legislation to afford protection to plants as well as animals. The law provided a mechanism for the definition and

listing of rare plants (see Figure 1). The Smithsonian Institution was requested to prepare a report suggesting candidate species for listing as rare plants and recommending procedures for the protection of such species.

This law is currently due for reauthorization in Congress. The Culver Amendment, without which it probably cannot be reauthorized, provides for a 7-member committee to review cases in which there is an irresolvable conflict between a project that would destroy a species and the Fish and Wildlife Service, which administers the act. Five of the seven members (Secretaries of the Interior, Agriculture, the Army, and Transportation, heads of the Smithsonian Institution, CEQ and EPA) must vote to exempt a project affecting a listed species. Reauthorization will probably be granted with this amendment by midsummer, 1978.

The Report on Endangered and Threatened Plant Species of the United States was issued by the Smithsonian Institution in 1975 in accordance with the 1973 Endangered Species Act (P.L. 93-205). This report defines three categories of plants:

> Endangered species are "those species of plants that are in danger of extinction throughout all or a significant portion of their ranges. Existence may be endangered because of destruction, drastic modification,

or severe curtailment of habitat, or because of over-exploitation, disease, predation, or even unknown reasons. Plant taxa from very limited areas (e.g., the type localities only, or from restricted fragile habitats) usually are considered endangered."

Threatened species are "those species of plants that are likely to become endangered within the foreseeable future throughout all or a significant portion of their ranges. This includes species categorized as rare, very rare, or depleted."

"A rare species is one that has a small population in its range. It may be found in a restricted geographic region, or it may occur sparsely over a wider area." (Smithsonian Institution, 1975)

The report also gives a state-by-state listing of species and includes a set of recommendations for the implementation of their protection. Minnesota plants recommended by the Smithsonian report are listed in Appendix II. The Smithsonian recommendations place an emphasis on habitat identification and preservation, public education, and addition of listed plants to those already protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (F.R., February 22, 1977). Species recommended by the Smithsonian report are subjected to the review procedure outlined in

Figure 1. Because of this lengthy review procedure, none of the Minnesota species recommended by the Smithsonian report is presently protected by the Endangered Species Act of 1973. Four species are currently recommended by the Department of Fish and Wildlife (see Appendix III). One of these, Plantago cordata, is not represented by any herbarium collections and is not on any other statewide list of rare plants, but has been reported from a station near Big Stone Lake.

Once a species has been included on the federal list its protection is administered by the Department of Fish and Wildlife Service. Protected species are assured habitat protection on all federal lands and on those private lands subject to cooperative agreements with federal agencies, but not on other private lands. It is protected from commercial exploitation on federal lands, but the "taking" by private individuals on private lands is not prohibited. (Zeedyk, Farmer, McBride, and Baker, 1978)

The International Convention on International Trade in Endangered Species of Wild Fauna and Flora of March 3, 1973 protects all members of the orchid family (Orchidaceae), the cactus family (Cactaceae) and the ginseng plant (Panax quinquefolius) from commercial exploitation (F.R., February 11, 1977). This act does not prevent domestic digging or picking but requires permits for export from member nations. Interstate commerce is regulated by Fish and Wildlife Service regulations effective July 25, 1977 (F.R., June 24, 1977).

B. State protection

Minnesota Statute 17.23 prohibits the buying and selling of all members of the orchid family (Orchidaceae), lilies (Lilium), trailing arbutus (Epigaea repens), gentians (Gentianaceae), trilliums (Trillium), and lotus (Nelumbo lutea). The act is administered by the Commissioner of the Minnesota Department of Agriculture and permits may be granted by his office. Although the wording of the statute is abstruse and would appear to prohibit only commercial exploitation, (Peder Hong, Attorney General's Office, assigned to the Department of Agriculture, personal communication), the Department of Agriculture interprets the law to include the picking or digging of protected plants (Robert Flaskerd, Department of Agriculture, personal communication).

IV. Rare plants in the study area

A. Overview

None of the species listed in the Smithsonian Report or proposed for listing by the U.S. Fish and Wildlife Service is known to exist within the Regional Copper-Nickel Study Area (RCNSA). Five of the Smithsonian candidate species have stations in northeastern Minnesota (see Appendix II). These species are mapped (Figures 2-4) and discussed in this report because "critical habitat" of protected species is defined by the U.S. Fish and Wildlife Service on a broad regional basis. "Critical habitat" is not defined until a species is listed for protection. It is likely that parts of the study area might be considered as "critical habitat" if Cypripedium arietinum,

Woodsia abbeae or Polemonium occidentale were listed for protection under the Endangered Species Act (P.L. 93-205). If the area is designated as critical habitat the Forest Service would be required to locate all stations of the species in question on its lands and to manage those lands in ways compatible with the preservation of the actual habitat of the plant. It would appear that exchanges of federal land with mining companies would be subject to review by the U.S. Fish and Wildlife Service, and, if denied, by the Secretary of the Interior.

Within the RCNSA there is a good representation of plants protected by Minnesota Statute 17.23. Although the statute includes listed species on all public lands, including federal lands, it makes no provision for habitat protection. It does not appear that this law is strong enough to have any direct bearing on the management practices of federal and state agencies in the RCNSA.

B. Methods used in documentation of occurrences of rare plants

1. Field methods

No extensive field inventory of rare plants was conducted as part of the Regional Copper Nickel Study. Documentation of stations for all species except orchids is derived from species lists compiled for a series of 277 Braun-Blanquet relevés. In addition to these relevé data, stations for orchids are augmented by records from field check sites used in preparation of a logging history map for the

Minesite (1975) resource inventory and from all observations of orchids reported by Regional Copper Nicekl Study personnel during the 1976 and 1977 field seasons.

Appendix I includes all species listed by Morley (1972) as rare for Minnesota and present in Lake, St. Louis or Cook Counties. Throughout the study Copper-Nickel botanists were aware of the rare status of the following species on Morley's (1972) list: Cypripedium arietinum, Selaginella selaginoides, Tsuga canadensis, Empetrum nigrum, Vaccinium uliginosum, Rubus chamaemorus, Waldsteinia fragarioides, Galium verum, Osmorhiza obtusa, and Polemonium occidentale. None of these plants were observed in the study area either as chance observations or during data collection.

Rare lichens were determined by generating a list of species with 2 or less collections within 64 stands sampled in 1977 for lichens by Dr. Clifford Wetmore, University of Minnesota, Department of Botany, for the RCNS.

Rare mosses were designated by Dr. Howard Crum at the University of Michigan, from the list of 107 moss species collected in 22 study plots sampled in 1976, by Rae Barclay for the RCNS.

2. Herbarium records

Previous stations of higher plants were compiled from records at the University of Minnesota herbarium, from locations shown on range maps compiled by Lakela (1965) and from original data of studies by Ohmann and Ream (1971), Dean (1971), Grigal (1969), Noble et al. (1972), Jones (1974) and Midwest Research Institute (1971), as well as personal communications from botanists familiar with the area. The source of each previous location can be determined by consulting Appendix IV, a complete list of all previous stations in Lake, Cook, and St. Louis Counties annotated with the source of information for each site.

Maps of previous stations within the RCNSA (Figures 2-38) were prepared for each rare, protected, or uncommon species based on the same records used to compile the list of locations (Appendix IV). Previously recorded stations are designated on this series of maps by closed circles, stations located by the RCNS are designated by open squares. New records from relevés conducted by Cushing et al. (1972) and used by the RCNS are designated by open triangles. Re-collections at old stations are accommodated by combining symbols. Stations of nationally recognized rare plant species are mapped on a separate map of the three county area. The proportion of all Minnesota collections occurring in Lake and St. Louis Counties is presented as a fraction following the counties in Appendix I.

Several sites have been stations for collection of more than one rare or protected species. Some of these multiple collections are early records and the herbarium labels are not very specific, as in the case of plants collected at "Vermilion Lake" by the Minnesota Geological and Natural History Survey before the turn of the century. Other stations with multiple collections that probably are an artifact of insufficient labeling are "Basswood Lake," "Burntside Lake," "Seagull Lake," "South Kawishiwi River" and "North Kawishiwi River." Multiple collections at South Fowl Lake and North Fowl Lake along the Canadian border are the result of expeditions by Butters and Abbé in the early part of this century. Herbarium labels from these collections are specific. It appears that these two lakes and the area around Mount Josephine and Pigeon Point have historically been the best collecting stations for rare plants in the Arrowhead Region. Stations with multiple collections of protected species (mainly orchids) that result mainly from work by Lakela are: "Sturgeon Lake," "Namakan Lake at the Narrows," "Vermilion Lake-Trout Lake Portage," "Highway 53 at Kebetogama Road," "Ash River Junction at Highway 53," "16 miles north of Duluth in Normanna Township," "6 miles south of Biwabik" and "Sturgeon Lake Observation Tower." A list of sites with multiple collections of rare and protected plants and the number of species collected is presented in Appendix V.

C. Relationships of rare and protected plants to habitat types

1. Higher plants - rare and protected species

A total of seventy-four occurrences of 22 rare, protected, and uncommon higher plant species is included in the RCNS relevé data. To assess the importance of each habitat type, both for individual species and for the group as a whole, a table was constructed showing the stands in which each species occurred (Appendix VI). The percentage of all species occurrences falling within each habitat type was used to rank the habitats from those containing the most rare and protected species to those with the least:

Habitat	Name	Percent of Rare Species
VI	aspen-birch	16.5%
III	jack pine	14.9%
II	mixed spruce-jack pine	13.5%
IA	black spruce bogs	10.8%
IV	red pine	9.4%
VII	mixed deciduous-coniferous	9.4%
IB	tamarack	8.2%
IC	cedar	6.8%
IX	white spruce	5.4%
V	ash	2.7%
VIIIA	shrub carr	1.4%

Such a system of ordering the habitats overemphasizes the habitats in which the four most common protected species

occur. There is a significant relationship between Corallorhiza maculata and all pine stands (x^2=9.0) and between this species and red pine stands in particular (x^2=14.1). The occurrence of Cypripedium acaule is significantly related to the mixed spruce-jack pine type (x^2=15.8). Although there are twelve stands containing Goodyera repens, it is not significantly related to either of the habitats in which it is most frequent (black spruce and jack pine). Trillium cernuum appears to be restricted to non-coniferous cover types, but is not significantly related to the aspen-birch cover types (in which it occurs most frequently). It is present in both ash stands subject to annual flooding and those occurring in sheltered draws. Habenaria hyperborea is restricted to wetlands and is significantly related to both black spruce (x^2=5.3) and cedar (x^2=11.0) habitats.

Since some habitats were severely undersampled and still show fairly high percentages of rare species, a synthetic index was created by dividing the percent of all rare species occurrences within a habitat type by the percent of all samples falling into that type. This new index is strongly dependent on sample size, as can be seen from the values for white cedar and white spruce habitats in the resultant ranking:

Habitat Type	Name	Index	Sample Size
IX	white spruce	13.5	3
IC	cedar	6.18	3
IB	tamarack	2.28	10
II	mixed black spruce-jack pine	1.88	20
III	jack pine	1.33	31
IV	red pine	1.24	21
VI	aspen birch	1.79	57
V	ash	.69	11
IA	black spruce	.56	53
VII	mixed coniferous-deciduous	.49	53
VIIIA	alder and shrub carr	.30	13

The high values for cedar and tamarack reflect the overall importance of coniferous wetlands for rare, protected and uncommon species. If Corallorhiza spp., Cypripedium, and Goodyera repens are excluded, there is a significant relationship (x^2=10.4) between orchids and wetland coniferous habitats.

Gentiana spp., also protected by Minnesota Statute 17.23, appear to prefer damp habitats. No members of this genus were recorded within the relevé plots, but Gentiana rubricaulis occurred in damp roadside ditches adjacent to plots G06 and G31 and was observed in other damp ditches throughout the study area.

V. Distribution and natural history of selected species

Of the Minnesota species suggested by the Smithsonian Report for listing as "rare" plants, five occur in the northeastern part of the state. The reported ranges and habitat preferences of these species are discussed here to shed some light on the probability of their occurrence within the RCNSA.

Listera auriculata is the most likely to be present within the study area. Case (1964) reports that it prefers "raw alluvial sand along rivers." Its Wisconsin stations are all on the south shore of Lake Superior (Read, 1976). Two of its three Minnesota collections along Lake Superior were made on stream banks. One of these banks was mossy and wooded. It would appear that the banks of the Stony River would be the most likely habitat in the RCNSA.

Both rare ferns listed for Minnesota (Appendix II) are infertile hybrids and have been collected mainly in areas of great microrelief where both parent species are present.

Woodsia abbeae is a hybrid between Woodsia ilvensis, which occurs fairly frequently in the RCNSA, and Woodsia scopulina which is restricted to calcareous ledges along the North Shore (9 stations). Its Wisconsin distribution is limited to Pattison State Park, south of Superior (Read, 1976).

Gymnocarpium heterosporum is similarly an infertile hybrid between the common Gymnocarpium dryopteris and the rare Gymnocarpium Robertianum, reported from a single granite ledge along Lake Superior and rare also in Wisconsin. In the case of both hybrids at least one parent species is believed to prefer calcareous cliffs (Tryon, 1954). The infrequency of calcareous rockly substrates within the RCNSA suggests that it is unlikely that either rare fern is present there. The most likely place to find both rare hybrid ferns in the RCNSA is probably in the rugged, thin-soiled area northeast of Birch Lake and the Stony River.

Polemonium occidentale v. lacustre is a disjunct species found in a single cedar bog north of Hibbing and in the western United States. No other records exist for the lake states (Fernald, 1950). If this species is present in the study area, the most likely locations would be cedar bogs in the southwestern portion.

Cypripedium arietinum is one of several boreal species reaching their southern range limits in the Great Lakes states. Its two Minnesota stations are widely separated, one along the border lakes in northwestern Cook County and the other in east-central Aitkin County. Case (1964) reports its preference for cold conifer swamps and open alkaline sedge swales with white cedar. Its Wisconsin distribution is mainly in the northeastern part of the state (Read, 1976). It is unclear where to search for this species in the RCNSA.

Several of the plants listed as rare for Minnesota (Appendix I) follow a boreal distribution pattern. Plants with such a pattern often have a circumpolar distribution and are often restricted to bogs or rocky habitats near the southern limits of their range. Both rare species located as part of the Regional Copper Nickel Study follow this pattern.

Arenaria macrophylla is generally distributed from the Ungava peninsula to northern New England, Ontario, Wisconsin, and around Lake Superior. It appears to reach its southwestern range limits within the RCNSA.

Geocaulon lividum (also known as Comandra livida) is more widely distributed in the northern United States than Arenaria macrophylla. It ranges throughout the northern states as far south as northern Ohio and as far west as northern Minnesota. Marie-Victorin (1964) characterizes Geocaulon lividum as a northern silicolous species. Like several other members of the Santalaceae it is a perennial root parasite (Kuijt, 1969; Marie-Victorin, 1964) suggests that the hosts may be Fragaria virginiana and Vaccinium vitis-idaea. Although it is insect pollinated and produces a single-seeded thin, fleshy nut it also propagates by rhizomes. This habit may help account for the fairly large population at plot T05, even though not many of the plants bore fruit. The station we reported at T05 appears to be the same as that recorded by Lakela (1965) within the RCNSA. All four collection sites in Minnesota are in areas where soils are shallow and non-calcareous

VI. LITERATURE CITED

Case, F.W. Jr. 1964. Orchids of the western Great Lakes Region Cranbrook Institute of Science Bulletin 48, 147 pp.

Convention on International Trade in Endangered Species of Wild Fauna and Flora. Federal Register, February 22, 1977.

Cushing, E.J., G.L. Jacobson, R.S. Rogers and N.P. Sather. 1972. Vegetation map of the Gabbro Lake Southwest and Kangas Bay Quadrangles, Minnesota; with supporting field data. Unpublished data. University of Minnesota, Minneapolis.

Dean, J.L. 1971. Wetland Forest Communities of the Eastern Boundary Waters Canoe Area. Unpublished master's thesis. University of Minnesota. 101 pp.

Drury, W.H. 1974. Rare Species. Biol. Conserv. 6:162-169.

Du Mond, D.M. 1973. A guide to the selection of rare, unique and endangered plants. Castanea. 38:387-395.

Endangered and Threatened Species Preservation Act of 1973, Public Law No. 93-205, 87 Stat. 884.

Federal Register, June 24, 1977. (Regulations of the U.S. Fish And Wildlife Service affecting interstate commerce in protected plants.)

Fernald, M.L. 1925. Persistence of plants in unglaciated areas of boreal North America. Memoirs of the American Academy of Arts and Sciences. 15:239-242.

Fernald, M.L. 1950. Gray's Manual of Botany, 8th Ed. Amercian Book Co., N.Y. lxiv + 1632 pp.

Grigal, D.F. 1968. The relationship between plant communities and soils in northeastern Minnesota. Unpublished PH.D. thesis University of Minnesota. 127 pp.

Griggs, R.F. 1940. The ecology of rare plants. Bulletin of the Torrey Botanical Club. 67:575-594.

Jones, J.A. 1974. Plant Ecology Report, Minnamax, an Exploration Project. Amax Environmental Services Group, Denver. 34 pp.

Kuijt, J. 1969. Biology of Parasitic Flowering Plants. University of California Press, Berkeley. 246 pp.

Lakela, O. 1965 A flora of Northeastern Minnesota. University of Minnesota Press, Minneapolis. 541 pp.

Marie-Victorin, frère. 1964. Flore Laurientienne, Les Presses d L'Universite' de Montreal, Montreal. 917 pp.

Midwest Research Institute. 1975. Data on Vegetation Communities, Appendix E in Barton-Aschman Associates, Inc. Draft Environmental Impact Statement Technical Appendix. Reserve Mining Company's proposed on land tailings disposal plan.

Minnesota Department of Natural Resources. 1975. The Uncommon Ones: Animals and plants which merit special consideration and management. St. Paul. 32pp.

Minnesota Statute 17.23.

Morley, T. 1972. Rare or endangered plants of Minnesota with the counties in which they have been found. Mimeo by the author. Department of Botany, University of Minnesota, St. Paul. 13 pp.

Noble, M.G., L.K. DeBoer, K.L. Johnson, B.A. Coffin, L.G. Fellows, and N.A. Christensen. 1977. Quantitative relationships among Pinus banksiana-Picea mariana forests subjected to wildfire and postlogging treatments. Can. Jour. of For. Res. 7·2:368-377.

Ohmann, L.F. and R.R. Ream. 1971. Wilderness Ecology: Virgin Plant Communities of the Boundary Waters Canoe Area. United States Department of Agriculture, Forest Service, Research Paper NC-63. 55 pp.

Read R. H. 1976. Endangered and Threatened Vascular Plants in Wisconsin. Technical Bulletin No. 92. Scientific Areas Preservation Council, Department of Natural Resources, Madison.

Smithsonian Institution. 1975. Report on endangered and threatened plant species of the United States submitted to the 94th Congress, 1st Session. House Document No. 94-51, Washington D.C. U.S., Govt. Printing Office. 200 pp.

Stebbins, G.L. 1942. The genetic approach to problems of rare and endemic species. Madrono. 6:241-272.

Tryon, R.M. 1954. The Ferns and Fern Allies of Minnesota. University of Minnesota Press, Minneapolis. 166 pp.

Zeedyk, W.D., R.E. Farmer, Jr., B. MacBride, and G.S. Baker. 1978. Endangered plant species and wildland management. Journal of Forestry, January, 1978: 31-36.

APPENDIX I

RARE OR ENDANGERED PLANTS OF MINNESOTA PRESENT IN ST. LOUIS, LAKE, OR COOK COUNTIES

All species below are listed in alphabetical order by scientific name, followed by common name, family, and the counties in which they have been found in Northeastern Minnesota. The list is taken from Morley (1972). Fractions following the counties show the proportion of Minnesota collections coming from Lake and St. Louis Counties (only).

Plants rare in Minnesota and all of North America

Draba norvegica, Whitlow Grass, Cruciferae (Brassicaceae): Cook, 0/1

Plants rare in Minnesota but more or less adequately represented in adjacent regions

Adlumia fungosa, Mountain Fringe, Fumariaceae: St. Louis, 3/3

Ammophila breviligulata, American Beach Grass, Gramineae (Poaceae): St. Louis, 1/1

Arenaria macrophylla, Large-leaved Sandwort, Caryophyllaceae: Cook, Lake, 1/4

Artemisia canadensis, Canadian Sage-bush, Compositae (Asteraceae): Cook, Lake, 1/3

Aster prealtus, Tall Aster, Compositae (Asteraceae): St. Louis, 1/3

Asplenium trichomanes, Maidenhair Spleenwort, Polypodiaceae: Cook, 0/3

Athyrium thelypteroides, Silvery Speenwort, Polypodiaceae: Lake, 1/4

Bidens discoidea, Small Beggar-ticks, Compositae (Asteraceae): St. Louis, 4/4

Caltha natans, Floating Marsh Marigold, Ranunculaceae: St. Louis, 4/4

Cardamine pratensis, Marsh Bitter Cress, Cruciferae (Brassicaceae): St. Louis, 1/4

Carex cephalantha, Cyperaceae: Cook, St. Louis, 1/3

Carex katahdinensis, Cyperaceae: St. Louis, 1/1

Carex ormostachya, Cyperaceae: Cook, St. Louis, 1/2

Castilleja septentrionalis, Northern Indian Paint-brush, Scrophylariaceae: Cook, 0/1

Corispermum nitidum, Shining Bug-seed, Chenopodiaceae: St. Louis, 1/16

Crataegus douglasii, Douglas' Hawthorn, Rosaceae: Cook, Lake, 1/2

Deschampsia flexuosa, Wavy Hair Grass, Gramineae (Poaceae): Cook, St. Louis, 1/2

Empetrum nigrum, Black Crowberry, Empetraceae: Cook, 0/1

Galium verum, Yellow Bedstraw, Rubiaceae: St. Louis, 1/3

Geocaulon lividum (Comandra livida), Northern Comandra, Santalaceae: Cook, Lake, 1/4

Geum laciniatum, Laciniate Geum, Rosaceae: St. Louis, 1/1

Glyceria pallida, Pale Manna Grass, Gramineae (Poaceae): Cook, 1/3

Juncus brachycephalus, Small-headed Rush, Juncaceae: Lake, St. Louis, 2/3

Juncus stygius, Moor Rush, Juncaceae: Cook, Lake, 1/1

Listera auriculata, Auricled Twayblade, Orchidaceae: Cook, St. Louis, 1/3

Listera convallarioides, Broad-lipped Twayblade, Orchidaceae: Cook, 0/1

Luzula parviflora, Small-flowered Wood Rush, Juncaceae: Cook, Lake, 1/3

Madia glomerata, Western Tarweed, Compositae (Asteraceae): St. Louis, 2/3

Muhlenbergia uniflora, One-flowered Muhly Grass, Gramineae (Poaceae): Lake, St. Louis, 2/3

Nymphaea tetragona, Small White Water Lily, Nymphaeaceae: Lake, 2/3

Ophioglossum vulgatum var. pseudopodum, Adder's Tongue, Ophioglossaceae: St. Louis, 3/8

Oxytropis viscida, Sticky Loco Weed, Leguminosae (Fabaceae): Cook, 0/1

Osmorhiza obtusa, Blunt-fruited Sweet Cicely, Umbelliferae (Apiaceae): Cook, 0/3

Penstemon pallidus, Pale Penston, Scrophulariaceae: St. Louis, 0/3

Plantago virginica, Hoary or Pale-seed Plantain, Plantaginaceae: Cook, 0/1

Poa chaixii, Chaix's Speargrass, Gramineae (Poaceae): St. Louis; possibly introduced, 1/1

Poa sylvestris, Sylvan Spear Grass, Gramineae (Poaceae): St. Louis, 1/1

Poa trivialis, Tough-stalked Meadow Grass, Gramineae (Poaceae): St. Louis, 1/1

Poa wolfii, Wolf's Spear Grass, Gramineae (Poaceae): Lake, 2/3

Polygonum ramosissimum, Bushy Knotweed, Polygonaceae: St. Louis, 2/30

Polygonum viviparum, Serpent-grass, Alpine Knotweed, Polygonaceae: Cook, 0/2

Potentilla flabelliformis, Fan-leaved Cinquefoil, Rosaceae: Cook, St. Louis (Absent from herbarium)

Ranunculus gmelini, Yellow Water-crowfoot, Ranunculaceae: St. Louis, 3/4

Ranunculus lapponicus, Lapland Buttercup, Ranunculaceae: St. Louis, 3/5

Rhynchospora fusca, Sooty Beaked-rush, Cyperaceae: St. Louis, 2/2

Rubus chamaemorus, Cloudberry, Rosaceae: Lake, 2/2

Rubus folioflorus, Blackberry, Rosaceae: St. Louis, 1/3

Sagina nodosa, Knotted Pearlwort, Caryophyllaceae: Cook, 9/1

Sagina procumbens, Procumbent Pearlwort, Caryophyllaceae: St. Louis, 1/1

Sagittaria graminea, Grass-leaved Arrowhead, Alismataceae: St. Louis, 1/4

Salix pellita, Willow, Salicaceae: Cook, St. Louis, 1/2

Saxifraga aizoon, American Livelong Saxifrage, Saxifragaceae: Cook, 0/5

Saxifraga cernua, Nodding Saxifrage, Saxifragaceae: Cook, 0/1

Selaginella selaginoides, Spikemoss, Selaginellaceae: Cook, 0/4

Senecio indecorus, Unattractive Ragwort, Compositae (Asteraceae): Cook, Lake, 1/5

Sparganium glomeratum, Bur-reed, Sparganiaceae: Lake, St. Louis, 3/3

Spiraea latifolia, Broad-leaved Meadowsweet, Rosaceae: Lake, 1/1

Subularia aquatica, Awlwort, Cruciferae (Brassicaceae): Cook, Lake, St. Louis, 3/4

Tofieldia pusilla, Small False Asphodel, Liliaceae: Cook, Lake, 1/2

Tsuga canadensis, Hemlock, Pinaceae: St. Louis, 2/7

Vaccinium uliginosum, Great Bilberry, Ericaceae: Cook, 1/1

Waldsteinia fragarioides, Barren Strawberry, Rosaceae: Lake, St. Louis, 4/4

Woodsia glabella, Smooth Woodsia, Polypodiaceae: Cook, Lake, 1/3

Woodsia scopulina, Rocky Mountain Woodsia, Polypodiaceae: Cook, (At least in part collections of this species from northeastern Minnesota kept at the Duluth herbarium have been synonymized with Woodsia abbeae, which is on the national list). 0/9

Xyris montana, Mountain Yellow-eyed Grass, Xyridaceae: St. Louis, 1/2

Protected plants

All members of *Orchidaceae*

Trillium spp.

Epigaea repens

APPENDIX II

PLANTS PRESENT IN MINNESOTA AND RECOMMENDED BY THE SMITHSONIAN INSTITUTION FOR FEDERAL PROTECTION

* *Cypripedium arietinum*

Erigeron pulchellus v. *tolsteadii*

Erythronium propullans

* *Gymnocarpium heterosporum*

Lespedeza leptostachya

* *Listera auriculata*

Platanthera leucophaea

* *Polemonium occidentale* v. *lacustre*

Sullivantia ohioensis

* *Woodsia abbeae*

* Species with stations in northeastern Minnesota

APPENDIX III

PLANTS BEING RECOMMENDED BY THE U.S. FISH AND WILDLIFE SERVICE FOR FEDERAL PROTECTION

Erythronium propullans

Lespedeza leptostachya

Plantago cordata

* *Polemonium occidentale* v. *lacustre*

APPENDIX IV

KEY TO SYMBOLS USED IN APPENDIX IV

SOURCES OF INFORMATION

AMAX - Jones, 1974

CW/SO - Charles Wick and Sigurd Olson, personal communication

DS - Deborah Shubat, personal communication

EJC - Cushing et. al., 1972, data collected by Cushing

G - Grigal, 1968, data from tables in thesis

GLJ - Cushing et. al., 1972, data collected by Jacobson

JD - Dean, 1972, data from thesis

N - Noble et. al., 1972

NS - Cushing et. al., 1972, data collected by Sather or additional data collected by Sather in 1973 and 1974

OL - Lakela, 1965, records included in book and not otherwise located at UM or UMD

O/R - Ohmann and Ream, 1971, raw data

UM - University of Minnesota herbarium, location as recorded on herbarium labels

UMD - University of Minnesota, Duluth, herbarium, location as recorded on herbarium labels

CuNi - Recorded as part of the data collected for the Regional Copper-Nickel Study.

Note: Locations are broken down with reference to an intensive Study Area, which coincides with the MINESITE area.

APPENDIX IV

STATIONS OF RARE AND PROTECTED PLANTS IN LAKE AND ST. LOUIS COUNTIES

Protection status - protected by Minnesota Statute 17.23

Arethusa bulbosa

In study area: Denley Lake Bog on USFS 424, NE-1/2 S2, T60N, R10W (Cu-Ni)

North Kawishiwi River (UM)

Approximately 11 miles NW of Virginia on Highway 53 (OL)

BWCA: Dark Lake south of Iron Lake on Canadian Border (UM)

South of study area: Finberg Lake, 70 miles north of Duluth on Highway 73 (UM)

Prairie Lake Township, near Highway 51, S28, T50N, R21W (UM)

West of study area: Sturgeon Lake on Highway 5, N. of Hibbing (UM)

East of study area: Kelso River, T63N, R5W (UM)

Calopogon pulchellus

BWCA and north of study area

West of study area: Sturgeon Lake Bog, 20 miles north of Hibbing (UM)

South of study area: Finberg Lake, 70 miles north of Duluth on Highway 73 (UM)
Auto Lake, south St. Louis County (UM)
Lake in Fredericksburg Township, 18 miles north of Duluth (UM)

East of study area: "Lake County" (UM)

Calypso bulbosa

East of study area: South side of South Lake, S19, T65N, R1W (UM)

BWCA: Seagull Lake (UM)
"Near the Canadian border, northern Minnesota" (UM)

West of study area: Junction of Highway 53 and Lake Kabetogama Road (UM)

Corallorhiza maculata

BWCA: NW-1/4 SW-1/4 S1, T63N, R4W (O/R)
SW-1/4 SE-1/4 S31, T64N, R03W (O/R)
NE-1/4 NW-1/4 S6, T63N, R03W (O/R)
NW-1/4 SW-1/4 S05, T63N, R03W (O/R)
NE-1/4 NE-1/4 S07, T63N, R03W (O/R)
SE-1/4 SW-1/4 S08, T63N, R03W (O/R)
NW-1/4 NE-1/4 S05, T63N, R03W (O/R)
SE-1/4 SW-1/4 S05, T63N, R03W (O/R)
SE-1/4 SW-1/4 S24, T64N, R04W (O/R)

NW-1/4 NW-1/4 S25, T64N, R04W (O/R)

NW-1/4 SW-1/4 S1, T63N, R4W (O/R)

SW-1/4 SE-1/4 S31, T64N, R03W (O/R)

NE-1/4 NW-1/4 S6, T63N, R3W (O/R)

NE-1/4 NE-1/4 S06, T63N, R3W (O/R)

NW-1/4 SW-1/4 S05, T63N, R3W (O/R)

SE-1/4 SW-1/4 S05, T63N, R3W (O/R)

NE-1/4 SW-1/4 S5, T63N, R3W (O/R)

SE-1/4 SW-1/4 S24, T64N, R04W (O/R)

NW-1/4 NW-1/4 S25, T64N, R04W (O/R)

NE-1/4 SE-1/4 S15, T64N, R04W (O/R)

NE-1/4 SE-1/4 S14, T64N, R04W (O/R)

SE-1/4 NW-1/4 S14, T64N, R04W (O/R)

NE-1/4 SE-1/4 S14, T64N, R04W (O/R)

SE-1/4 NW-1/4 S23, T64N, R04W (O/R)

Gunflint Lake (UM)

Seagull Lake (UM)

Curtain Falls (UM)

Woods near Portage River on Echo Trail (UM)

Sandpoint Lake (UM)

Alton-Sawbill Portage (UM)

West of study area: Ash River (UM)

Rainy River (UM)

Namakan Lake (2 specimens, UM)

1.6 mi. N of Minn. 135 and Minn. 100, S32, T59N, R15W (G)

East of study area: Mineral Center (UM)

Pigeon Point, T64N, RNE (UM)

Mountain Lake, Cook Co., T65N, R1E

Ada River between Ada Lake and Sawbill Lake, T63N, R4W (UM)

1.74 mile south of intersection Cook Co. 57 and USFS 158, S36, T62N, R2W (G)

South of study area: Normanna Road 14 miles north of Duluth

1.4 mile south of intersection 16 and USFS 417, S9, T56N, R14W (G)

In study area: Colvin tailing disposal site, 14 mi. S. of Babbitt and 1 mi. fr. Colvin R. (UM)

Burntside Lake (UM)

Four mile portage between Fall and Basswood Lakes (UM)

Trout Lake end of Portage from Vermilion Lake (UM)

Amax exploration site (Amax)

NE-1/4 SW-1/4 S25, T60N, R12W (NS)

Plot T04, SE-1/4 NW-1/4 S18, T57N, R14W (Ci-Ni)

Plot T08, SE-1/4 SW-1/4 S8, T57N, R13W (Cu-Ni)

Plot T10, SW-1/4 NW-1/4 S6, T59N, R10W (Ci-Ni)

Plot T11, SE-1/4 SE-1/4 S7, T60N, R11W (Cu-Ni)

Plot T13, SE-1/4 NE-1/4 NW-1/4 S33, T58N, R14W (Cu-Ni)

Plot T32, NW-1/4 NW-1/4 S5, T57N, R14W (Cu-Ni)

Plot G17, NE-1/4 NE-1/4 S15, T60N, R12W (Cu-Ni)

Plot G23, SW-1/4 NE-1/4 S30, T57N, R14W (Cu-Ni)

Plot G27, NW-1/4 NW-1/4 S20, T60N, R11W (Cu-Ni)

Plot G34, SE-1/4 S19, T57N, R12W (Cu-Ni)

Plot G35, SW-1/4 S18, T57N, R12W (Cu-Ni)

Plot G42, NE-1/4 NW-1/4 S17, T57N, R13 (Cu-Ni)

Corallorhiza striata

East of study area: Lima Mountain Trail, Cook Co., T64N, R1W (UM)

Pigeon Point (UM)

Between Pike and Mountain Lakes, T65N, R2W (UM)

Royal Lake, T64N, R3E (UM)

Between Bush and Poplar Lakes, T64N, R2W (UM)

Between Seagull and Alpine Lakes (UM)

BWCA: Pipestone Bay of Basswood Lake (UM)

8 miles west of Crooked Lake on Lac La Croix (UM)

South Arm Crane Lake (UM)

Gunflint Lake (UM)

Meander Lake (UM)

Crooked Lake - Iron Lake Portage (UM)

Friday Bay, Crooked Lake (UM)

South of study area: 16 miles north of Duluth (UM)

West of study area: Highway 53 at Kabetogama Lake Rd. (UM)

Lake Kabetogama (uM)

Namakan Point (UM)

In study area: 6 miles south of Biwabik at Esquagama Lake (UM)
3 miles south of Biwabik (UM)
South Kawishiwi River (UM)
North Arm of Burntside (UM)
North Kawishiwi River (UM)
Vermilion Lake (UM)
Mature black spruce forest west of Isabella Lake (UM)
Releve R79, NW-1/4 NW-1/4 S09, T62N, R11W (RSR)
Releve R22, S26, T62N, R11W (RSR)
Releve S15, SE-1/4 NE-1/4 S13, T61N, R11W (NS)

Corallorhiza trigida

East of study area: Poplar Lake, Cook Co. (UM)
"Carribeau R., Lake Co." (UM)
Tucker Lake, Cook Co. (UM)
Birch Lake near Poplar Lake, T64N, R2W (UM)
North Fowl Lake, Cook Co. (UM)
SE of Royal Lake, T64N, R3E (UM)
T65N, R2E, Cook Co. (UM)
North Lake, Cook Co. (UM)
.2 miles north of intersection Cook Co. 2 and 3, S6, T61N, R4W (G)

BWCA: Edges of Bog near SW end of Gunflint Lake (UM)
Sawbill Lake (UM)
Seagull Lake (UM)

South of study area: 14 miles N of Duluth on Hwy. 4 (UM)
Prairie Lake, SW St. Louis Co. (UM)
Fond du Lac Lake (UM)

West of study area: Namakan L. (UM)
Junction Hwy. 53 and Kabetogama Lake Road (UM)
Crane Lake Road west of Vermilion River Bridge (UM)
Namakan Narrows (UM)
Northside US 169, S33, T62N, R15W (G)

Cypripedium acaule Seagull Lake (UM)

BWCA: NW-1/4 NW-1/4 S4, T67N, R15W (O/R)
NE-1/4 NE-1/4 S06, T63N, R3W (O/R)
SW-1/4 NE-1/4 S1, T66N, R5W(O/R)
NE-1/4 NE-1/4 S06, T63N, R03W (O/R)
Winchell-Larsen Lake Bog S28, T64N, R2W (JD)
Little Sioux Fire, Dogfish Lake (UM)
Clearwater Lake, Cook Co. (UM)
Second Lake, Echo Trail W of Ely (UM)
Portage between Gun and Wagosh Lakes (UM)
Curtain Falls, Crooked Lake (UM)
Nels Lake, Echo Trail W of Ely (UM)

East of study area: .4 mile E of USFS 152 and Cook Co. 12, S33, T64N, R1E (G)
Partridge Lake, Cook Co. (UM)
Brule River, Cook Co. (UM)
Poplar Lake, Cook Co. T64N, R2W (UM)

South of study area: Normanna Road 10 miles north of Duluth (UM)

Prairie Lake, SW St. Louis Co. (UM)

Meadowlands (UM)

West of study area: Kabetogama State Forest (UM)

Side Lake, 20 miles north of Hibbing (UM)

East end of Dogfish Lake (N)

3 mi. S. of Echo Trail on Moose Loop Rd.

200 yds. E. of Moose R. (N)

In study area: North Kawishiwi River (UM)

Eagles' Nest Lake Road (UM)

Hwy. 1, SE of Ely (UM)

White Iron Lake (UM)

Between Pine Lake and the Reserve Railroad

tracks N. of Toimi (UM)

Gabbro Lake Shore (N)

Plot G20, SW-1/4 NE-1/4 S35, T61N, R10W (Cu-Ni)

Plot G46, E-1/2 SE-1/4 S3, T60N, R12W (Cu-Ni)

Plot G08, SW-1/4 NW-1/4 S1, T60N, R11W (cu-Ni)

Plot G26, SE-1/4 SW-1/4 S7, T61N, R10W (Cu-Ni)

Releve J23, NW-1/4 NW-1/4 S19, T61N, R11W (GLJ)

Releve C07, SE-1/4 NE-1/4 S10, T61N, R12W (EJC)

Releve N01, NE-1/4 SW-1/4 S11, T60N, R12W (NS)

Releve N35, SW-1/4 SW-1/4 S14, T60N, R12W (NS)

East Shore of Little Isabella River (N)

Cypripedium calceolus v. parviflorus and v. pubescens

South of study area: French Twp., St. Louis Co. (UM)
Prairie Lake Twp., Hwy. 51 (UM)
Prairie Lake, S28, T50N. R21W (UM)
Highway 4, 14 miles N. of Duluth (UM)

West of study area: Kabetogama (UM)
Highway 5 north of Sturgeon Lake (UM)

BWCA: Seagull Lake (UM)

Cypripedium reginae

South of study area: Prairie Lake area, S28, T50N, R21W (UM)
13 miles north of Duluth on Highway 4 9UM)

West of study area: Highway 53 south of Ash River Point
Sturgeon Lake Observation Tower 25 miles N. of Hibbing (UM)

Epigaea repens

In study area: Mixed dry forest on USFS 178 near Stony River 1/2-3/4 mi. S. of 424 (CuNi)
Jack pine forest about 6 miles south of Biwabik (UM)
Under jack pine, sandy terrace of St. Louis River, Palo, Highway 4 (UM)
Jack pine forest on a lake 5 miles south of Biwabik (UM)
Listening Point on Burntside Lake near outlet of Burntside River (CW/SO)

South of Trygg Land Office just south of Ely (CW/SO)

Jack pine forest at junction of Echo Trail and north arm of Burntside Lake (CW/SO)

Near Makinen (approximate location taken from OL)

East of Highway 4 and north of Highway 371, south of Pineville and north of Cedar Lake (approximate location taken from OL)

BWCA and north of study area:

.2 mile west of east intersection of 116 and 464, S24, T65N, R14W (G)

Near Upper Basswood Falls on the Basswood River (CW/SO)

Portage from Echo Trail to Angleworm Lake (DS)

West of study area:

14 miles north of Virginia on Highway 53 (UM)

1 mile north of St. Louis County 68 and 405, S25, T60N, R18W (G)

.5 mile west of interestion of St. Louis County 20 and 388, S9, T57N, R16W (G)

3 mi. south of Echo Trail on Moose Loop Road (N)

East of study area:

SW-1/4 NW-1/4 S5, T65N, R06W (O/R)

SE-1/4 SE-1/4 S5, T65N, R06W (O/R)

NW-1/4 NW-1/4 S04, T65N, R06W (O/R)

Gentiana andrewsii v. dakotica

West of study area: Ash River at end of road to Lake Kabetogama (UM)

South of study area: Duluth (UM)

Gentiana andrewsii v. andrewsii

South of study area: Bank of Cloquet River by Dam (UM)

Fond du Lac (UM)

Gentiana rubricaulis

In study area: "Sandy flat of Stony River on Highway 1" (UM)

6 miles south of Biwabik (UM)

SE of Gilbert, 1.5 mile from Bass Lake on Highway 20 (UM)

Big Stony River, 2nd crossing from north between Ely and Finland (UM)

Mud River near Vermilion Lake (UM)
NW¼ S12, T60N, R12W (CuNi)

East of study area: Between Jasper and Alpine Lakes, Cook Co. (UM)

4 miles east of Lake Co. line in Cook Co. on Highway 61 (UM)

"Ely-Finland Road near SN lodge, Lake Co." (UM)

Spring Lake on Tofte-Isabella Road (UM)

Temperance River at junction of Sawbill Trail and Tofte-Isabella Road (UM)

South of study area: Indian Lake near Rollins (UM)

Zim, on Highway 7 (UM)

16 miles north of Duluth on Highway 4 (UM)

Location uncertain: Alden Lake, St. Louis County (UM)

Goodyera repens

BWCA: SW-1/4 NE-1/4 S19, T65N, R02W (O/R)
NE-1/4 NW-1/4 S23, T65N, R02W (O/R)
SW-1/4 NW-1/4 S5, T65N, R06W (O/R)
SE-1/4 SE-1/4 S16, T66N, R12W (O/R)
NW-1/4 SE-1/4 S11, T64N, R15W (O/R)
SE-1/4 NE-1/4 S22, T64N, R14W (O/R)
NW-1/4 SE-1/4 S12, T64N, R5W (O/R)
NE-1/4 SW-1/4 S12, T64N, R04W (O/R)
NE-1/4 SE-1/4 S4, T64N, R04W (O/R)
SE-1/4 SW-1/4 S13, T65N, R02E (O/R)
SW-1/4 NE-1/4 S22, T66N, R15W (O/R)
NW-1/4 SW-1/4 S11, T65N, R14W (O/R)
NW-1/4 NE-1/4 S5, T65N, R5W (O/R)
NW-1/4 NE-1/4 S5, T63N, R03W (O/R)
NE-1/4 SE-1/4 S15, T64N, R04W (O/R)
SW-1/4 SE-1/4 S23, T64N, R04W (O/R)
NW-1/4 SE-1/4 S24, T64N, R04W (O/R)
SW-1/4 NE-1/4 S14, T66N, R12W (O/R)
NE-1/4 NW-1/4 S23, T63N, R08W (O/R)
NE-1/4 SW-1/4 S13, T66N, R05W (O/R)
NW-1/4 NW-1/4 S32, T63N, R08W (O/R)
East Bearskin Cedar Bog, T64N, R1E (JD)

East Bearskin Spruce Bog, T64N, R1E (JD)

East End of Dogfish Lake (N)

Gunflint Trail (UM)

Curtain Falls, Crooked Lake (UM)

Sawbill Lake (UM)

T64N, R5W, near Sawbill (UM)

Isabella Lake (UM)

Papoose Lake, South of Friday Bay (UM)

Saganagons Lake (N)

Seagull Lake (UM)

East BWCA, Boundary near Gunflint Trail (N)

South of study area: 7 miles N. of Rollins on State Highway 44 (UM)

13.5 miles N. of Duluth on Highway 4 (UM)

East of study area: Gunflint Trail 11 miles north of Grand Marais (UM)

.3 mi. W. of West Crossing of Larch Creek on Cook Co. 12, S9, T65N, R4W (G)

T64N, R7E, Pigeon Point (UM)

Rove Lake, T65N, R1W (UM)

T64N, R1W, Poplar Lake (UM)

1.15 mi. S. of Kaw. Lake Campground on USFS 354, S27, T62N, R6W (G)

West of study area: Namakan Lake (UM)

Northside Blackduck Trail, S9, T66N, R19W (G)

South of Moose Loop, 28 miles NW of Ely (UM)

2.5 mi. S. of Echo Trail on Moose Loop Road (N)

In study area:

Halfway between Tower and Ely (UM)

Gabbro Lake at BWCA Boundary (N)

"Swamp near Ely"

South Kawishiwi River (UM)

Vermilion Lake (UM)

Colvin site, about 14 miles south of Babbitt, north of Colvin Creek (UM)

Burntside Lake (UM)

1.6 mile N. of railroad on Lake Co. 2, S19, T59N, R10W (G)

G03, NE-1/4 NE-1/4 S31, T61N, R10W (Cu-Ni)

G27, NW-1/4 NW-1/4 S20, T60N, R11W (Cu-Ni)

G17, NE-1/4 NE-1/4 S15, T60N, R12W (Cu-Ni)

G30, SE-1/4 NE-1/4 S7, T57N, R14W (Cu-Ni)

G33, NW-1/4 SE-1/4 S2, T60N, R11W (Cu-Ni)

R29, NE-1/4 S24, T62N, R11W (Cu-Ni)

R45, NE-1/4 NE-1/4 S33, T62N, R11W (Cu-Ni)

R67, SW-1/4 SW-1/4 S33, T62N, R11W (Cu-Ni)

R74, S4, T61N, R11W (Cu-Ni)

N23, SW-1/4 SW-1/4 S25, T60N, R12W (Cu-Ni)

T18, SE-1/4 NE-1/4 S18, T59N, R12W (Cu-Ni)

S28, SW-1/4 NW-1/4 S14, T61N, R11W (Cu-Ni)

Goodyera tesselata

BWCA:

NE-1/4 NE-1/4 S6, T63N, R3W (O/R)

NE-1/4 SE-1/4 S14, T64N, R04W (O/R)

SE-1/4 NW-1/4 S14, T64N, R04W (O/R)

NE-1/4 NE-1/4 S6, T63N, R3W (O/R)

NE-1/4 NE-1/4 S21, T64N, R13W (O/R)

SE-1/4 NE-1/4 S35, T65N, R1W (O/R)

NE-1/4 NW-1/4 S10, T65N, R13W (O/R)

Pipestone Bay, Basswood Lake (UM)

8 miles west of Crooked Lake on Lac La Croix (UM)

South arm Crane Lake (UM)

Meander Lake (UM)

Portage between Iron and Portage Lakes (UM)

Friday Bay, Basswood Lake (UM)

In study area: 6 miles south of Biwabik on Eskquagama Lake (UM)

3 miles south of Biwabik (UM)

South Kawishiwi River (UM)

North Arm, Burntside Lake (UM)

North Kawishiwi River (UM)

Mature black spruce forest west of Isabella Lake (UM)

Vermilion Lake (UM)

T30, W-1/2 SE-1/4 S10, T58N, R13W (Cu-Ni)

G30, SE-1/4 NE-1/4 S7, T57N, R14W (Cu-Ni)

East of study area: Between Seagull and Alpine Lakes (UM)

T64N, R1W, Lima Mountain Trail, Cook Co. (UM)

Pigeon Point, Cook Co. (UM)

T65N, R2W, Between Pike and Mountain Lakes (UM)
Gunflint Lake (UM)
Royal Lake, T64N, R3W (UM)
Between Bush and Poplar Lakes, T64N, R2W (UM)

West of study area: Namakan Point (UM)
2.9 miles north of intersection St. Louis Co. 24 and 422, S15, T64N, R17W (G)
.2 miles west of east intersection 116 and 464, S24, T65N, R14W (G)

South of study area: 16 miles north of Duluth (UM)

Habenaria clavellata

In study area: Greenwood Lake (UM)

South of study area: Normanna Township, 16 miles north of Duluth on Highway 4 (UM)

BWCA: East Bearskin Cedar, T64N, R1E (JD)

Habenaria dilatata and varieties

East of study area: Highway 61 at Park Bay Bridge, Lake Co. (UM)
1 mile east of Grand Portage, T63N, R6E (UM)

South of study area: Normanna Township, 16 miles north of Duluth on Hwy. 4 (UM)
Duluth (UM)
"St. Louis River" (UM)
Prairie Lake Area, S28, T50N, R21W (UM)

In study area: "Vermilion Lake" (UM)
Cedar Bog, G43, SE-1/4 SW-1/4 S2, T60, R12W (Cu-Ni)

Habenaria hyperborea

In study area:
SE-1/4 NE-1/4 S24, T62N, R11W (EJC)
SW-1/4 NE-1/4 S26, T62N, R11W (RSR)
S24, T62N, R11W (RSR)
NE-1/4 SW-1/4 S31, T62N, R11W (RSR)
Vermilion Lake (UM)
Jasper Peak, Soudan, along Highway 1 (UM)
35 miles north of Two Harbors on Highway 2 (UM)
3 miles SE of junction of Dunka Mine Road and Reserve RR (UM)
North Kawishiwi River (UM)
Plot G18, NW¼, NW¼, S8, T57N, R13W (Cu-Ni)
Plot G43, Sw, T60N, R12W (Cu-Ni)
NE¼, SQ¼, S34, T62N, R11W (RSR)
Plot G03, S31, T61N, R10W (Cu-Ni)
Amax exploration site (S29, T60N, R12W) (Amax)

BWCA:
SW-1/4 NE-1/4 S19, T65N, R02W (O/R)
SW-1/4 SW-1/4 S3, T62N, R9W (O/R)
Seagull Lake (UM)
Knife River (UM)

South of study area:
Superior (UM)
"St. Louis River" (UM)
Highway 4, 13 miles N. of Duluth (UM)
Duluth (UM)

Between Duluth and Fish Lake (UM)

Ash River junction, Highway 53 (UM)

Prairie Lake Area, S28, T50N, R21W (UM)

17 miles northeast of Duluth (UM)

3 miles from Duluth (UM)

East of study area: Temperance River (UM)

Ditch, Grand Portage (UM)

Tofte (UM)

Shorewoods of Lake Superior near Stony Point (UM)

'Encampment forest between Highway 61 and Lake'

Knife River (UM)

North Shore Lake Superior (UM)

Grand Portage (UM)

Highway 61 a few miles east of Lake-Cook Co. Line (UM)

Hovland (UM)

1 mile west of Tofte (UM)

West of study area: Junction Highway 53 and Kabetogama Road (UM)

Hammer Creek off Namaken Lake 3 miles from Narrows (UM)

Sturgeon Lake 25 miles north of Hibbing (UM)

Habenaria hookeri

East of study area: .4 mile S. of intersection Lake Co. 18 and Snowbank Rd., S9, T63N, R9W (G)

South Lake, T65N, R1W (UM)

Southeast of Birch Lake, T65N, R1W, S31 (UM)

Tucker Lake Trail, S36, T65N, R3W (UM)

BWCA: Portage Trail 1/8 mile west of Curtain Falls on Crooked Lake (UM)

Sandpoint Lake (UM)

Seagull-Alpine Lake Portage (UM)

Basswood Lake (UM)

Seagull Lake (UM)

Sawbill Lake (UM)

Meander Lake (UM)

1 mile portage from Iron Lake to Lac La Croix (UM)

Gun Lake (UM)

In study area: Jack pine forest 6 miles south of Gilbert (UM)

East of Ely on Highway 1 (UM)

North Kawishiwi River (UM)

Burntside Lake (UM)

Portage between Vermilion Lake and Trout Lake (UM)

Habenaria lacera

South of study area: North of Zim on Highway 7 along railroad right-of-way (UM)

Habenaria orbiculata

In study area:	1 mile south of Picnic area on Lake Co. 2, S19, T57N, R10W (G)
	SW-1/4 SE-1/4 S14, T62N, R10W (O/R)
	Burntside Lake (UM)
	South Kawishiwi River (UM)
	Mud Lake (UM)
	Vermilion Lake (UM)
	S26, T60N, R12W (NS)
East of study area:	2 miles north of intersection Cook Co. 2 and 3, S 6, T61N, R4W (G)
	Mineral Center (UM)
	Partridge Lake, T65N, R1W (UM)
	French River (UM)
	SW-1/2 S12, T64N, R2W (UM)
South of study area:	13.5 miles north of Duluth on Highway 4 (UM)
	"St. Louis River" (UM)
West of study area:	Junction of Highway 53 and Lake Kabetogama Road (UM)
	Junction of Ash River and Highway 53 (UM)
BWCA:	NE-1/4 SE-1/4 S14, T64N, R04W (O/R)
	NW-1/4 SW-1/4 S6, T65N, R05W (O/R)
	Basswood Lake (UM)
	Portage between Moose Camp Lake and Gun Lake (UM)
	Devil's Track River (UM)
	Sawbill Lake, T63N, R04W (UM)

West of study area: Hammer Creek 3 miles from narrows of Namakan Lake (UM)

Vermilion River south of Crane Lake (UM)

In study area: Fall Lake (UM)

Esquagama Lake (UM)

Stony River at Highway 1 (UM) 1957 (Cu-Ni collection at same location about 20 years later!)

South Kawishiwi River (UM)

White Iron Lake (UM)

South of study area: Highway 53, 1 mile north of Carlton (UM)

17 miles N. of Duluth on Stony Point Road (UM)

Confluence of Floodwood and St. Louis Rivers at Floodwood (UM)

Prairie Lake (UM)

Indian Lake near Rollins (UM)

1 mile south of Zim on Highway 7 (UM)

Cloquet River at Rollins (UM)

East of study area: Between Jasper and Alpine Lakes (UM)

Knife River (UM)

Beaver River on Highway 61 (UM)

Kettle Falls (UM)

Habenaria viridis

East of study area: North Fowl Lake, T65N, R3W (UM)

Manitou River, T58N, R6W (UM)

Grand Portage, T63N, R3E, also T63N, R6E (8 coll. UM)

Liparis loeselii

East of study area: 2 miles east of Lake-Cook County Line, T58N, R5W (UM)

South of study area: Duluth (UM)

NW of Floodwood on Highway 2, St. Louis/Aitkin Co. Border (UM)

N. of Rollins (UM)

West of study area: Sturgeon Lake (UM)

7 miles SE of Hibbing (UM)

In study area: 2 miles south of Babbitt in Reserve Mining Co. Tailings Basin (UM)

North of Greenwood Lake on Highway 2 (UM)

Listera cordata

BWCA: Larsen Lake Spruce S28, T64N, R2W (JD)

Winchell-Larson Lake Bog, S28, T64N, R2W (JD)

Meads Lake Bog, SW-1/4, S13, T64N, R2W (JD)

Lesson Lake Bog (JD)

East Bearskin Lake (JD)

Swamper Lake Alder (JD)

In study area: Amax exploration site (AMAX)

SW-1/4 SW-1/4 S25, T60N, R12W (NS)

Colvin tailings disposal site, 12 miles SE of Babbitt (UM)

Malaxis brachypoda

West of study area: Junction of Highway 53 and Ash River (UM)

Prairie Lake Road at Highway 51 (UM)

Malaxis unifolia

East of study area:	Grand Portage (UM)
	Kelso Mountain, T63N, R5W (UM)
	2 miles east of Lake-Cook County Line, T58N, R5W (UM)
	Tofte (UM)
	"Shovel Pt., Lake Co. Station 5" (UM)
BWCA:	Bass Lake (UM)
	West of Curtain Falls Portage (UM)
West of study area:	Ash River junction with Highway 53 (UM)
	Lake Kabetogama (UM)
	Ash River Observation Tower (UM)
	Sturgeon Lake Observation Tower (UM)
South of study area:	Duluth (UM)
	Prairie Lake (UM)
	1-1/2 mi. N. of Palmerson, DMIR railroad track (UM)
In study area:	Highway 2, 30 miles north of Two Harbors (UM)
	Moose Line Road near St. Louis River (UM)
	Portage between Trout and Vermilion Lakes (UM)
	Plot G34, SE-1/4 S19, T57N, R14W (Cu-Ni)

Pogonia ophioglossoides

In study area:	Denley Lake Bog, NE-1/4 S2, T60N, R10W (Cu-Ni)
BWCA:	Basswood Lake (OL)
	South of Lac La Croix (approximate location from OL)

Larsen Lake spruce bog north-central S28, T64N, R2W (JD)

Sawbill Trail, 3 miles south of Sawbill Lake, T62N, R4W (UM)

S9, T64N, R10W (UM)

Portage between Little Alice Lake and Saganaga Lake (UM)

West of study area: Sturgeon Lake, Highway 5 about 25 miles N. of Hibbing (UM)

Sturgeon Lake Observation Tower, 25 miles N. of Hibbing (UM)

South of study area: Normanna Township, 16 miles N. of Duluth on Highway 4 (UM)

Finberg Lake on Highway 73 north of Floodwood Lake (UM)

Small Lake Fredericksburg Township, 18 miles N. of Duluth (UM)

Spiranthes cernua (No locations in UM, specimens on loan)

Spiranthes lacera (Locations from UM herbarium approximate, specimens on loan)

In study area: SE-1/4 NE-1/4 S10, T61N, R12W (EJC)

West of Fall Lake (UM)

Just west of East Arm, South Kawishiwi River (UM)

North of Shagawa Lake (UM)

Road to Seven Beaver Lake west of Toimi (UM)

North end of Fall Lake (UM)

Northwest of Hoyt Lakes (approximate location from OL)

North of Aurora (UM)

East of Highway 4 and north of Highway 341, south of Pineville (OL)

S29, T60N, R12W (AMAX)

West of Eveleth (approximate location from OL)

Plot T01, S14, T60N, R12W (Cu-Ni)

Plot G04, S24, T59N, R13W (Cu-Ni)

Plot G10, S32, T57N, R14W (Cu-Ni)

Plot G12, S28, T57N, R12W (Cu-Ni)

Plot G42, S17, T57N, R13W (Cu-Ni)

Plot N06, S10, T59N, R12W (Cu-Ni)

Plot S41, S23, T62N, R11W (Cu-Ni)

North of study area: Basswood Lake (OL)

Basswood River (CW/SO)

Portage from Echo Trail to Bass Lake (CW/SO)

NW-1/4 NW-1/4 S25, T64N, R04W (O/R)

West of study area: Ash forest Sturgeon River valley, Highway 73 (UM)

Highway 5, about 5 miles north of Meadowlands (UM)

Meadowlands (UM)

Paleface River (approximate location from OL)

Highway 53, north of Virginia, 2 locations (OL)

Near Eveleth (approximate location from OL)

Southwest of Hibbing on Highway 73 (OL)

West side Blackduck Trail, T66N, R19W (G)

About 1 mile E. of intersection 71 and Minn. 1, S14, T62N, R18W (G)

Highway 73 west of Pelican Lake, 2 locations (OL)

Ash River - Moose Bay Trail (UM)

Namakan Lake at the narrows (OL)

Lake Kabetogama (OL)

Near Kabetogama Tower (approximate location, OL)

East of study area: Mineral Center, T63N, R5E (UM)

Sawbill Lake, T62N, R4W (UM)

Grand Portage (UM)

Poplar Lake area, T64N, R1W (UM)

South Fowl Lake, T64N, R3E (UM)

2 miles north of Two Harbors (UM)

Pigeon River (UM)

Manitou River,2 miles from Lake Superior (UM)

S20, T64N, R10W (UM)

Gooseberry River (UM)

Encampment Forest (UM)

French River (UM)

Midway Road about 2 miles N. of Jct. 61 (UM)

Sucker River Woods (UM)

.4 miles north of intersection Lake Co. 4 and Beaver River, S23, T56N, R8W (G)

.4 mile east of county line on Cook Co. 1, S7, T58N, R5W (G)

6.65 miles north of Lutsen on Cook Co. 4, S34, T61N, R3W (G)

0.1 miles north of intersection of Cook Co. 57 and USFS 158, S36, T62N, R2W (G)

South of study area: West Swan River, north of Toivola on Hwy. 5 (UM)

Duluth (UM)

Brookston (UM)

Prairie Lake, SW St. Louis County (UM)

Fond du Lac (UM)

Trillium cernuum var. micranthrum

South of study area: Duluth (UM)

St. Louis River (UM)

Highway 51, Prairie Lake (UM)

Trillium grandiflorum

BWCA: NW-1/4 SW-1/4 S11, T65N, R14W (O/R)

South of study area: Highway 5, N. of junction 133, 4 miles N. of Meadowlands (UM)

Nopeming on Highway 61 (UM)

Duluth (UM)

Fond du Lac (UM)

Wrenshall (UMD)

In study area: Plot T1 (DS) (no voucher)

Protection status - Rare in Minnesota (Morley, 1972)

Adlumia fungosa (non-native, imported from Wisconsin in late 1800's)

South of study area: Duluth (UM)

Minnesota point (UM)

Island Lake Bridge, 20 miles N. of Duluth (UM)

Ammophila breviligulata

East of study area: Two Harbors (UM)

Arenaria macrophylla

In study area: Plot T20, SE-1/4 NW-1/4 S26, T62N, R11W (Cu-Ni)

Endless Waters Trail, Kawishiwi River, Lake Co. (UM)

East of study area: 1/2 mile from east end of Mountain Lake, T65N, R2E (UM)

Rove Lake, T65N, R1E (UM)

Between Clearwater and West Pike Lakes, T65N, R2E (UM)

South end south Fowl Lake, T64N, R3E (UM)

3/4 mile east of source of Royal River, T64N, R3E (UM)

Watab Lake, T65N, R1E (UM)

Royal Lake, T64N, R3E (UM)

Artemisia canadensis

East of study area: South Fowl Lake, T64N, R3E (UM)
Mount Josephine near Grand Portage, T63N, R3E (UM)
Grand Palisades, Hwy. 61, 6 mi. NE of Beaver Bay (UM)

Aster prealtus

South of study area: Prairie Lake area (UM)

Athyrium thelypteroldes

Previously reported station in northeastern St. Louis County was incorrect (UM)

Bidens discoidea

In study area: Portage between Trout Lake and Vermilion Lake (UM)

South of study area: Small Lake on Fredenberg L. Road (UM)
New Duluth (UM)
St. Louis River Estuary, Duluth (UM)

Caltha natans

In study area: Vermilion Lake (UM)
Tower (UM)
T58N, R17W, S35, 1.5 mile south of Gilbert (UM)

West of study area: Highway 73, north of Hibbing, east of Sturgeon Lake and west of Lake Leander (OL)
6 miles southeast of Hibbing (UM)

South of study area: East side of Highway 7, 1 mile south of Zim (UM)

Cardamine pratensis

South of study area: Floodwood River Marsh, 3 miles north of Floodwood (UM)

North of study area: East End Crooked Lake (approximate location OL)

Carex cephalantha

No location available at UM, specimens on loan

Carex Katahdinensis

BWCA: Iron Lake, south of Curtain Falls (UM)

Carex ormostachya

In study area: Burntside Lake (UM)

East of study area: Gooseberry Falls State Park (UM)
Between Clearwater and Pike Lakes, T65N, R2E (UM)

Corispermum nitidum

South of study area: Duluth (UM)

Deschampsia flexuosa

East of study area: Two Harbors (UM)

Pigeon Point (UM)

Galium verum

South of study area: Duluth (UM)

Geocaulon lividum (Comandra livida)

In study area: Spruce bog along Tomahawk road between Highway 1 and Isabella. (Cu-Ni, UM, UMD)

East of Study Area: Pigeon River near highway 1 Pigeon Point T64N, R75W (sic, Grand Portage Bay, Siesie Islands near Grand Portage

West of Study Area: Pine Creek, Angle Inlet, Lake of the Woods County

Geum laciniatum

South of study area: Elm-ash forest, Highway 5, north of Toivola (UM)

Swan River, Highway 27, Southeast of Hibbing (UM)

Terrace of Whiteface River, 1 mile south of Cotton (UM)

Glyceria pallida

West of Study Area: "Vermilion Lake"

Juncus brachycephalus

Absent from herbarium

Juncus stygius

In study area: Head of St. Louis River (UM)

Littorella americana

BWCA: Basswood Lake (UM)

Snowbank Lake (UM)

Luzula parviflora

East of study area: North of Grand Marais (UM)

Madia glomerata

West of study area: Chisholm (UM)

Duluth (OL)

Muhlenbergia uniflora

East of study area: Lake-Cook County line, near Little Saganaga Lake (UM)

In study area: Near head of the St. Louis River (UM)

Nymphaea tetragona

In study area: Bald Eagle Lake (UM)

Ophioglossum vulgatum v. pseudopodum

South of study area: 7 miles SE of Hibbing (UM)

Superior Bay (UM)

West of study area: Sturgeon Lake (UM)

Penstomen pallidus

South of study area: Gowan, St. Louis County at junction of Prairie Lake Road and Hwy. 2 (UM)

East of study area: Tofte (UM)

Poa chaixii

East of study area: Two Harbors (UM)

Poa sylvestris

In study area: Head of St. Louis River (UM)

Poa trivialis

East of study area: Two Harbors, 2 sites (UM)

Poa wolfii

East of Study Area: Beaver Bay Island, Gliff of Gooseberry River

Polygonum ramosissimum — This taxon is represented by 27 collections in the University of Minnesota herbarium and cannot be considered as rare.

Ranunculus gmelini

BWCA and north of study area: Basswood Lake, Central portion (approximate location from OL)

Basswood Lake near Prairie Portage (approximate location from OL)

West of study area: Vermilion River at the Gorge, 3 miles north of Gold Mine Camp (UM)

South of study area: Highway 73 north of Meadowlands junction (UM)

Cloquet River Woods 16 miles north of Duluth (UM)

In study area: Armstrong Lake near Ely (UM)

Vermilion Lake (UM)

Vermilion Lake at Glenwood Lodge (UM)

Ranunculus lapponicus

In study area:	Highway 1, 1 mile from Soudan (UM)
Northwest of study area:	Highway 5, North of Sturgeon Lake, Marcum (UM)
	Crane Lake Road, north of Vermilion River Bridge (UM)
	Halfway between Effie and Togo (UM)

Rhynchospora fusca

In study area:	"Wahlberg Station, south of Soudan on Highway 35" (UM)

Rubus chamaemorus

BWCA:	Back Bay, Basswood Lake (UM) (UMD)
	Snowbank Lake (UM)

Rubus folioflorus

South of study area:	Island Lake Resort, Highway 73, south of Hibbing (UM)

Sagina procumbens

East of study area:	Two Harbors (UM)
	Grand Portage (UM)

Sagittaria graminea

West of study area:	St Louis-Itasca County line near Bear River (UM)

Salix pellita

South of study area: South of Indian Lake near Rollins (8 miles south of study area, 3 miles east of Cadotte L.) (UM)

Senecio indecorus

East of study area: Susie Islands near Grand Portage, Pigeon River-Partridge Falls, S35, T53N, R5W Lake County "near Grand Marais", Lucille Island, Susie Islands south side John Lake, T65N, R5E

Sparganium glomeratum

BWCA: Basswood Lake (UM)

South of study area: Bog 18 miles N. of Duluth on Hwy. 53 (UM)

Minnesota Point, Duluth (UM)

Spiraea latifolia

East of study area: Between Beaver Bay and the Palisades (UM)

Subularia aquatica

BWCA: Snowbank Lake (UM)

Basswood Lodge, (in bay west of Washington Island) Basswood Lake (UM)

East of study area: Poplar Lake, T64N, R2W (UM)

Tofieldia pusilla

East of study area: Two Harbors (UM)

Grand Marais (UM)

Tsuga canadensis

West of study area: Bear River (UM)

South of study area: Duluth (UM)
Carlton (UM)
Finlayson (UM)
Jay Cooke State Park (UM)

Waldsteinia fragariodes

BWCA: NW-1/4 NW-1/4 S4, T65N, R06W (O/R)
SE-1/4 SW-1/4 S5, T63N, R3W (O/R)
Little Sioux Fire area, stands 1, 2 and 5, T65 and 66N, R14W (O/R)
NE-1/4 NE-1/4 S13, T65N, R7W (O/R)
NE-1/4 SW-1/4 S14, T65N, R15W (O/R)

Unknown: Juction of Highway 20 and Vermilion Road at Bass Lake (UM)

South of study area: Jack pine forest on highway from Brimson to Two Harbors (UM)

In study area: Sandy jack pine forest south of Gilbert, Highway 20, St. Louis County (UM)

Woodsia glabella

East of study area: Grand Portage (UM)
Pigeon Point (UM)
Gooseberry River (UM)

Woodsia scopulina

East of study area: Between Mountain Lake and Pike Lake, T65N, R2E (UM)

Pigeon Point (UM)

Watab Lake, T65N, R1E (UM)

S. Fowl Lake, T65N, R1E (UM)

N. Fowl Lake, T64N, R3E (UM)

West Pike Lake, T65N, R2E (UM)

Grand Portage (UM)

Between Clearwater Lake and West Pike Lake, T65N, R2E (UM)

Between Clearwater Lake and Mountain Lake, T65N, R1E (UM)

3/8 mile east of source of Royal River, T64N, R3E (UM)

Between Mountain Lake and Moose Lake, T65N, R2E (UM)

Royal Lake, T64N, R3E (UM)

Alder Lake, T64N, R1E (UM)

Clearwater Lake, T65N, R1E (UM)

McFarland Lake, T64N, R3E (UM)

East end of Mountain Lake, T65N, R2E (UM)

Xyris montana

South of study area: Hornby Lake, T56N, R12W (UM)

APPENDIX V

SITES WITH COLLECTIONS OF MORE THAN ONE RARE OR PROTECTED PLANT SPECIES

	Number of Species protected by Minnesota Statute 17.23	Species recognized as rare in Minnesota
"Basswood Lake"	8	5
Lake Vermilion	9	3
Pigeon Point	4	3
South Fowl Lake	1	3
Grand Portage	5	2
Prairie Lake	11	1
Burntside Lake	8	1
Poplar Lake	4	1
Lake Vermilion - Trout Lake Portage	3	1
Sturgeon Lake	3	1
Crane Lake Road, at Vermilion River	2	1
North Fowl Lake	2	1
Seagull Lake	9	
North Kawishiwi River	7	
South Kawishiwi River	6	
Highway 53, Kabetogama Road	6	
Ash River Jct. Highway 53	6	
Namakan Lake Narrows	5	
16 miles N. of Duluth, Normanna Twp.	5	
6 miles south of Biwabik	4	
Sturgeon L. Obs. Tower	4	
Finberg Lake	3	

APPENDIX VI
Relationship of rare and protected plants to habitat types

	Total # occurrence of species in all stands	BLACK SPRUCE BOG IA							TAMARACK BOG IB					
		T05 m	T30 m	G02 m	G03 m	Other	Stands	T16 i	T31 i	Denly L. Bog	Other			
Arenaria macrophylla	1													
Geocaulon lividum	1	x												
Arethusa bulbosa	1									x				
Corallorhiza maculata	14													
Corallorhiza striata	3													
Corallorhiza trifida	2													
Cypripedium acaule	9													
Goodyera repens	12				x	S28	R74							
Goodyera tesselata	3		x											
Habenaria dilatata	1													
Habenaria hyperborea	5				x		R74							
Habenaria obtusata	1													
Habenaria orbiculata	1													
Habenaria psychodes	1										Stony R., Hwy 1			
Listera cordata	1					N22								
Malaxis unifolia	1													
Pogonia ophioglossoides	1									x				
Spiranthes lacera	1													
Spiranthes Romanzoffiana	1													
Trillium cernuum	7													
Epigaea repens	1													
Botrychium matricariaefolium	1													
Lycopodium annotinum v. acrifolium	2			x										
Lycopodium Selago	1								x					
Rubus acaulis	2							x	x					
Gentiana spp.	79													
TOTAL FOR PLOT		1	1	1	2	1	2	1	2	2	1			
TOTAL FOR HABITAT		8						6						
RARE PLANT HABITAT INDEX		HI=.56, 10·8%						HI = 2.28, 8·2%						

Stands in which no rare plants were recorded.
T28m, G01y, G06m, G44m, T14i, T15i, G45i

APPENDIX VI continued

	CEDAR SWAMP IC			ASH V		SHRUB CARR VIIIA							
	T17 m	G43 m	G46 m	Other		G18							
Arenaria macrophylla													
Geocaulon lividum													
Arethusa bulbosa													
Corallorhiza maculata													
Corallorhiza striata													
Corallorhiza trifida			x										
Cypripedium acaule			x										
Goodyera repens													
Goodyera tesselata													
Habenaria dilatata													
Habenaria hyperborea	x	x				X							
Habenaria obtusata		x											
Habenaria orbiculata													
Habenaria psychodes													
Listera cordata													
Malaxis unifolia													
Pogonia ophioglossoides													
Spiranthes lacera													
Spiranthes Romanzoffiana													
Trillium cernuum				N06,S41									
Epigaea repens													
Botrychium matricariaefolium													
Lycopodium annotinum v. acrifolium													
Lycopodium Selago													
Rubus acaulis													
Gentiana spp.													
TOTAL FOR PLOT	1	2	2	2									
TOTAL FOR HABITAT	5			2		1							
RARE PLANT HABITAT INDEX	HI = .30 1·4%			HI = .69 2·7%		HI = .30 1·4%							

Stands in which no rare plants were recorded.
T25, T22, T24, D24, G48

APPENDIX VI

	BLACKSPRUCE-JACK PINE II						JACK PINE III						
	G25 y	G26 p	OTHER			T02 m	T20 y	T31 y	G17 m	G27 m	G30 m	Other	
Arenaria macrophylla							x						
Geocaulon lividum													
Arethusa bulbosa													
Corallorhiza maculata									x	x		N33	
Corallorhiza striata				S15									
Corallorhiza trifida													
Cypripedium acaule		x	J23,C07,N01,N35									S25	
Goodyera repens			N23						x	x	x		
Goodyera tesselata											x		
Habenaria dilatata													
Habenaria hyperborea													
Habenaria obtusata													
Habenaria orbiculata				N15									
Habenaria psychodes													
Listera cordata													
Malaxis unifolia													
Pogonia ophioglossoides													
Spiranthes lacera													
Spiranthes Romanzoffiana				C07									
Trillium cernuum													
Epigaea repens													
Botrychium matricariaefolium						x							
Lycopodium annotinum v. acrifolium	x												
Lycopodium Selago													
Rubus acaulis													
Gentiana spp.								x					
TOTAL FOR PLOT	1	2	7			1	1	1	1	1	1	1,1	
TOTAL FOR HABITAT	10					11							
RARE PLANT HABITAT INDEX	HI = 1.88					HI = 1.33							
	13·5%					14·9%							

Stands in which no rare plants were recorded.
T01m, T19,y G11y, G16p, G13y, G28p

APPENDIX VI continued

	RED PINE IV							WHITE SPRUCE IX					
	T04 m	T26 m	T32 m	T34 m	G20 y	G21 m	G23 m	G34 m	G35	G36			
Arenaria macrophylla													
Geocaulon lividum													
Arethusa bulbosa													
Corallorhiza maculata	x	x	x	x			x		x				
Corallorhiza striata													
Corallorhiza trifida													
Cypripedium acaule					x								
Goodyera repens													
Goodyera tesselata													
Habenaria dilatata										x			
Habenaria hyperborea													
Habenaria obtusata													
Habenaria orbiculata													
Habenaria psychodes													
Listera cordata													
Malaxis unifolia								x					
Pogonia ophioglossoides													
Spiranthes lacera													
Spiranthes Romanzoffiana													
Trillium cernuum								x					
Epigaea repens													
Botrychium matricariaefolium													
Lycopodium annotinum v. acrifolium													
Lycopodium Selago													
Rubus acaulis													
Gentiana spp.						x							
TOTAL FOR PLOT	1	1	1	1	1	1	1	2	1	1			
TOTAL FOR HABITAT	7							4					
RARE PLANT HABITAT INDEX	HI = 1.24							HI = 13.5					
	9·4%							5·4%					

Stands in which no rare plants were recorded.
G19y, G22p, G24m,

APPENDIX VI continued

	ASPEN-BIRCH VIB					VIC	ASPEN-BIRCH-FIR VID						
	T11 m	T13 p	G08 p	G10 y	G33 m	T18	T08 m	T10 m	G12 m	G42 m	OTHER		
Arenaria macrophylla													
Geocaulon lividum													
Arethusa bulbosa													
Corallorhiza maculata													
Corallorhiza striata	x	x					x	x		x			
Corallorhiza trifida											R22		
Cypripedium acaule													
Goodyera repens			x										
Goodyera tesselata					x	x					R67		
Habenaria dilatata													
Habenaria hyperborea													
Habenaria obtusata													
Habenaria orbiculata													
Habenaria psychodes													
Listera cordata													
Malaxis unifolia													
Pogonia ophioglossoides													
Spiranthes lacera													
Spiranthes Romanzoffiana													
Trillium cernuum													
Epigaea repens				x					x	x			
Botrychium matricariaefolium													
Lycopodium annotinum v. acrifolium													
Lycopodium Selago													
Rubus acaulis													
Gentiana spp.													
TOTAL FOR PLOT	1	1	1	1	1	1	1	1	1	2	2		
TOTAL FOR HABITAT	8					1			7				
RARE PLANT HABITAT INDEX	HI = .79												

16·8%

Stands in which no rare plants were recorded.
T07m, T12p, T27m, T20m, G09m, G32m, G39m, G40m,
T33m, G05m, G14m, G15m, G37y, G38m, G41m

APPENDIX VI continued

MIXED CONIFEROUS-DECIDUOUS

	VIIA		VIIB		VIIC								
	G04 m				G47 p								
Arenaria macrophylla													
Geocaulon lividum													
Arethusa bulbosa													
Corallorhiza maculata													
Corallorhiza striata		R79											
Corallorhiza trifida						S10							
Cypripedium acaule						S10							
Goodyera repens			R45,	R29									
Goodyera tesselata													
Habenaria dilatata													
Habenaria hyperborea													
Habenaria obtusata													
Habenaria orbiculata													
Habenaria psychodes													
Listera cordata													
Malaxis unifolia													
Pogonia ophioglossoides													
Spiranthes lacera													
Spiranthes Romanzoffiana			C06										
Trillium cernuum	x												
Epigaea repens													
Botrychium matricariaefolium													
Lycopodium annotinum v. acrifolium													
Lycopodium Selago													
Rubus acaulis													
Gentiana spp.													

TOTAL FOR PLOT	1	1				2							
TOTAL FOR HABITAT			7										
RARE PLANT HABITAT INDEX			HI = .49										
			9.4%										

APPENDIX VII

RARE LICHENS IN THE RCNSA

A LIST OF LICHENS WITH ONLY ONE OR TWO COLLECTIONS, ARRANGED BY HABITAT TYPE

VIC ASPEN-BIRCH-FIR COMMUNITY	Plots in this habitat	Total # of collections in RCNSA
Arthonia radiata	G38	1
Bacidia atrogrisea	G15	1
Bacidia naegelii	G38	1
Biatorella microhaema	G14	1
Candelaria fibrosa	G37	1
Chaenotheca ferruginea	G38	2
Cladonia arbuscula	G41	1
Cladonia caespiticia	G42	1
Cladonia cylindrica	G41	2
Cladonia macilenta	G41	1
Cladonia stellaris	G05	2
Lecidea vernalis	G15	1
Lepraria neglecta	G14	1
Leptogium tenuissimum	G37	2
Leptogium saturninum	G38	1
Lobaria pulmonaria	G15	2
Melanoma sp.	G12	1
Parmelia plittii	G05	2
Parmelia trabeculata	G12	1
Peltigera evansiana	G42	1

VIC ASPEN-BIRCH-FIR COMMUNITY (cont.)	Plots in this habitat	Total # of collections in RCNSA
Peltigera horizontalis	G05	1
Phaeocalicium polyporaeum	G12	1
Physia dubia	G05	1
Physia setosa	G37	1
Physia subtilis	G05	1
Rhizocarpon petraeum	G14	2

VIB NEARLY PURE ASPEN-BIRCH	Plot #s in this community	Total # of collections in RCNSA
Candelaria concolor	G40	2
Cladonia cylindrica	G10	2
Lasallia papulosa	G39	1
Lecanora caesiocinerea	G07	2
Lecidea plebeja	G39	1
Leptogium hirsutum	G08	1
Nephroma bellum	G08	1
Nephroma helveticum	G39	1
Parmelia aurulenta	G33	1
Parmelia fraudens		
Peltigera evansiana	G39	2
Physia phaea	G33, G39	2

IA SPRUCE BOG		
Calicium glaucellum	G03	1
Calicium parvum	G03	1
Chaenothecopsis debilis	G03, G06	2
Dimerella lutea	G03	2
Sphinctrina microcephala	G03	1
Xylographa abietina	G01	1

IX WHITE SPRUCE	Plot #s in this community	Total # of collections in RCNSA
Buellia schaereri	G35	1
Cladonia cornuta	G36	1
Dimerella lutea	G35	2
Lecidia erratica	G34	2
Lobaria pulmonaria	G35	2
Thrombium epigaeum	G34	2

IC CEDAR COMMUNITY	Plot #s in this habitat	Total # of collections in RCNSA
Bacidia schweinitzii	G46	1
Cetraria aurescens	G43, G46	2
Cetrelia chicitae	G46	2
Chaenotheca ferruginea	G43	2
Chaenotheca laevigata	G46	1
Chaenotheca trichialis	G43, G46	2
Lopadium pezizoideum	G43, G46	2
Micarea violacea	G43	1
Pannaria pityrea	G43, G46	2
Parmelia revoluta	G46	1
Pertusaria amara	G43, G46	2
Physia setosa	G46	2
Rinodina archaea	G43	1
Strigula stigmatella	G43	1

III JACK PINE	Plot #s in this habitat	Total # of collections in RCNSA
Cladonia farinacea	G25	1
Cladonia gonecha	G26	1
Cladonia stellaris	G25	2
Cetraria orbata	G28	2
Lecanora caesiocinerea	G11	2
Parmelia infumata	G26	1
Parmelia plittii	G26	2
Peltigera lepidophora	G26	1
Spilonema revertans	G25, G26	2
IV RED PINE		
Bacidia sabuletorum	G21	1
Candelaria concolor	G19	2
Cetrelia chicitae	G23	2
Collema nigrescens	G19	1
Lecidea erratica	G19	2
Leptogium tenuissimum	G24	2
Pachyphiale fagicola	G19	1
Rhizocarpon petraeum	G21	2
Thrombium epigaeum	G19	2
VIII ALDER		
Caloplaca flavorubescens	G18	1
Cyphelium tigellare	G18	1

V ASH (on USFS 130, S30, T57N, R14W)	Plot #s in this habitat	Total # of collections in RCNSA
Lobaria quercizans	---	1
Parmelia albertana	---	1
IB TAMARACK		
Cetraria orbata	G45	2
Cetraria sepincola	G45, G31	2
VII MIXED CONIFEROUS DECIDUOUS		
Cyphelium lucidum	G04	1
Rinodina adirondackii	G47	1
GRASSLAND		
Caloplaca arenaria	G29	1

APPENDIX VIII

HABITATS OF ORCHIDS IN THE GREAT LAKES REGION

(from Case, 1964 pp. 19-22)

"Northern, more open, black spruce - tamarack or spruce - tamarack-white cedar bogs"

Arethusa bulbosa

Calopogon pulchellus

Corallorhiza trifida

Cypripedium acaule

Habenaria dilatata

Listera cordata

Malaxis unifolia

Pogonia ophioglossoides

Spiranthes cernua

Spiranthes romanzoffiana

Habenaria obtusata

"Heavily wooded, cool, damp, mossy black spurce, tamarack white cedar, balsam fir swamps and bogs, where sphagrium is present primarily as a superficial surface layer and grows along with many other moss species"

Arethusa bulbosa (occasional in clearings)

Calypso bulbosa (always very local)

Corallorhiza maculata v. punicea

Corallorhiza striata

Corallorhiza trifida

Cypripedium acaule (occasional)

Cypripedium arietinum

Goodyera repens v. ophioides

Goodyera tesselata

Habenaria dilatata (occasional in clearings)

Habenaria hyperborea

Habenaria obtusata (abundant)

Habenaria orbiculata

Listera cordata

"Damp to wet, rather open aspen-alder thickets along streams, or in border meadows in drained beaver-dammed ponds"

Corallorhiza maculata

Corallorhiza striata

Corallorhiza trifida

Habenaria hyperborea

Habenaria psychodes

Spiranthes cernua

"Marl bogs, sandy, swampy lake shores, and floating sedge mats in otherwise more acid lake bogs"

Arethusa bulbosa (on logs or more acid hummocks)

Calopogon pulchellus (mostly on acid hummocks)

Habenaria dilatata

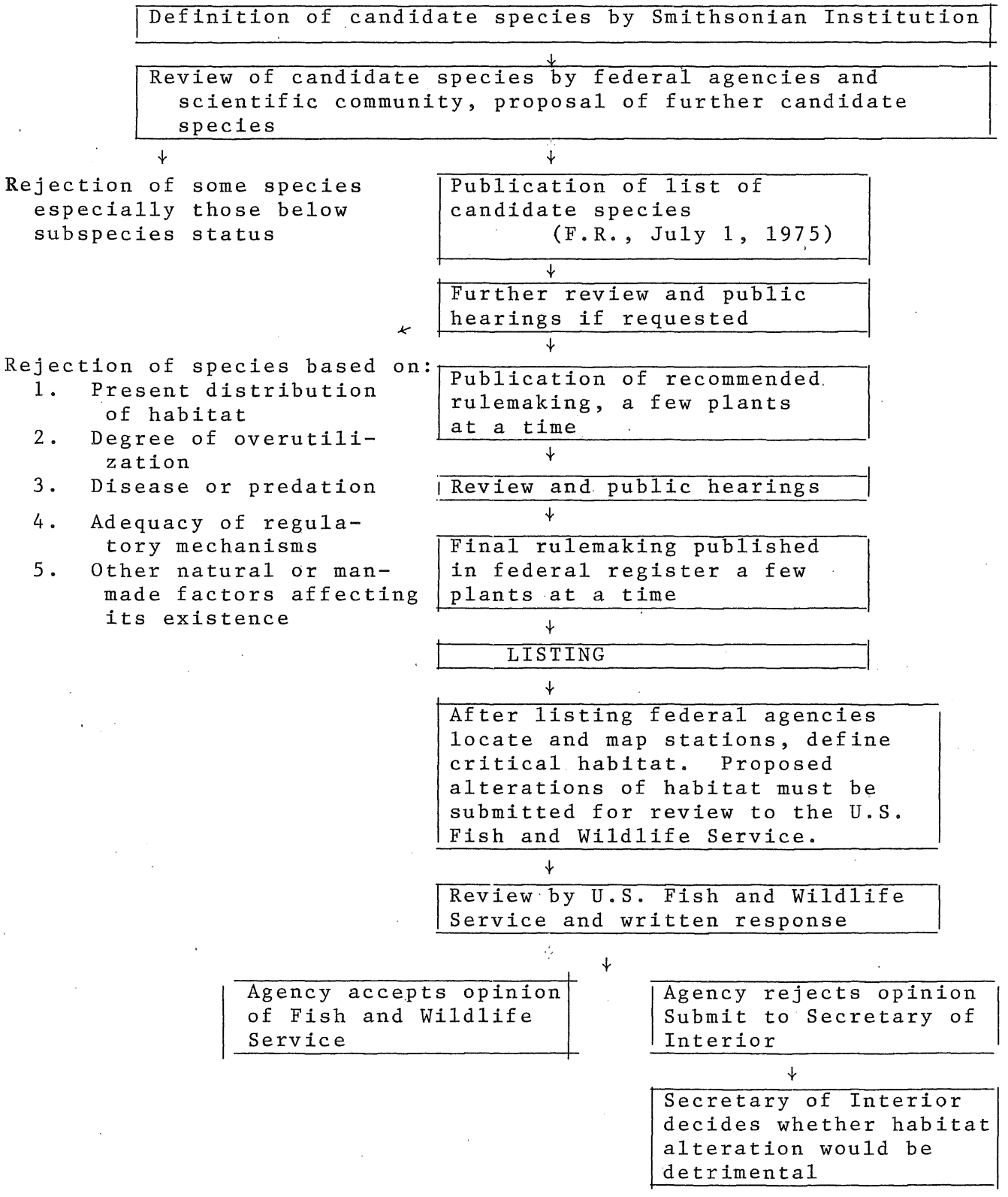
Habenaria hyperborea

Habenaria psychodes

Pogonia ophioglossoides

Spiranthes cernua

FIGURE 1. PROCEDURES FOR LISTING AND PROTECTING RARE PLANTS



after Zeedyk, et.al., 1978

Protection status - Nationally recognized as rare

Cypripedium arietinum ●

Listera auriculata ■

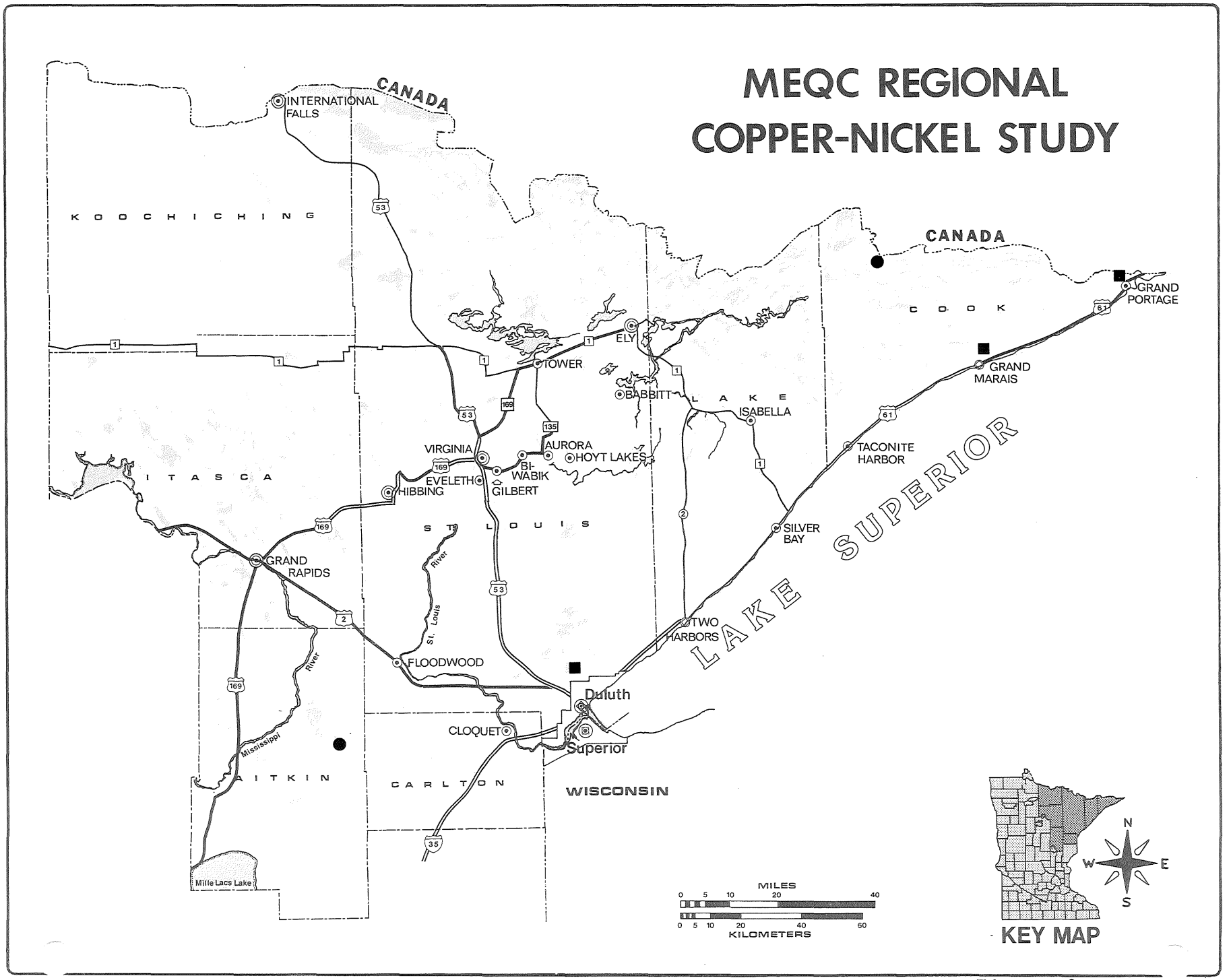


Figure 2

Protection status - Nationally rare

● Draba norvegica

■ Polemonium occidentale v. lacustre

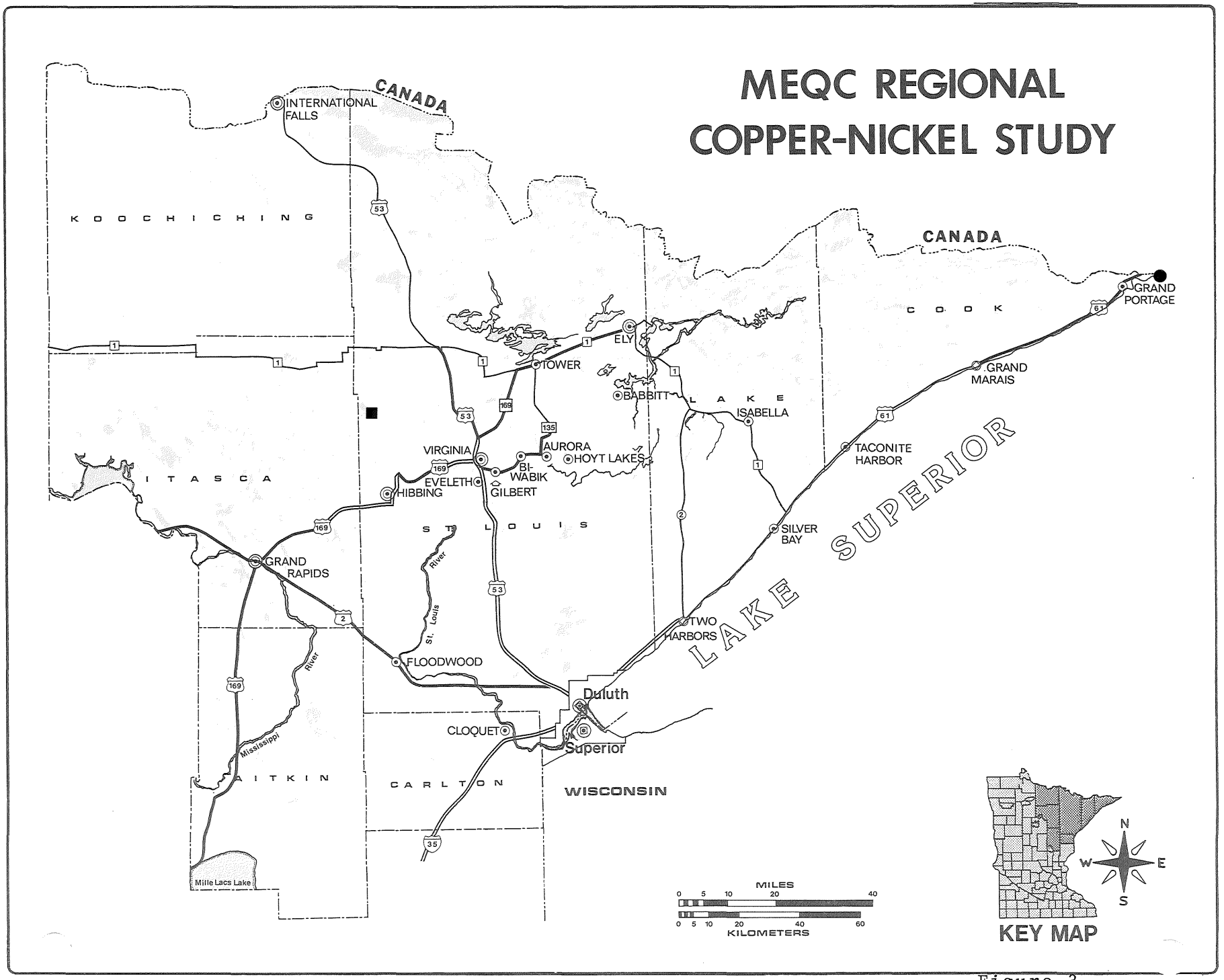


Figure 3

Protection status - Nationally recognized as rare

Woodsia abbeae ●

Gymnocarpium heterosporum ■

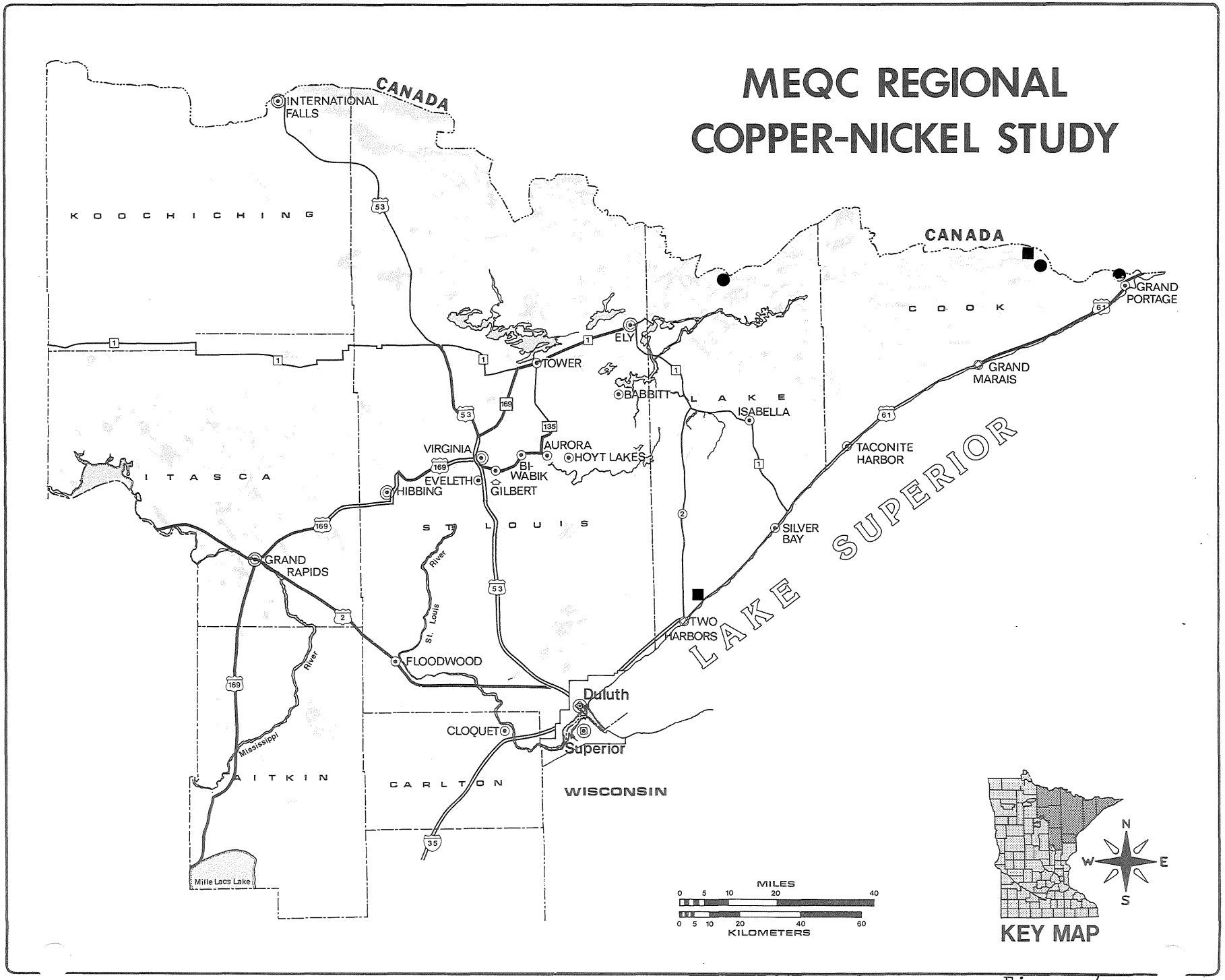


Figure 4

Arethusa bulbosa

Protection status: Protected by Minnesota Statute 17.23

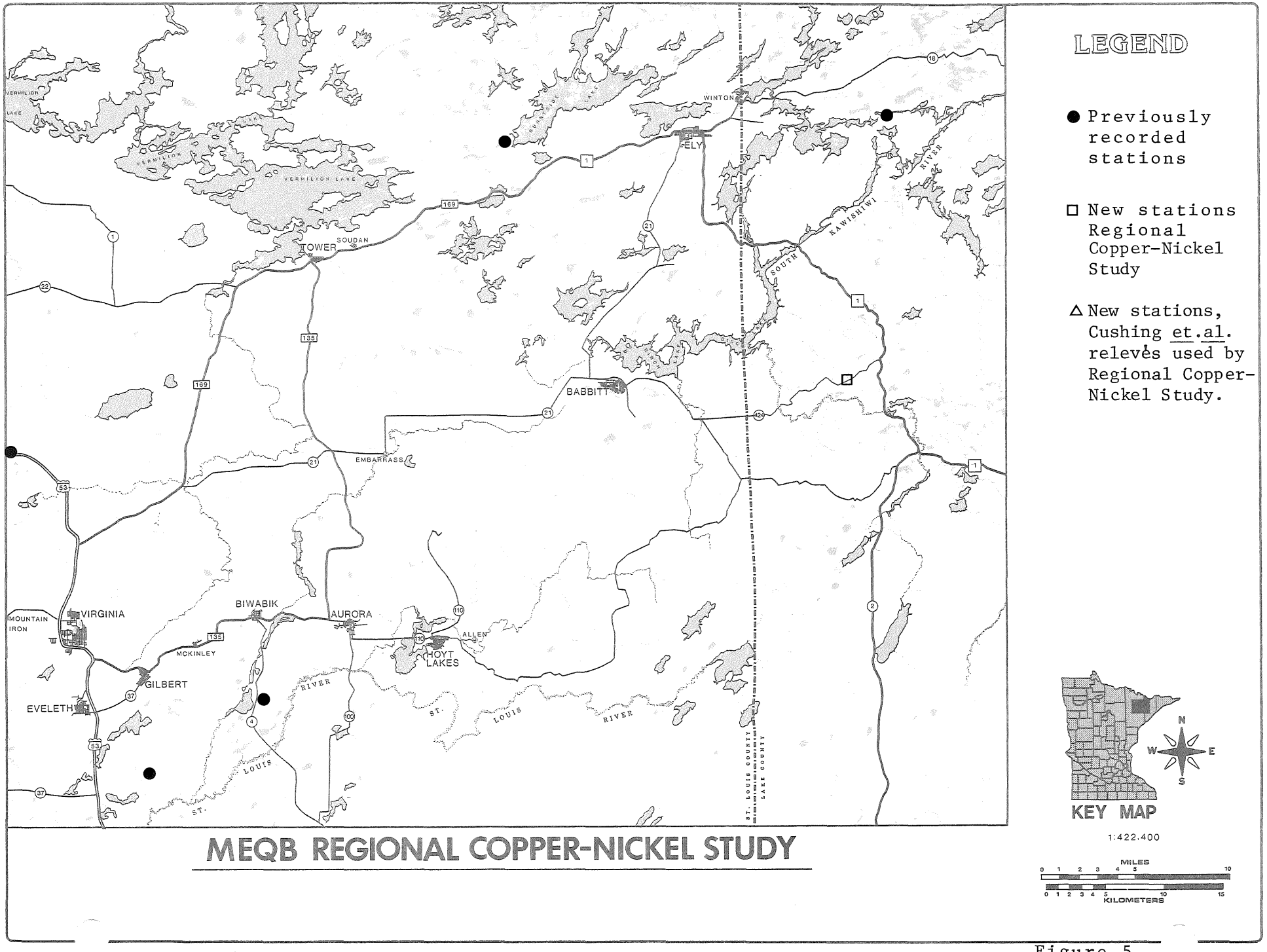


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Figure 5

Protection status: Protected by Minnesota Statute 17.23

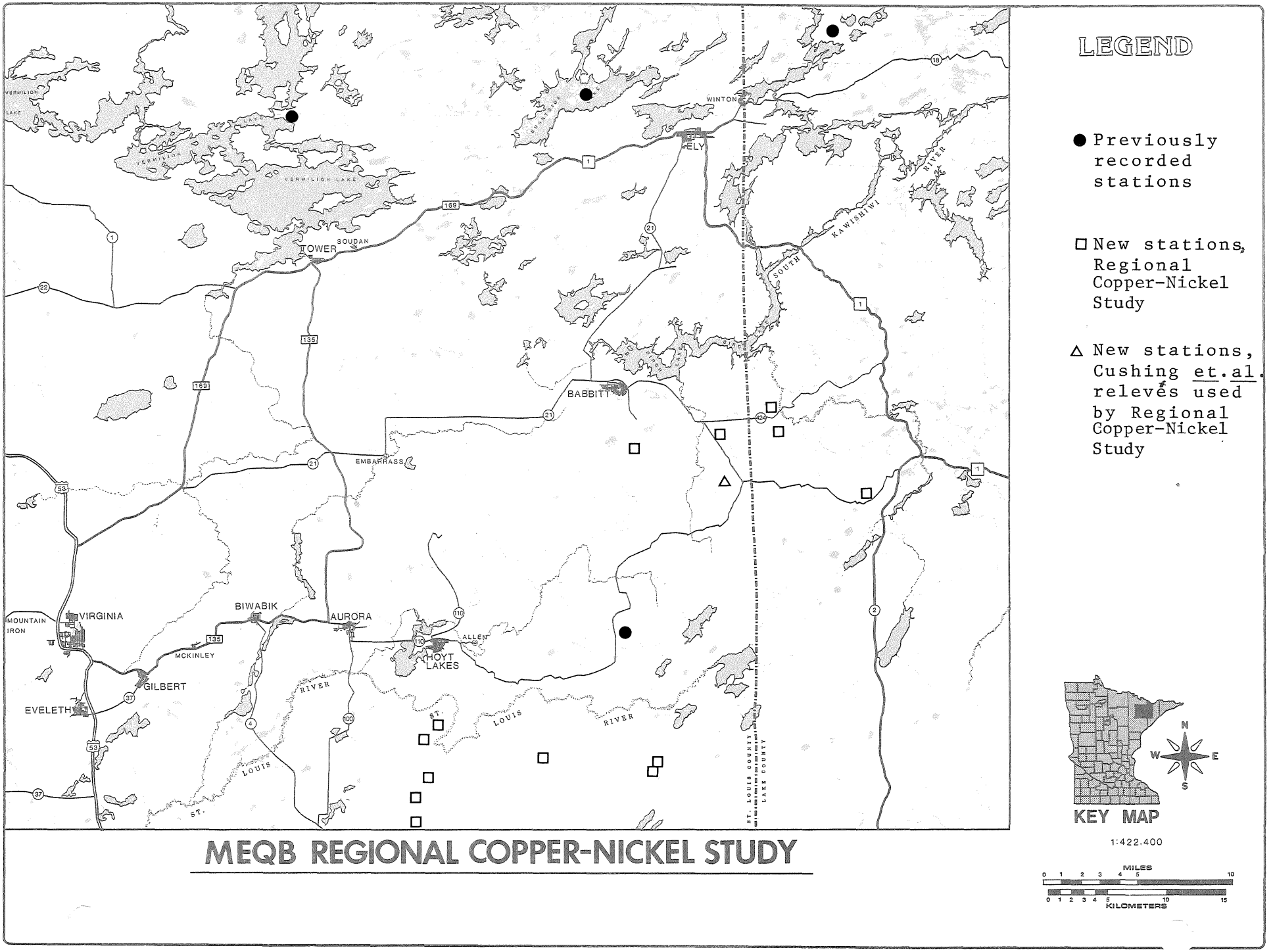

Figure 6

Corallorhiza striata

Protection status: Protected by Minnesota Statute 17.23

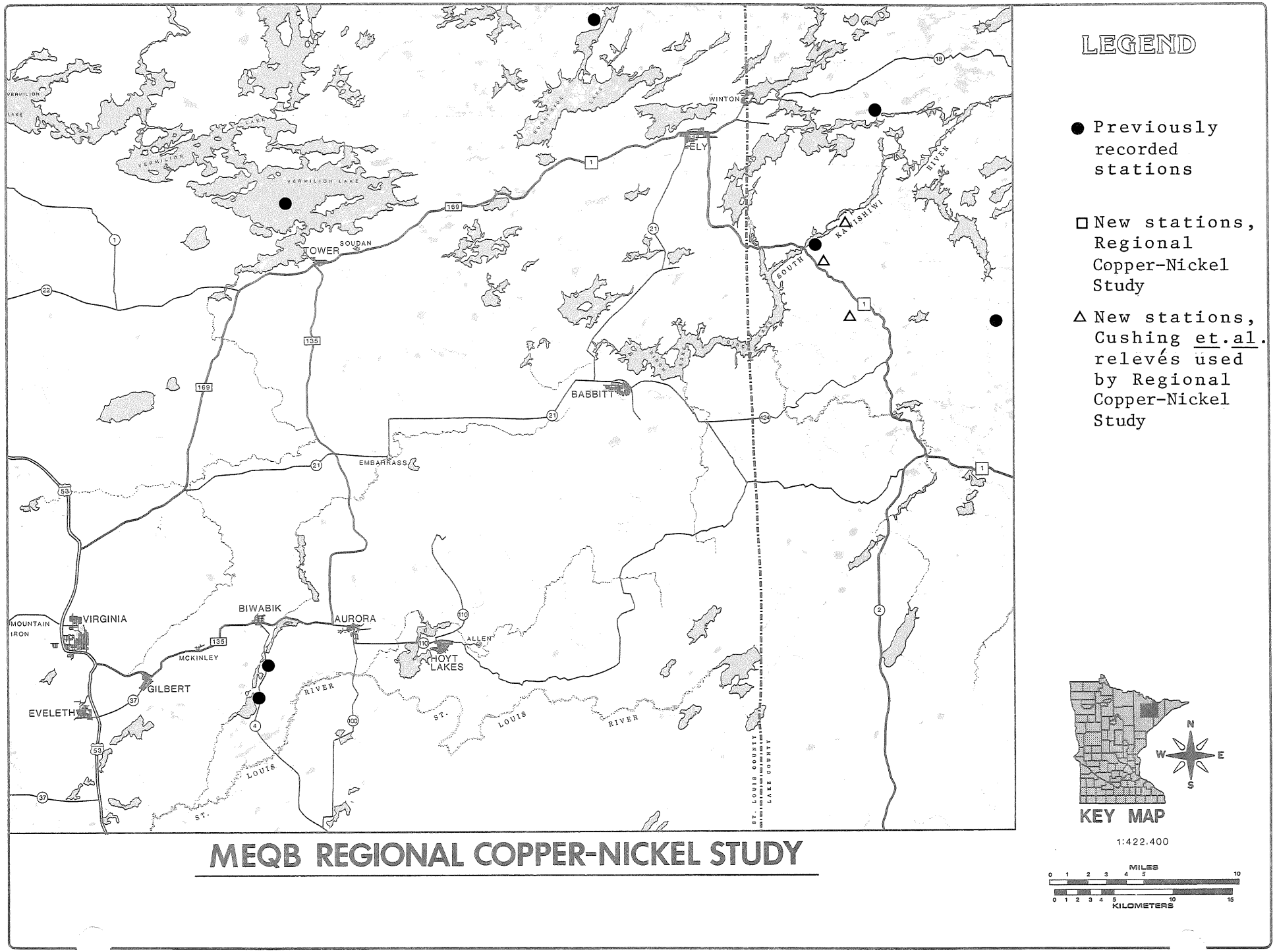

Figure 7

Corallorhiza trifida

Protection status: Protected by Minnesota Statute 17.23

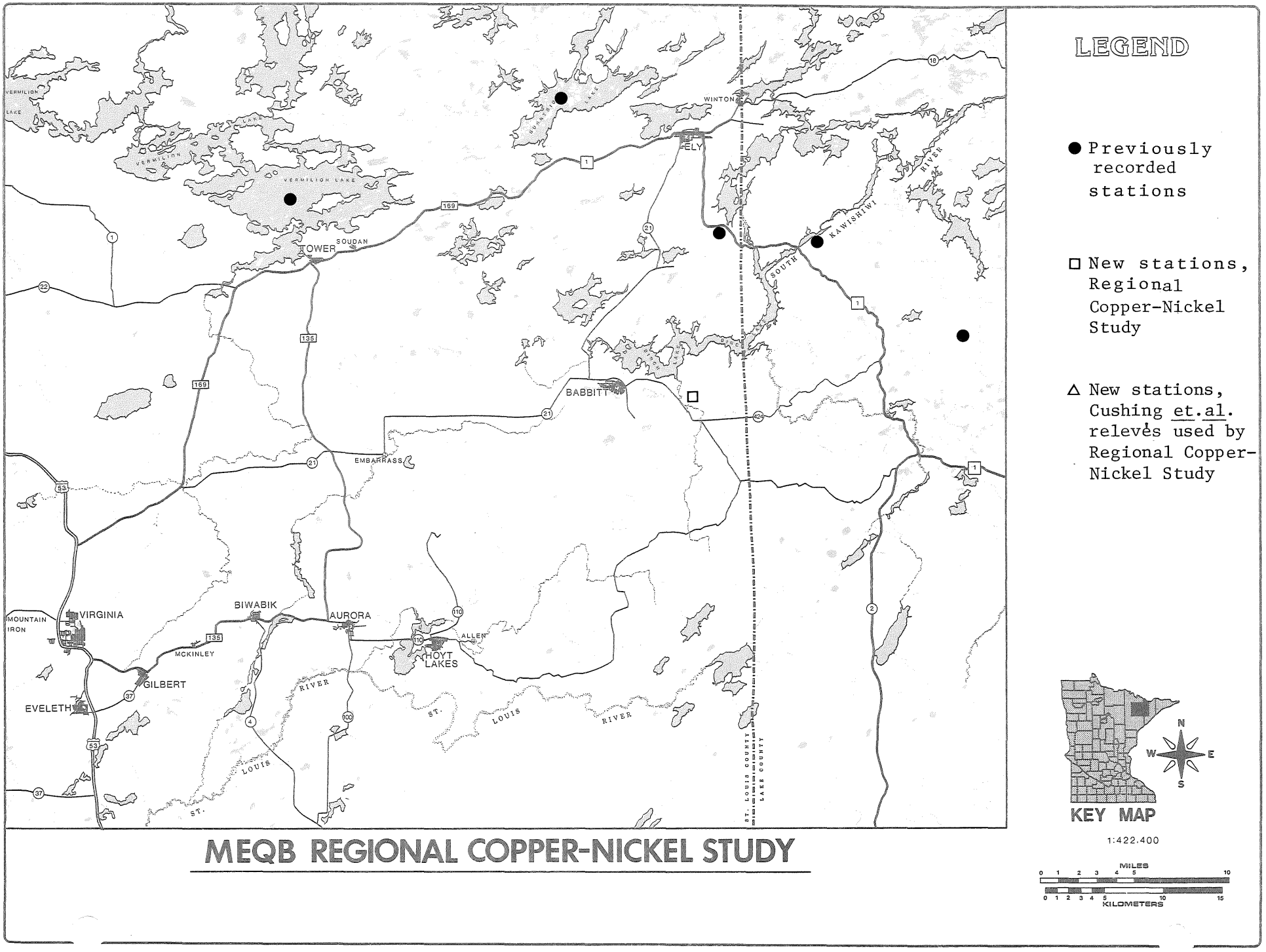

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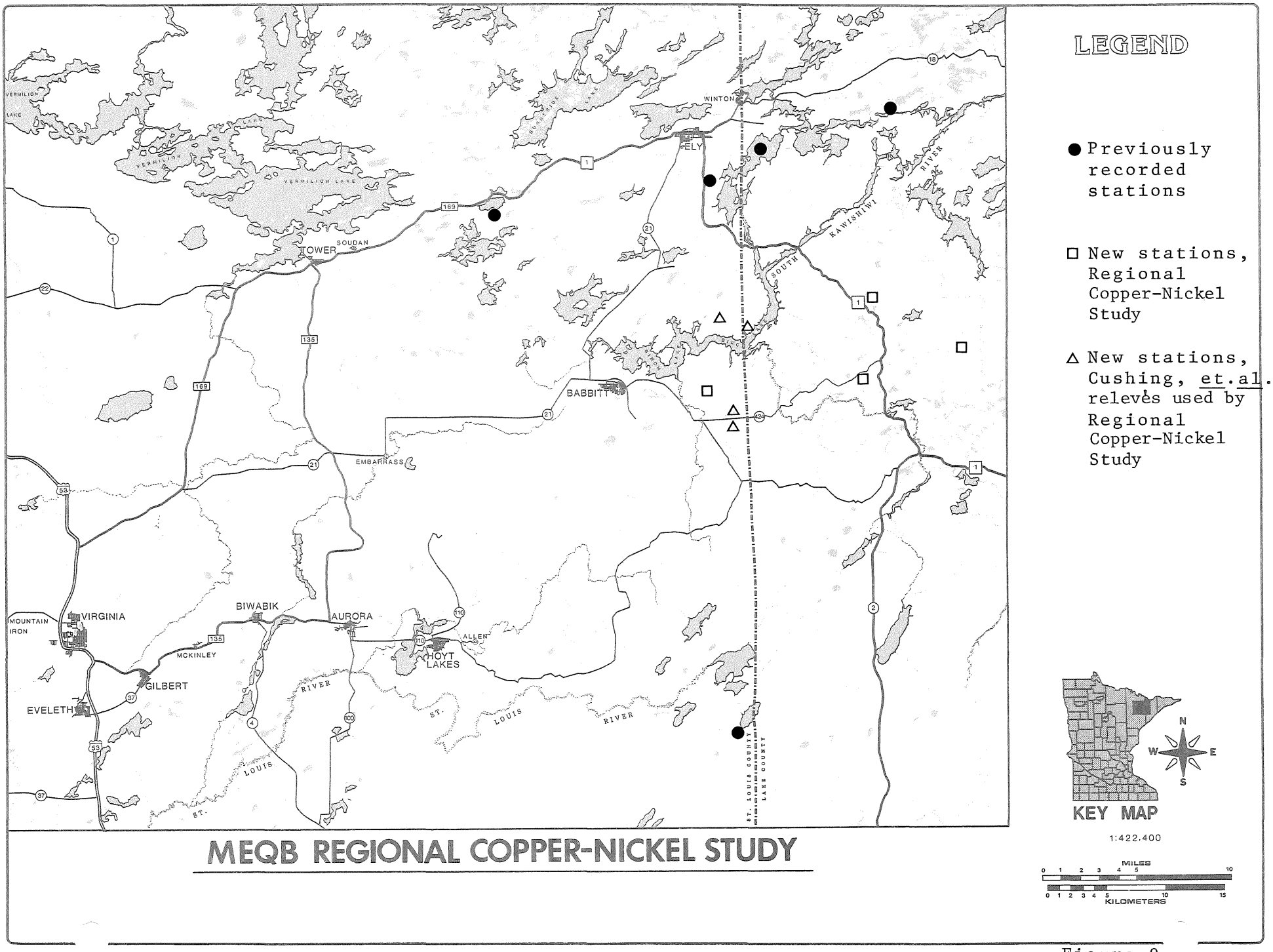
Figure 8

Cypripedium acaule

PROTECTION STATUS: Protected by Minnesota Statute 17.23

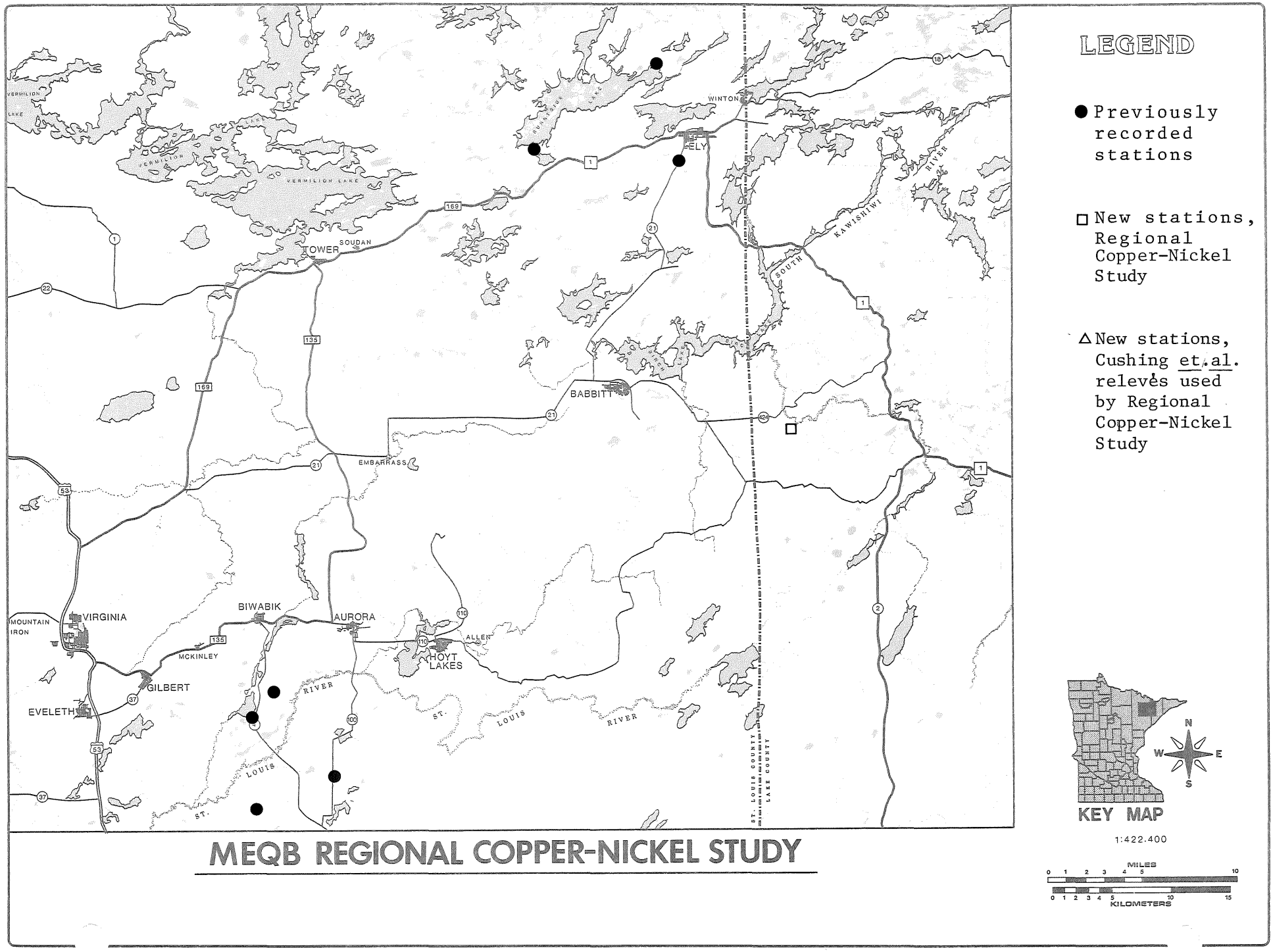


MEQB REGIONAL COPPER-NICKEL STUDY

Figure 9

Epigaea repens

Protection status: Protected by Minnesota Statute 17.23



MEQB REGIONAL COPPER-NICKEL STUDY

Figure 10

Gentiana rubricaulis

Protection status: Protected by Minnesota Statute 17.23

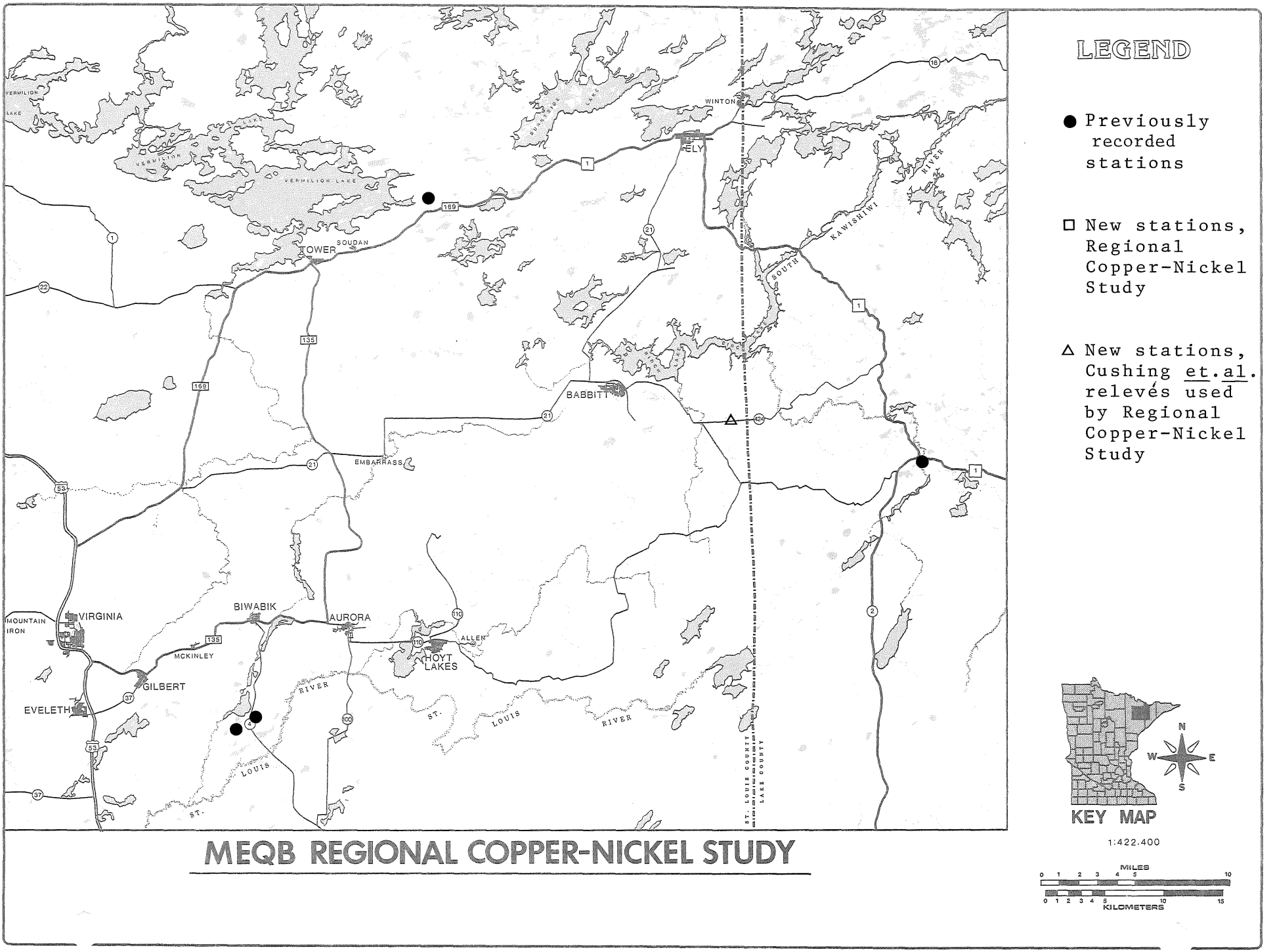


Figure 11

Goodyera repens

Protection status: Protected by Minnesota Statute 17.23

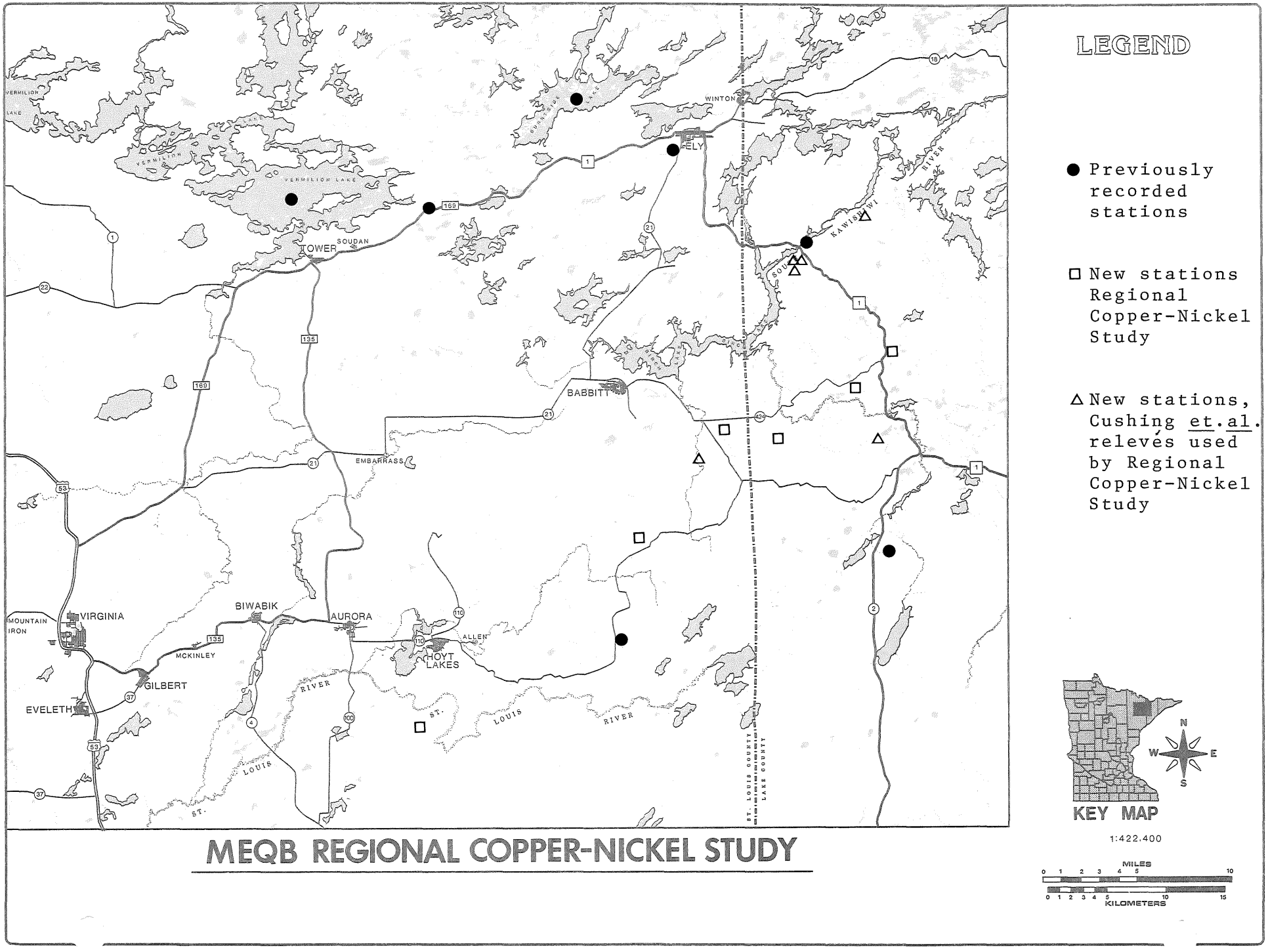
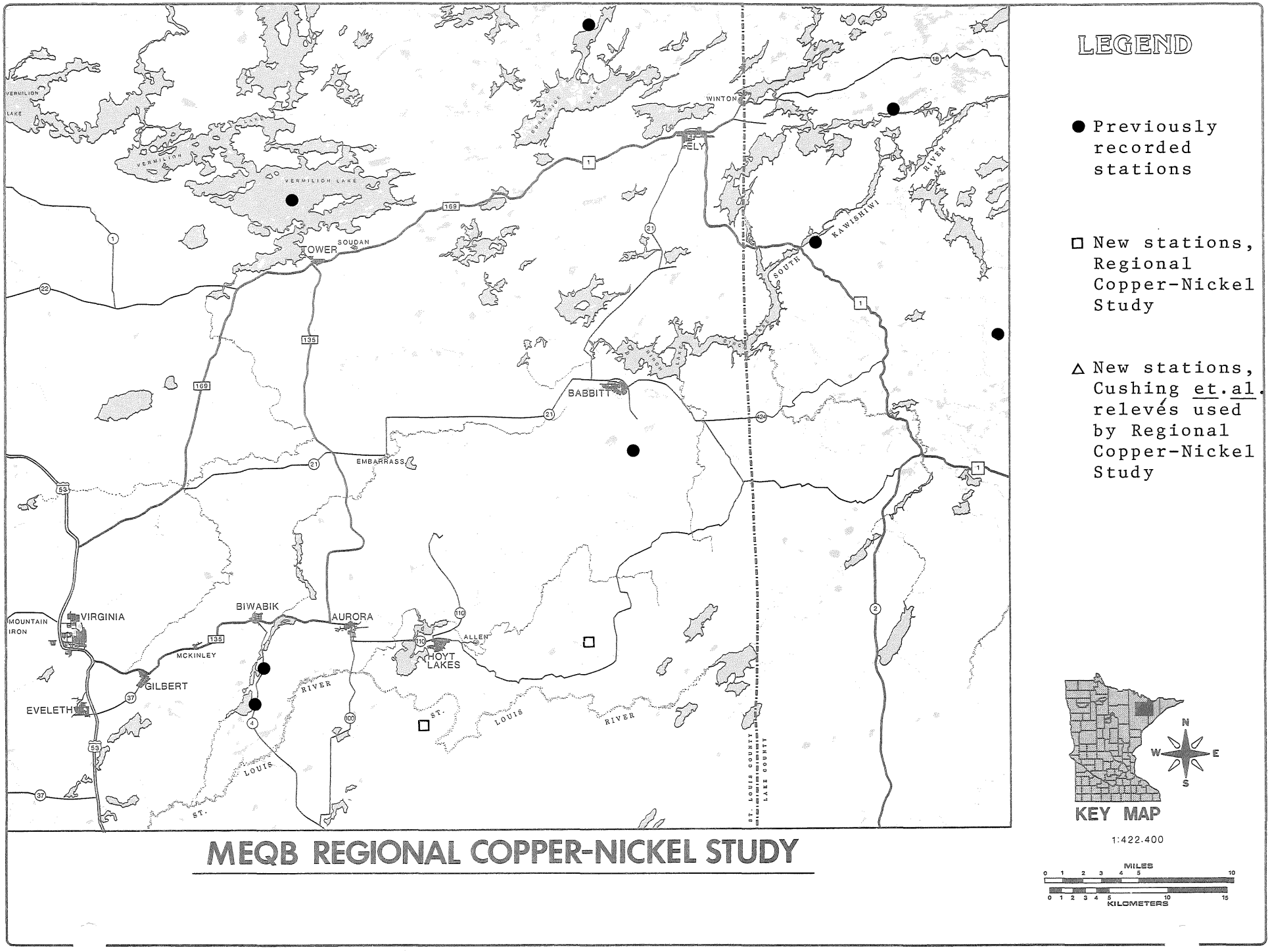


Figure 12

Goodyera tesselata

Protection status: Protected by Minnesota Statute 17.23



MEQB REGIONAL COPPER-NICKEL STUDY

Figure 13

Habenaria clavellata

Protection status: Protected by Minnesota Statute 17.23

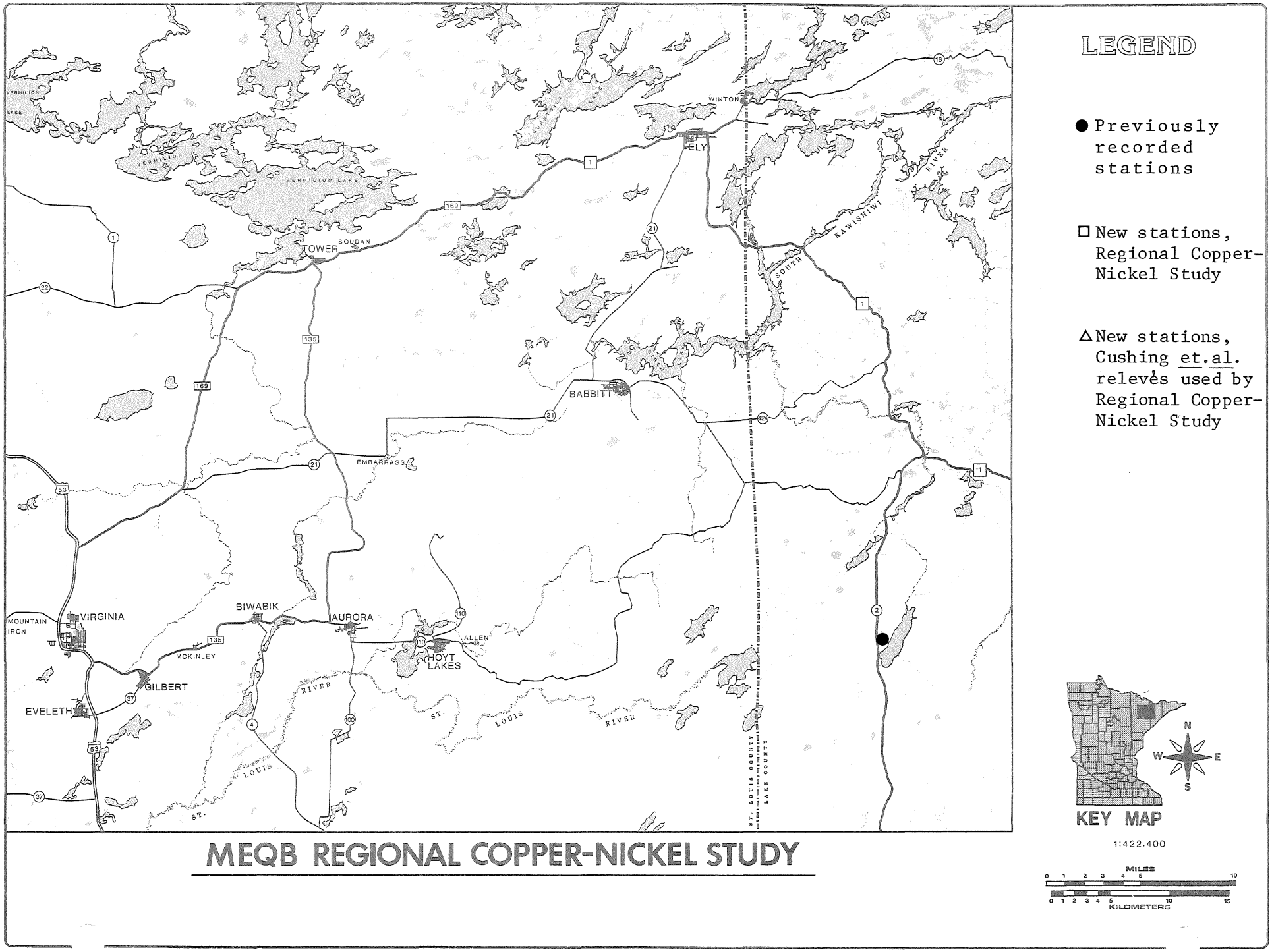
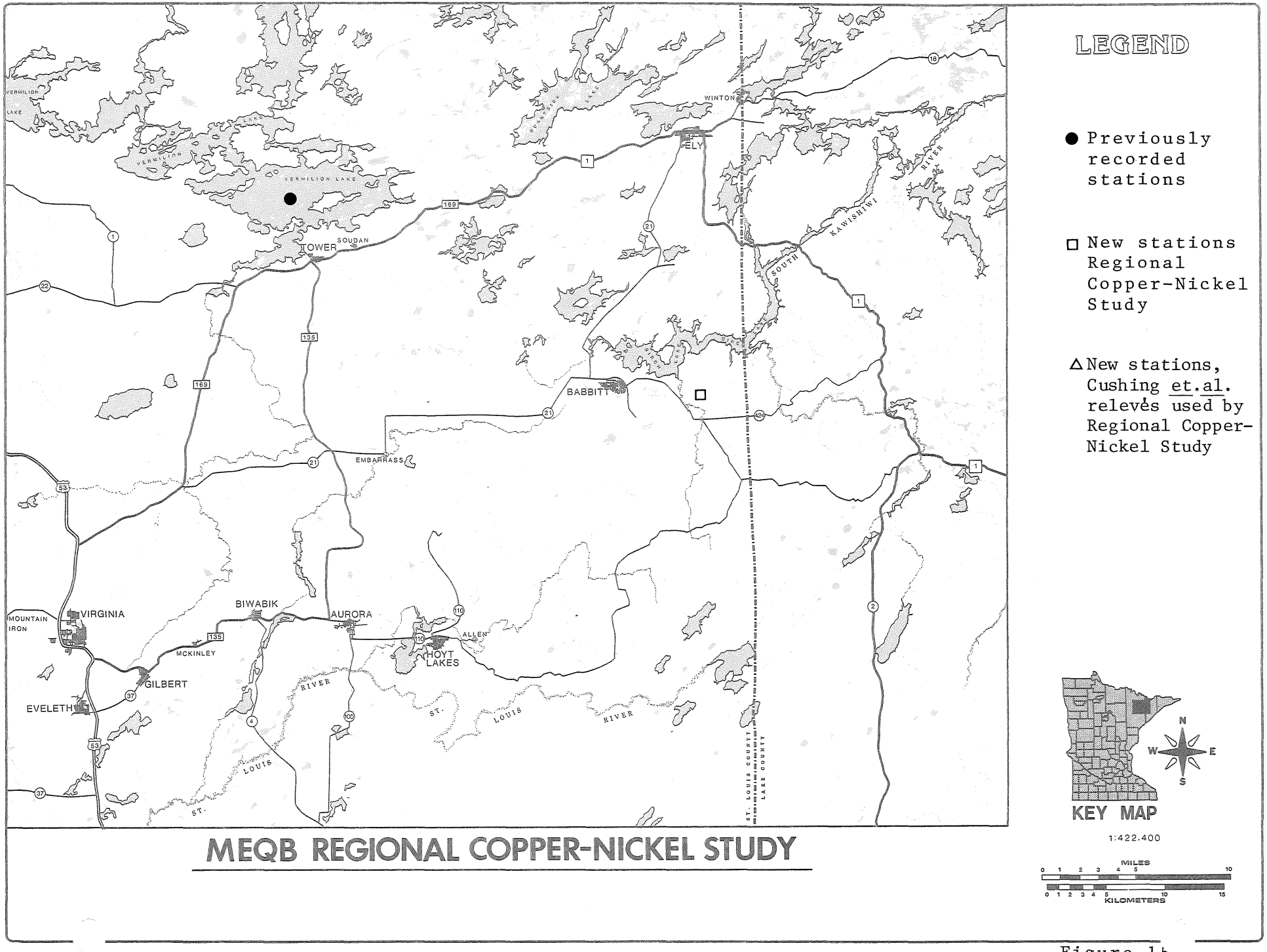


Figure 14

Habenaria dilatata

Protection status: Protected by Minnesota Statute 17.23



MEQB REGIONAL COPPER-NICKEL STUDY

Figure 15

Habenaria hookeri

Protection status: Protected by Minnesota statute 17.23

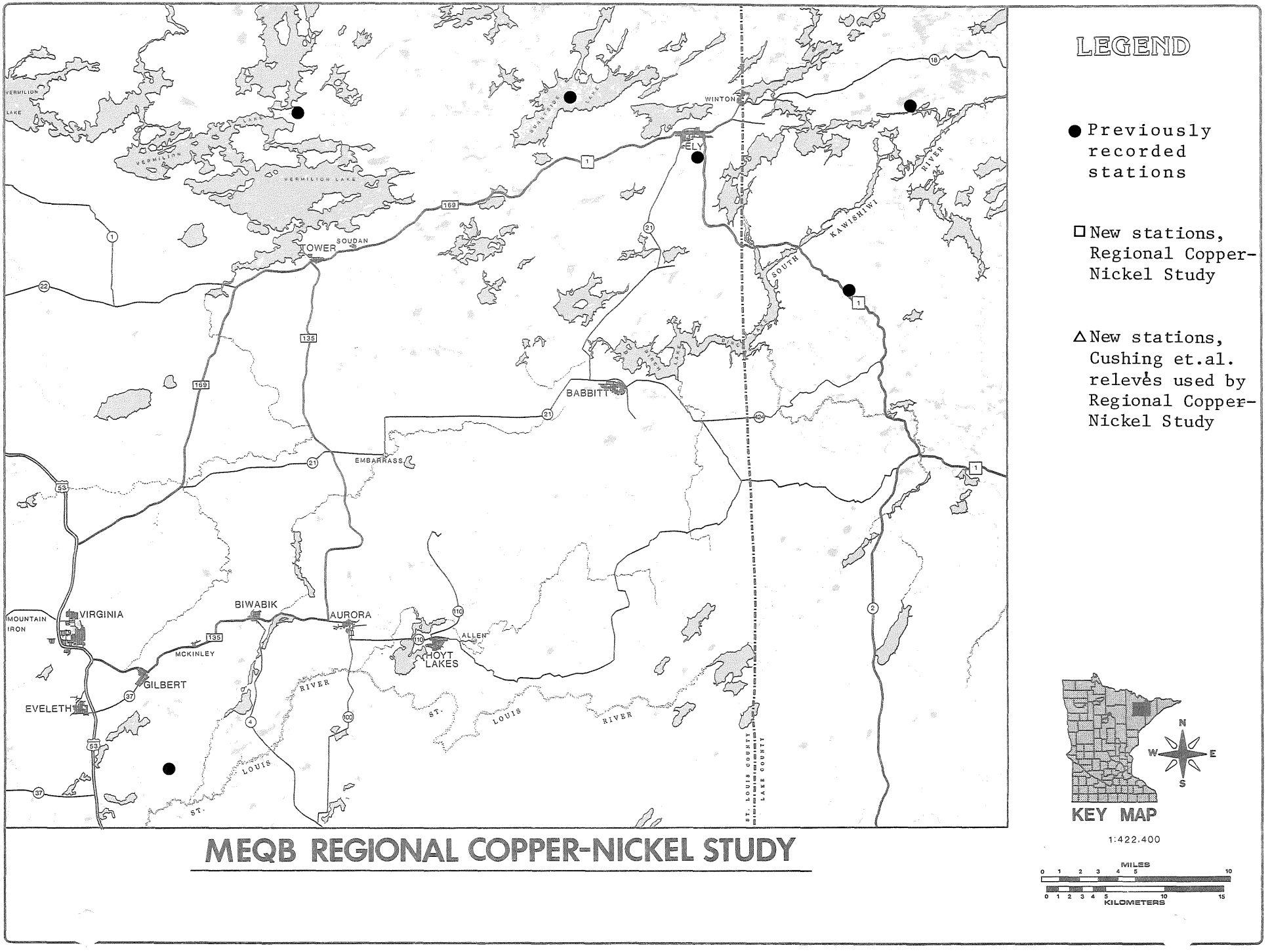


Figure 16

Habenaria hyperborea

Protection status: Protected by Minnesota Statute 17.23

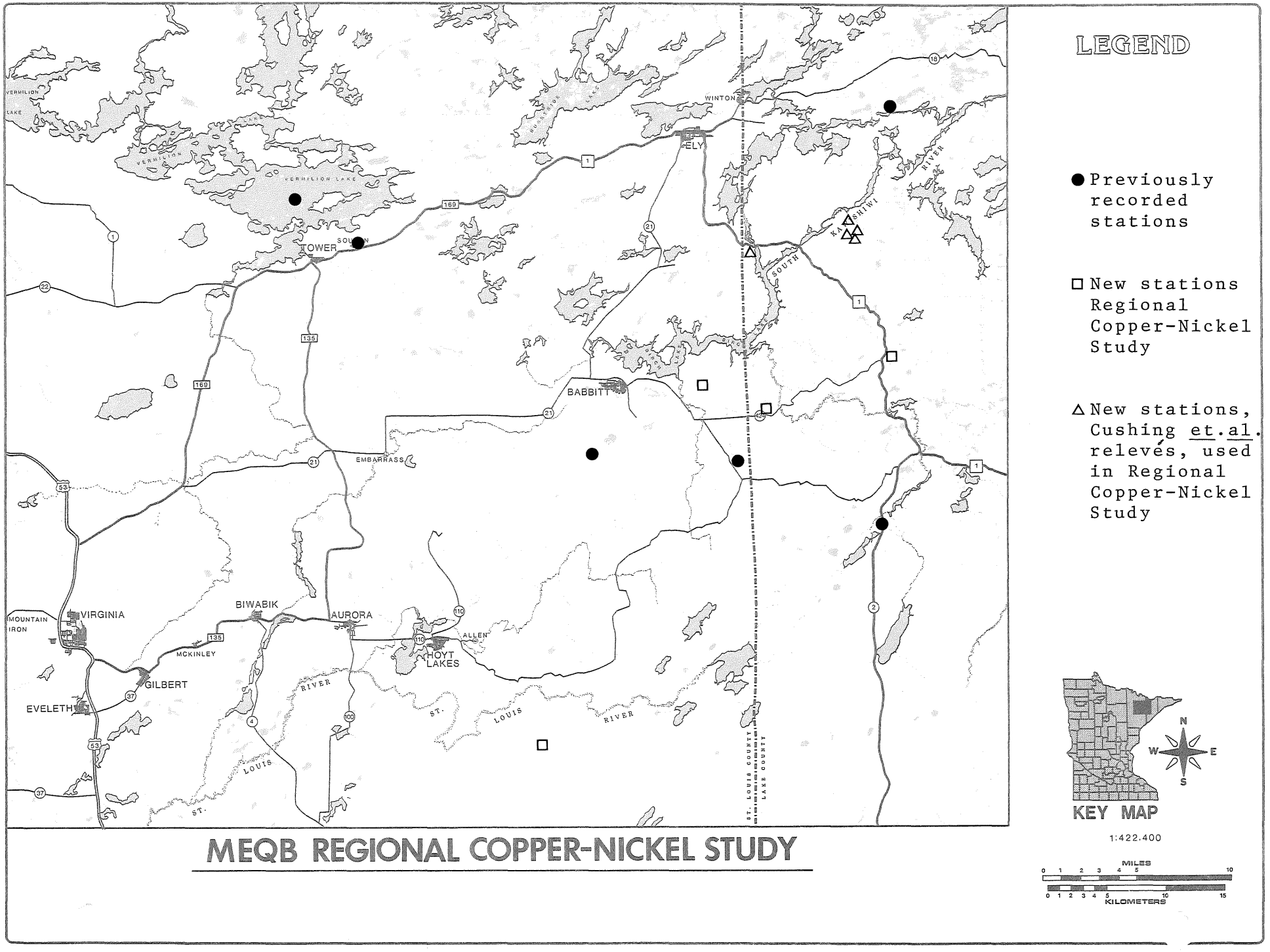


Figure 17

Habenaria orbiculata

Protection status: Protected by Minnesota Statute 17.23

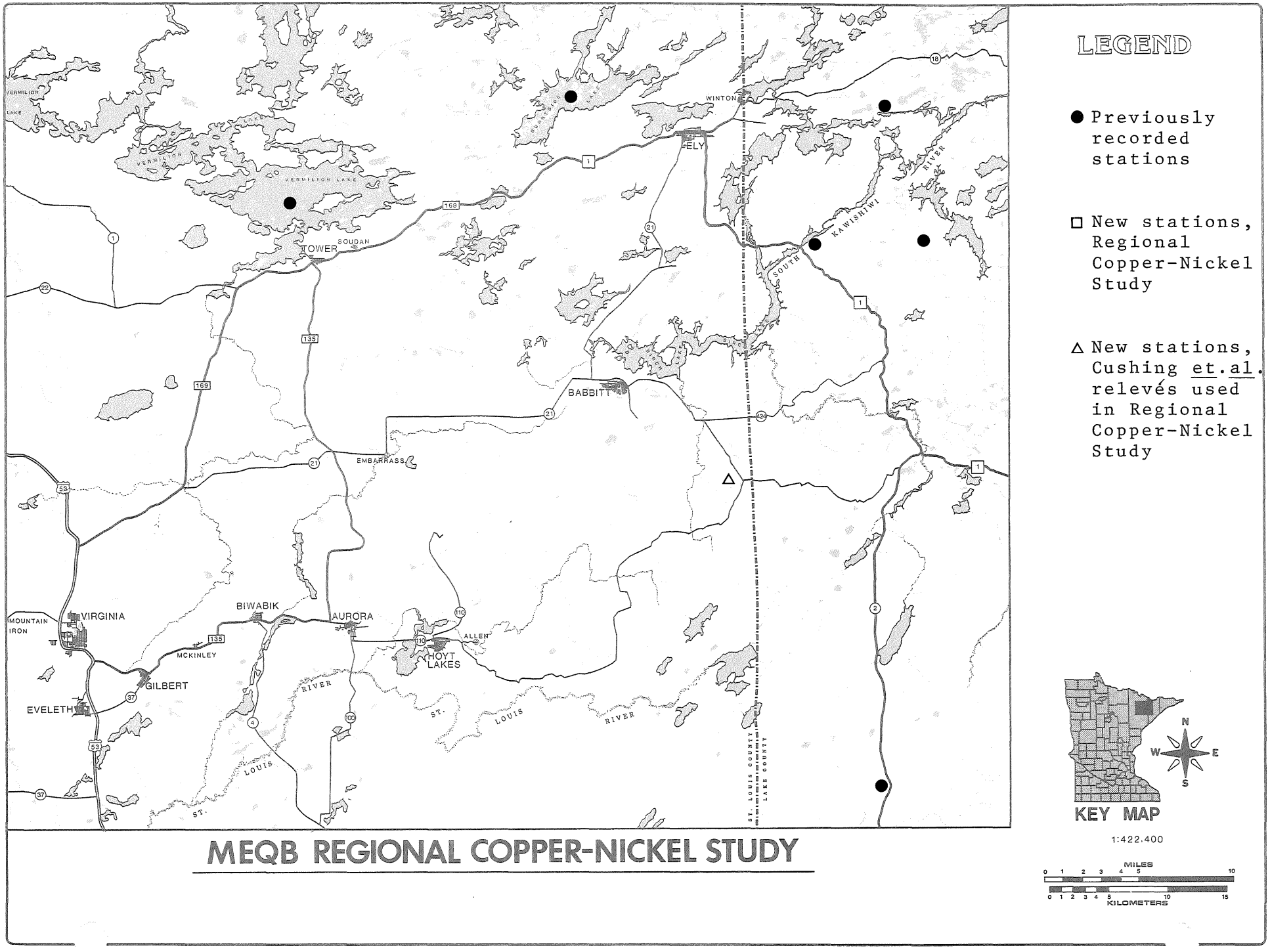


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Figure 18

Habenaria obtusata

Protection status: Protected by Minnesota Statute 17.23

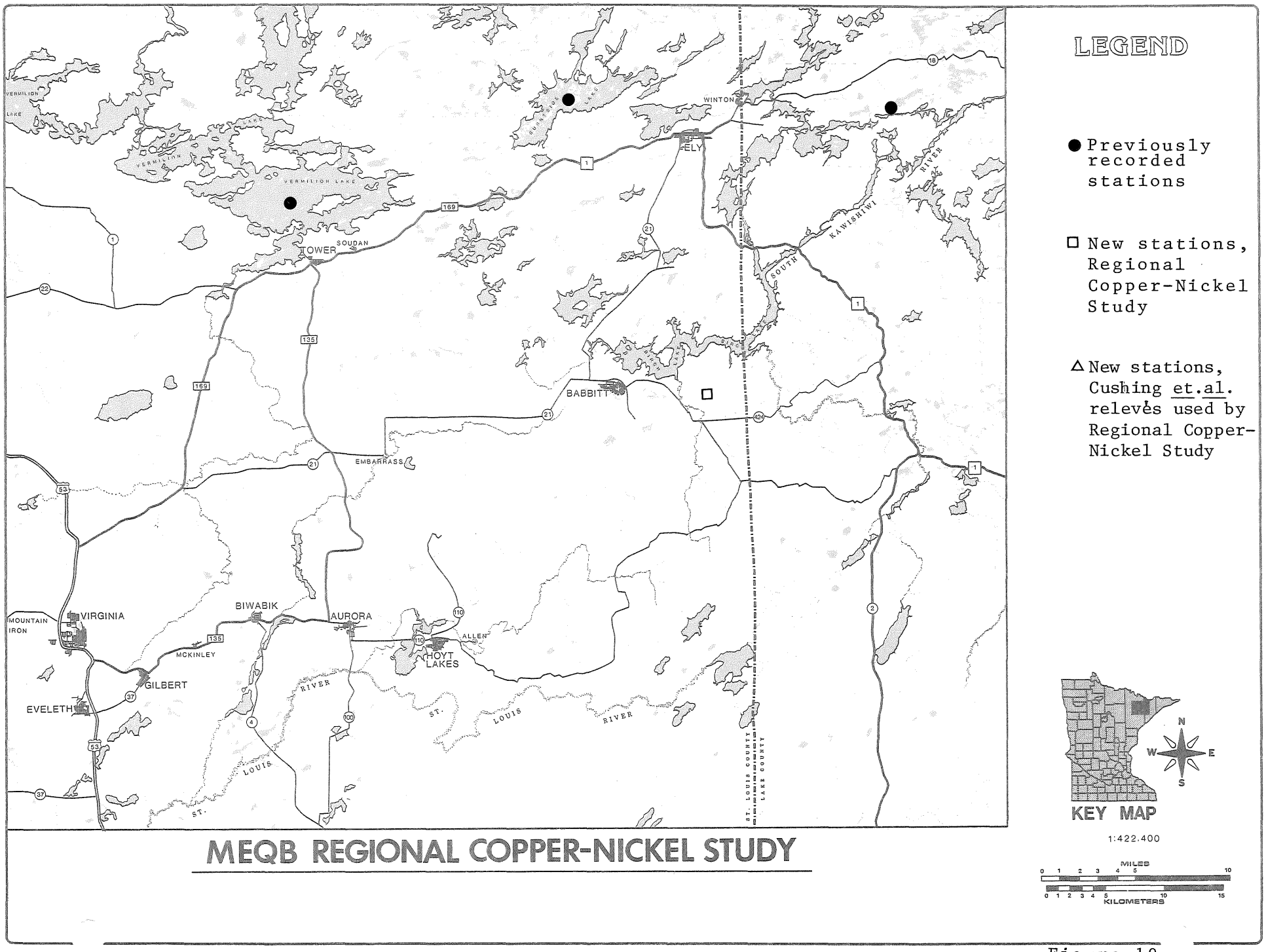


Figure 19

Habenaria psychodes

Protection status: Protected by Minnesota Statute 17.23

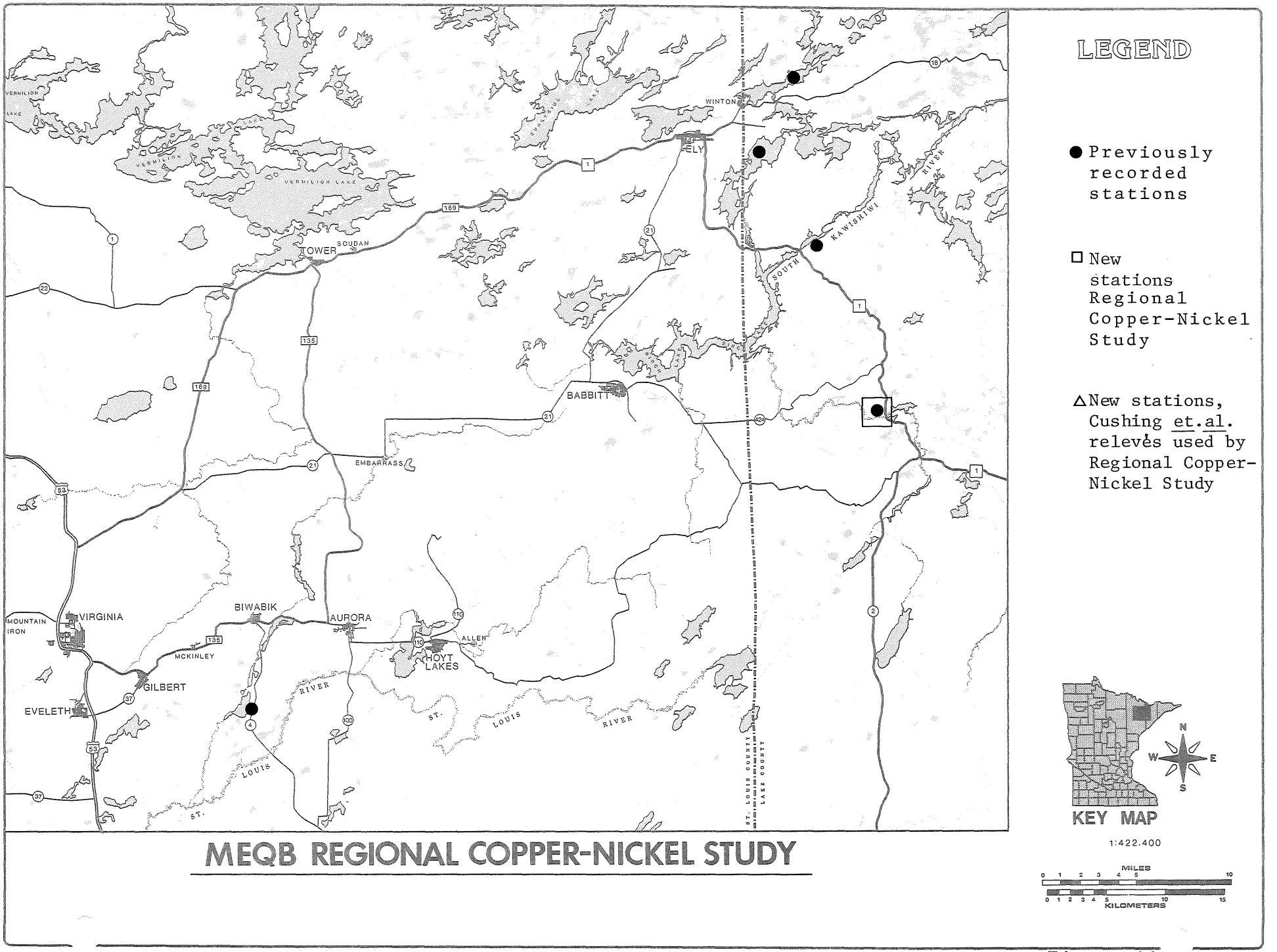


Figure 20

Liparis loeselii

Protection status: Protected by Minnesota statute 17.23

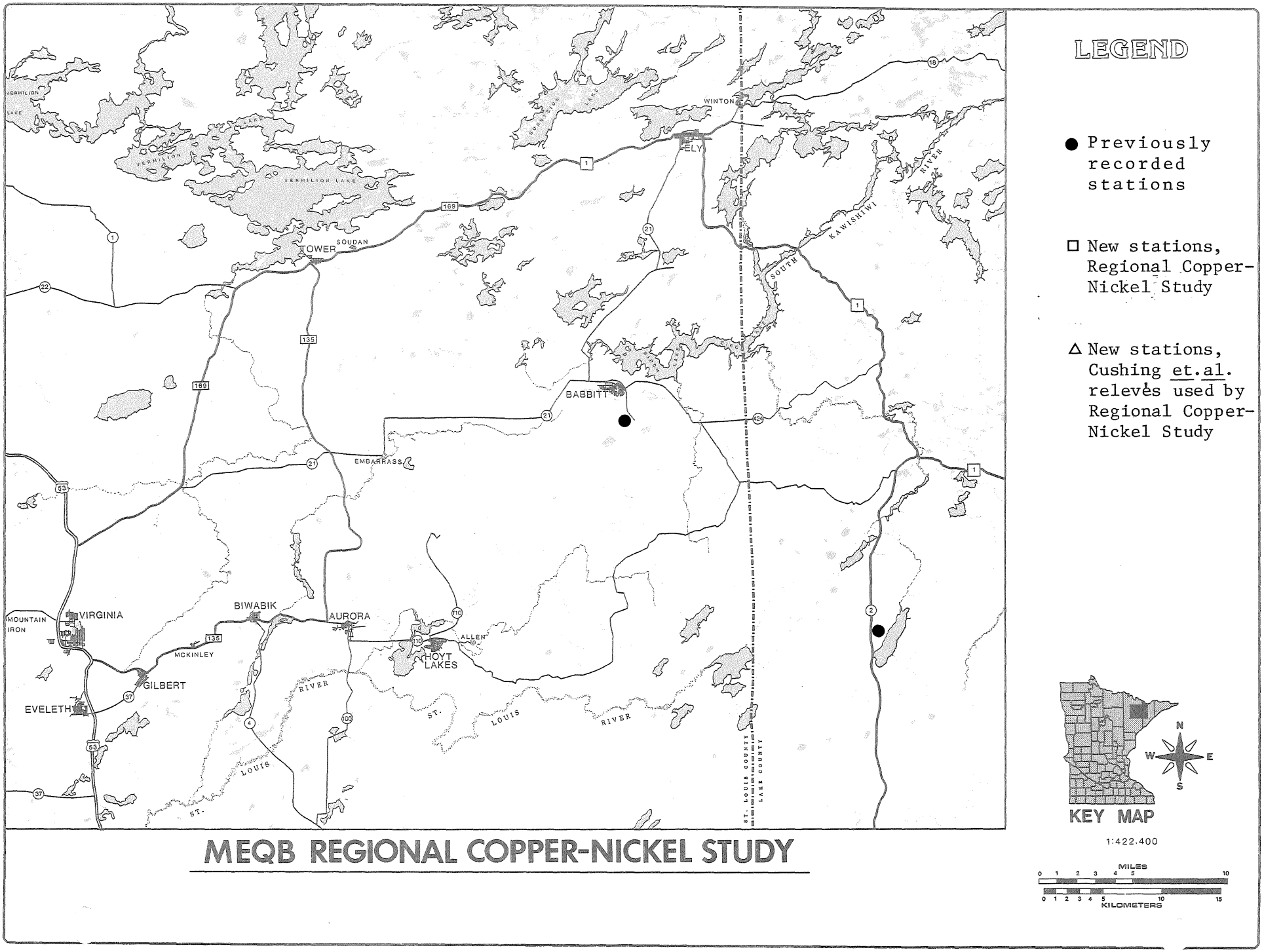


Figure 21

Listera cordata

Protection status: Protected by Minnesota Statute 17.23

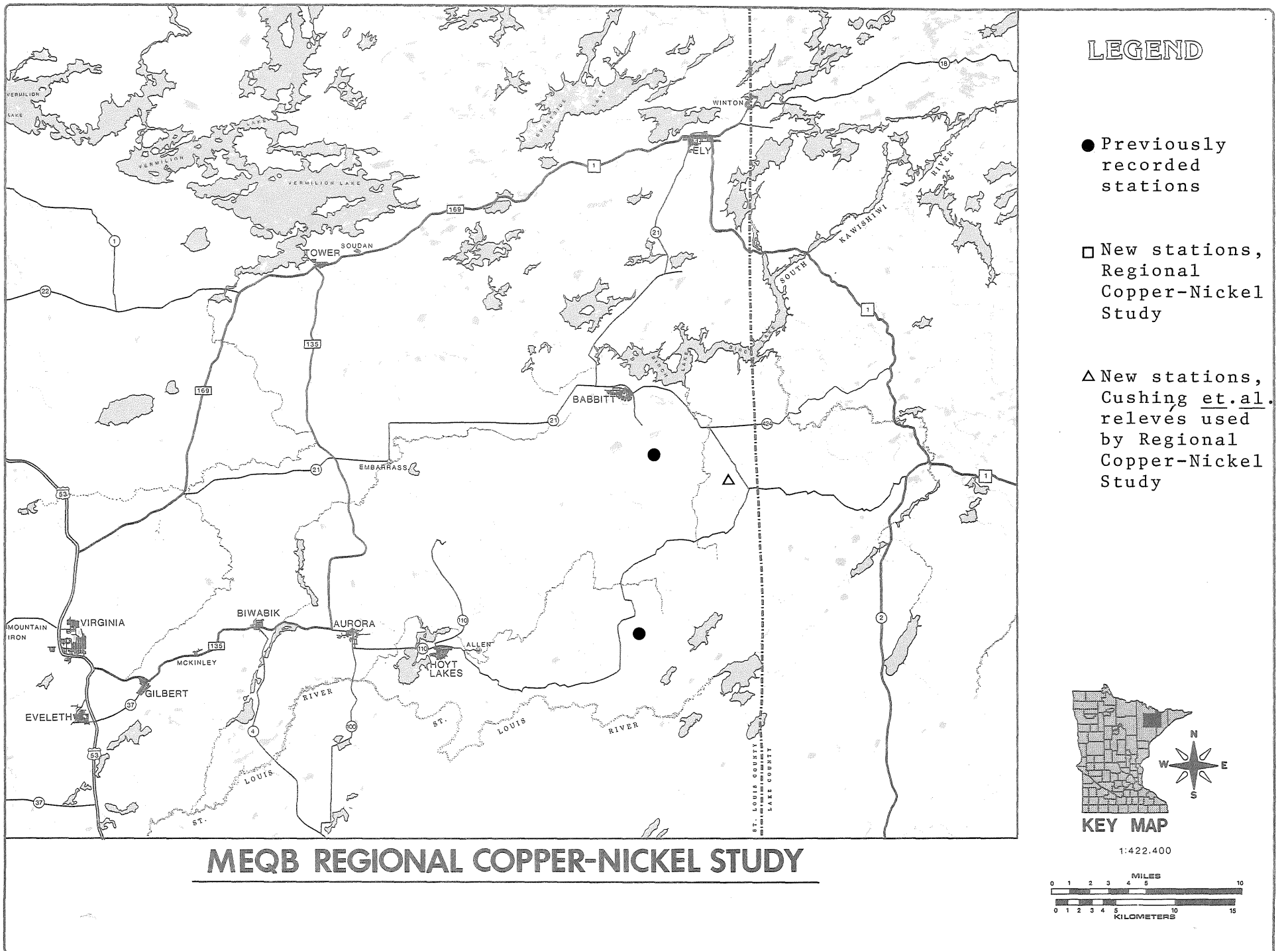


Figure 22

Malaxis unifolia

Protection status: Protected by Minnesota Statute 17.23

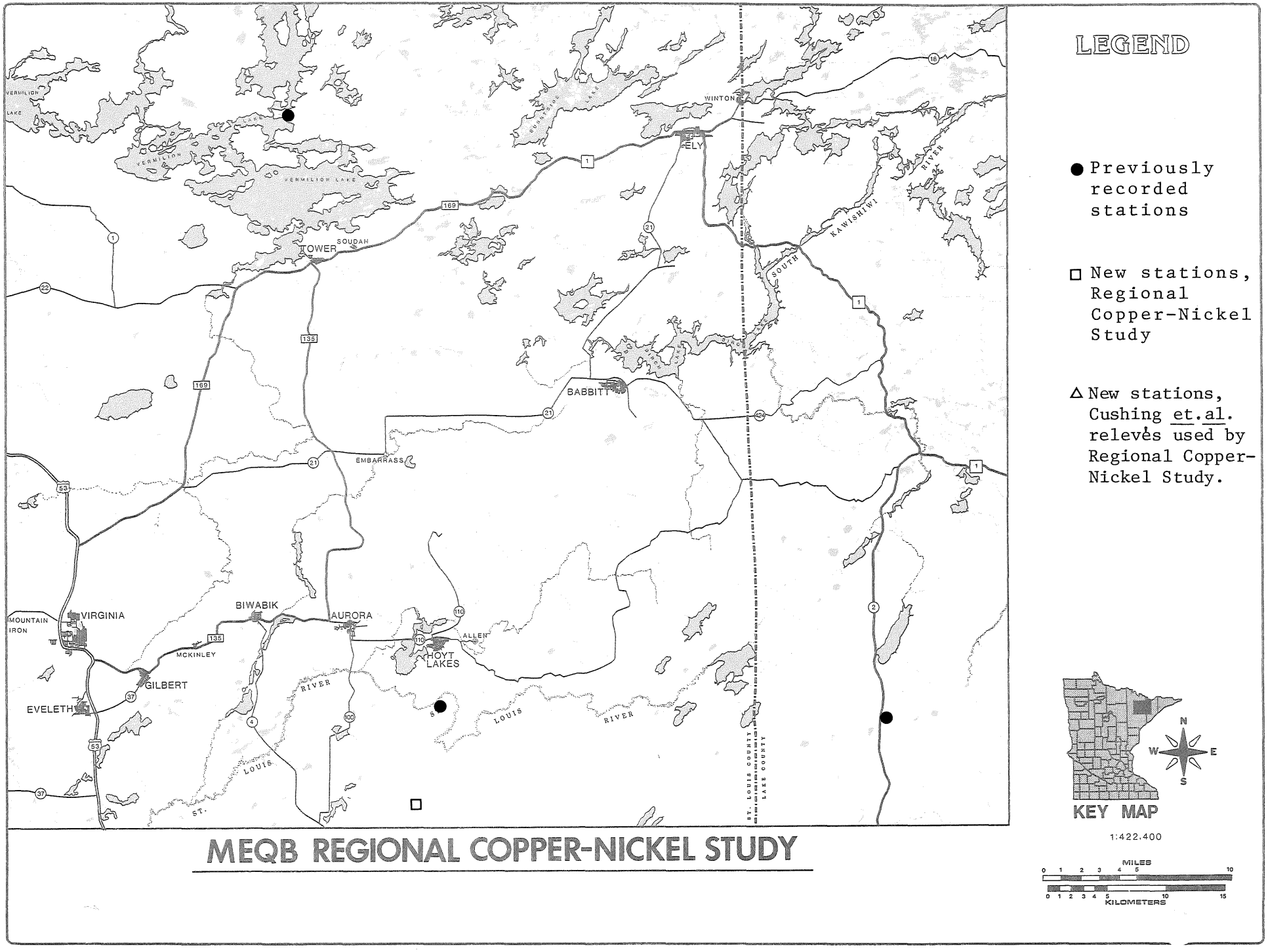
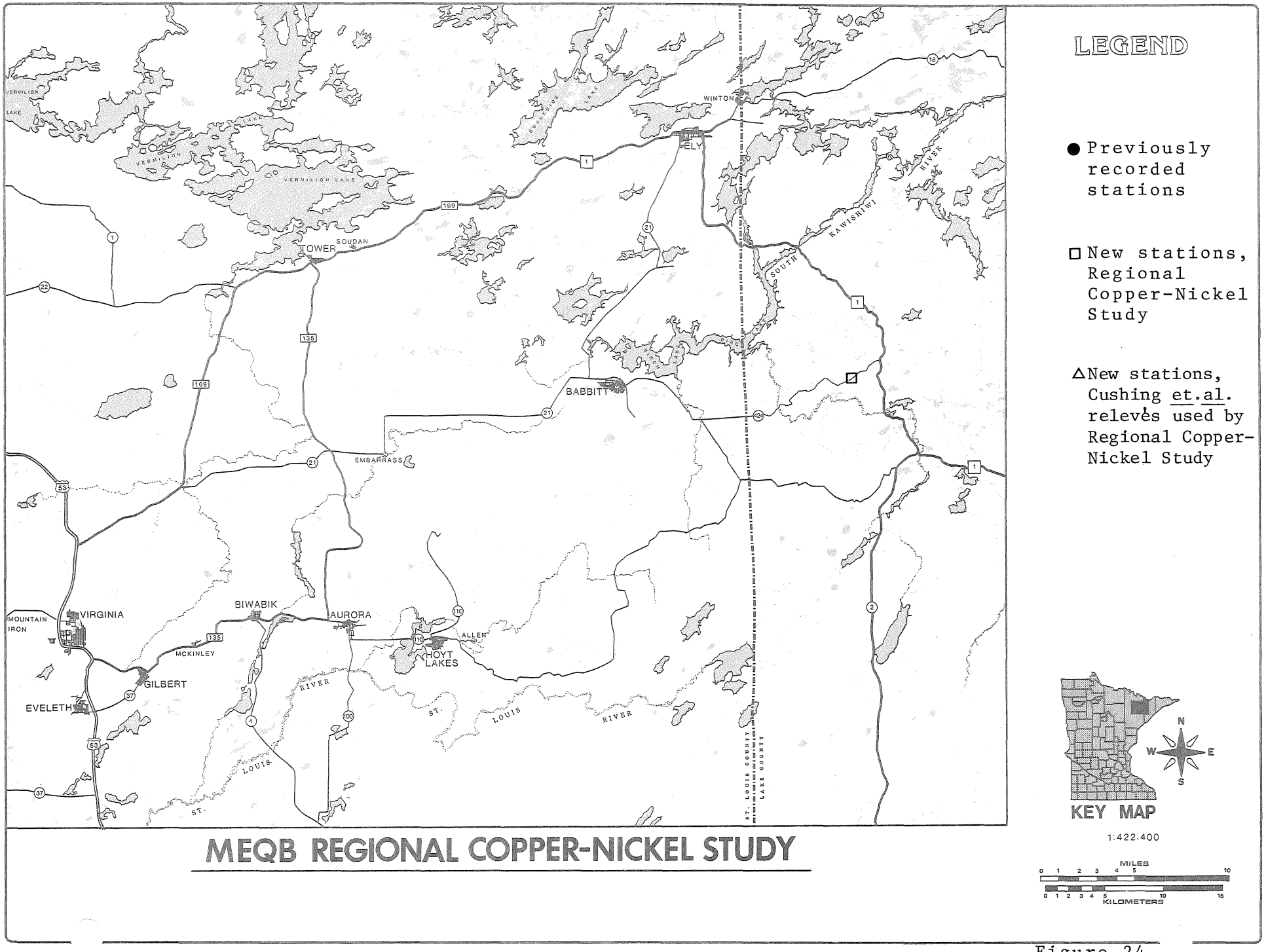


Figure 23

Protection status: Protected by Minnesota Statute 17.23



MEQB REGIONAL COPPER-NICKEL STUDY

Figure 24

Spiranthes lacera

Protection status: Protected by Minnesota Statute 17.23

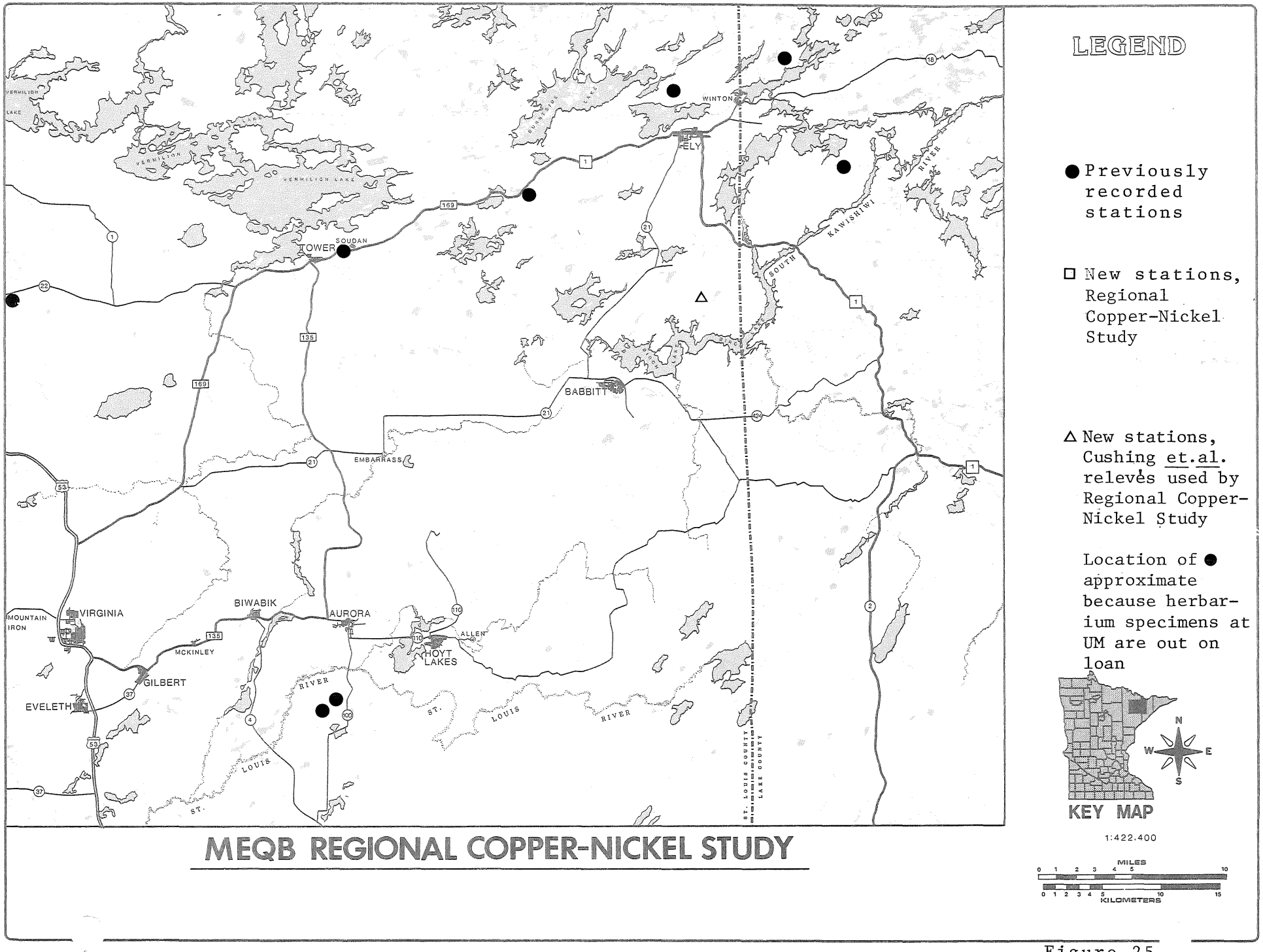


Figure 25

Spiranthes romanzoffiana

Protection Status: Protected by Minnesota Statute 17.23

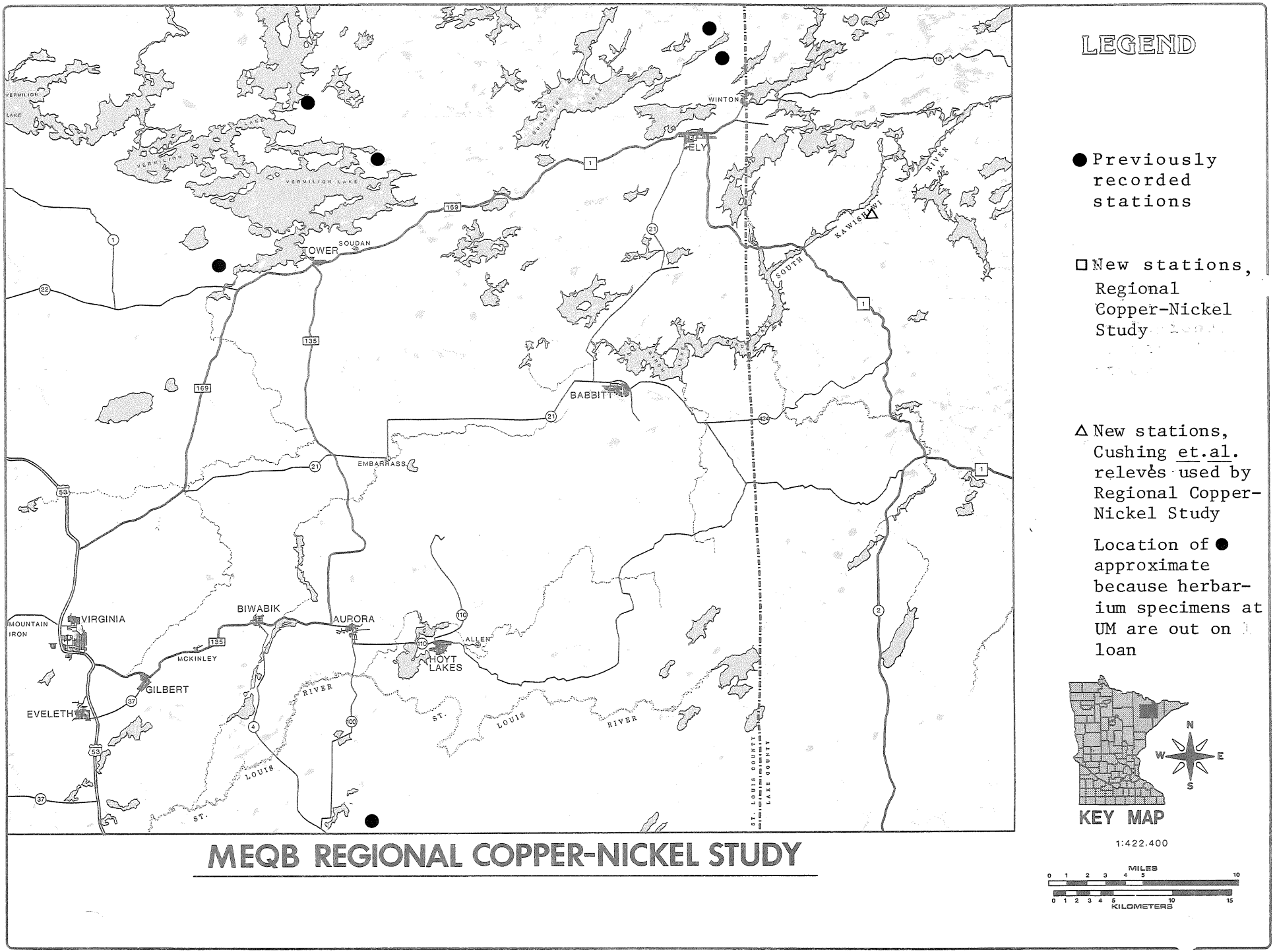


Figure 26

Trillium cernuum (includes "Trillium sp." from O/R and CuNi studies)

Protection status: Protected by Minnesota Statute 17.23

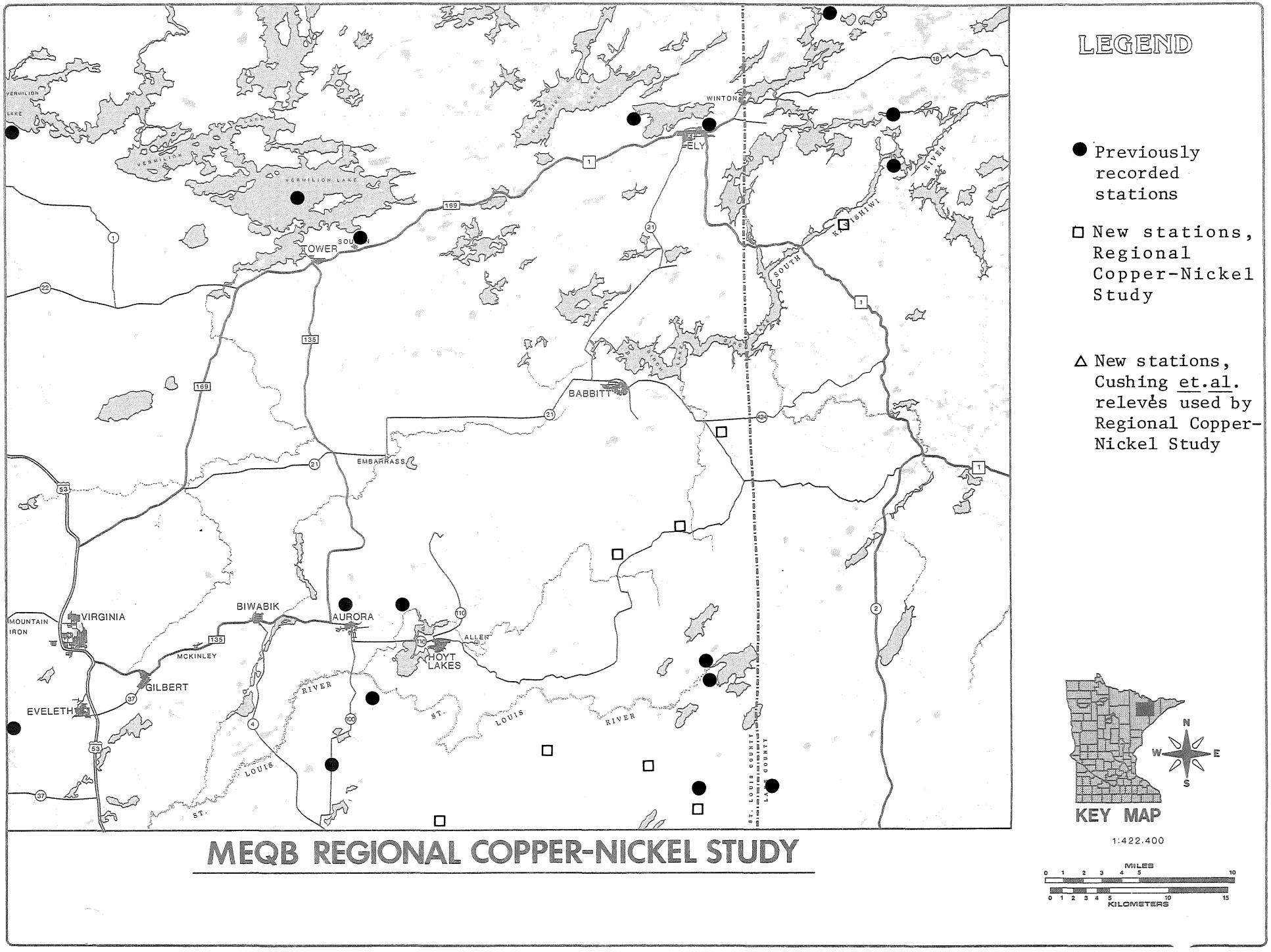


Figure 27

Trillium grandiflorum

Protection status: Protected by Minnesota Statute 17.23

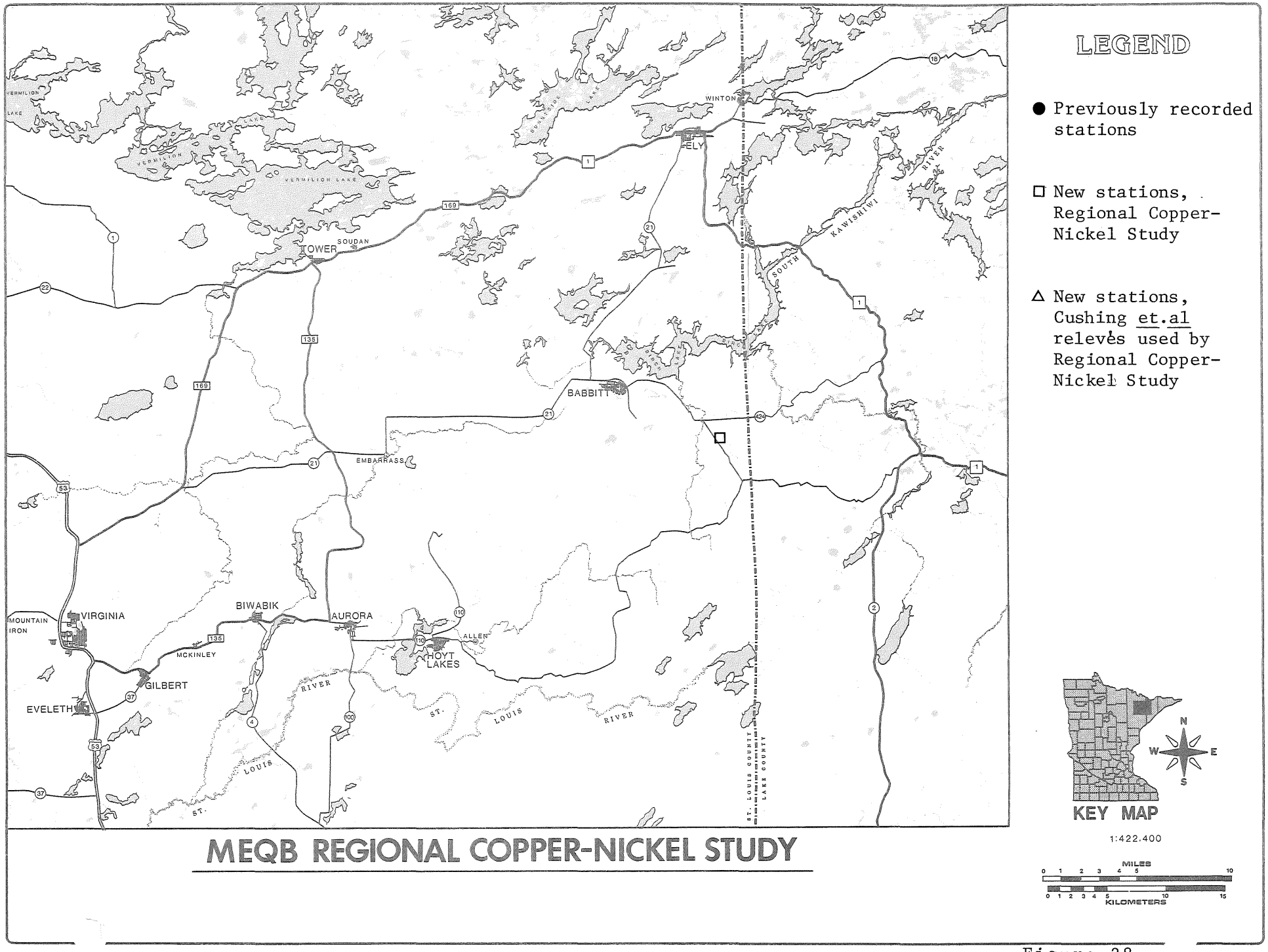


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Figure 28

Protection status - uncommon

Botrychium matricariaefolium ●
Botrychium multifidum v. intermedium ■
Botrychium multifidum v. multifidum □
Botrychium simplex ▲

Fractions represent proportion of stations in state shown on this map

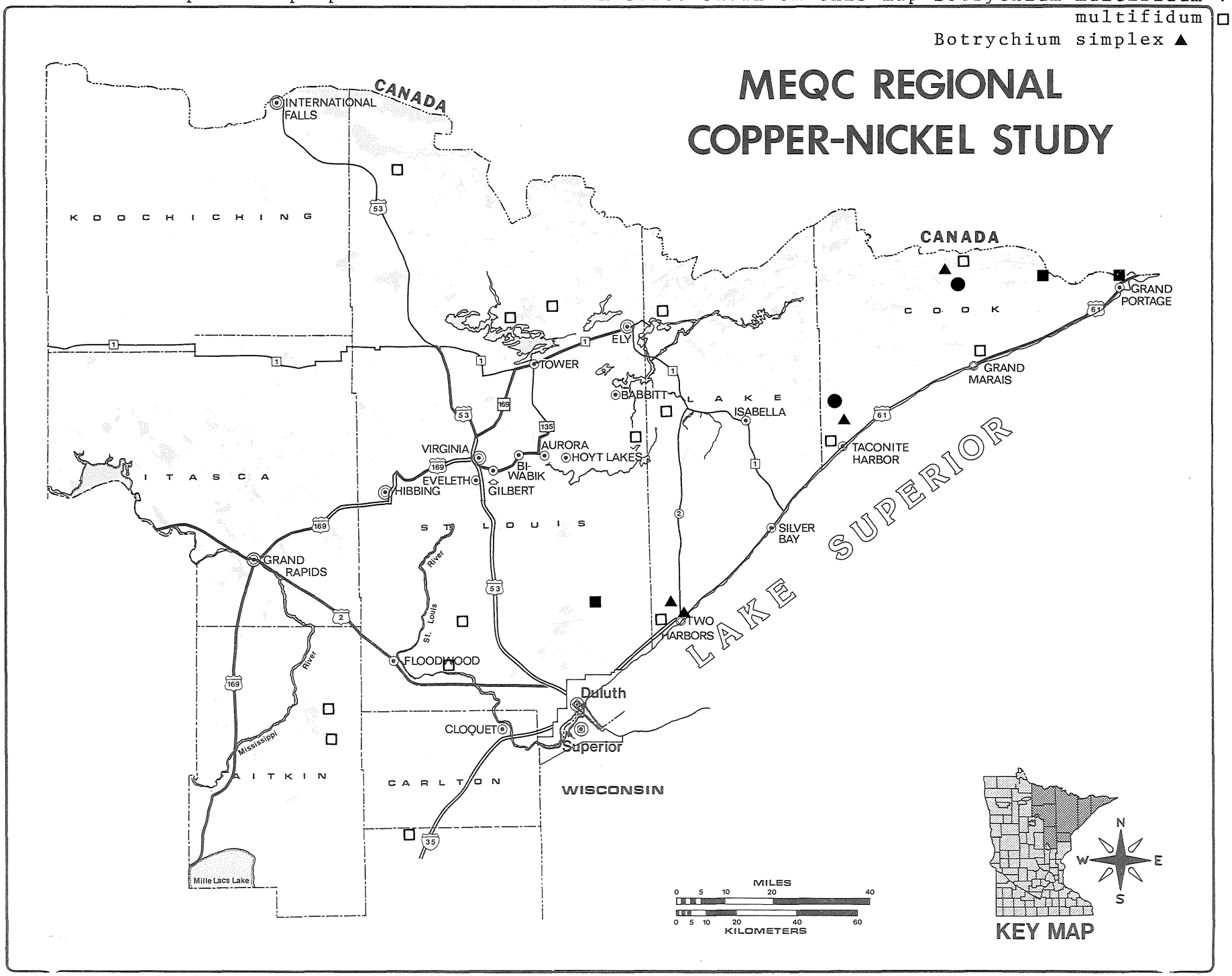
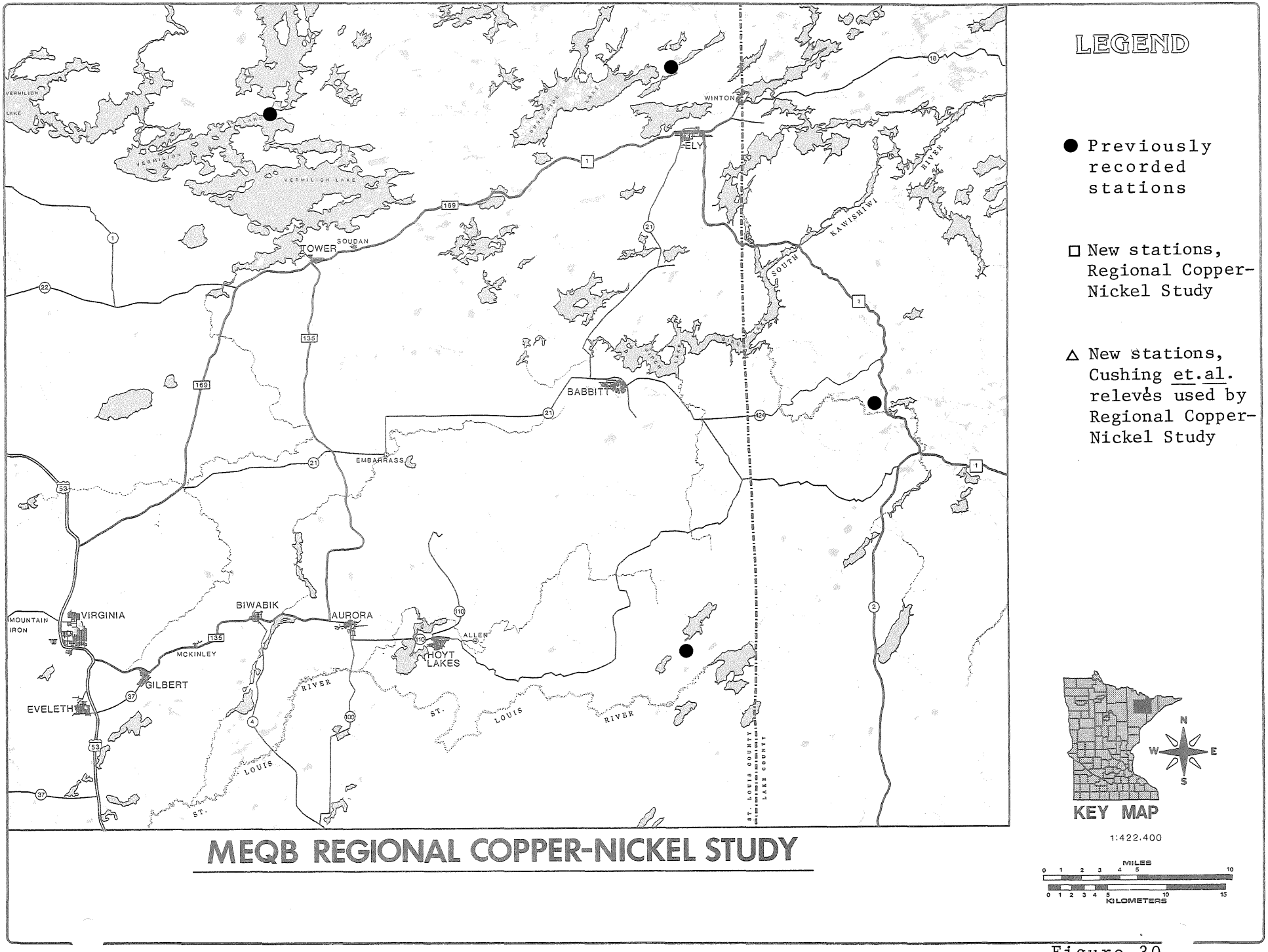


Figure 29

Botrychium multifidum v. multifidum

Protection status: Uncommon



MEQB REGIONAL COPPER-NICKEL STUDY

Figure 30

Lithospermum canescens

Protection status: Uncommon in study area

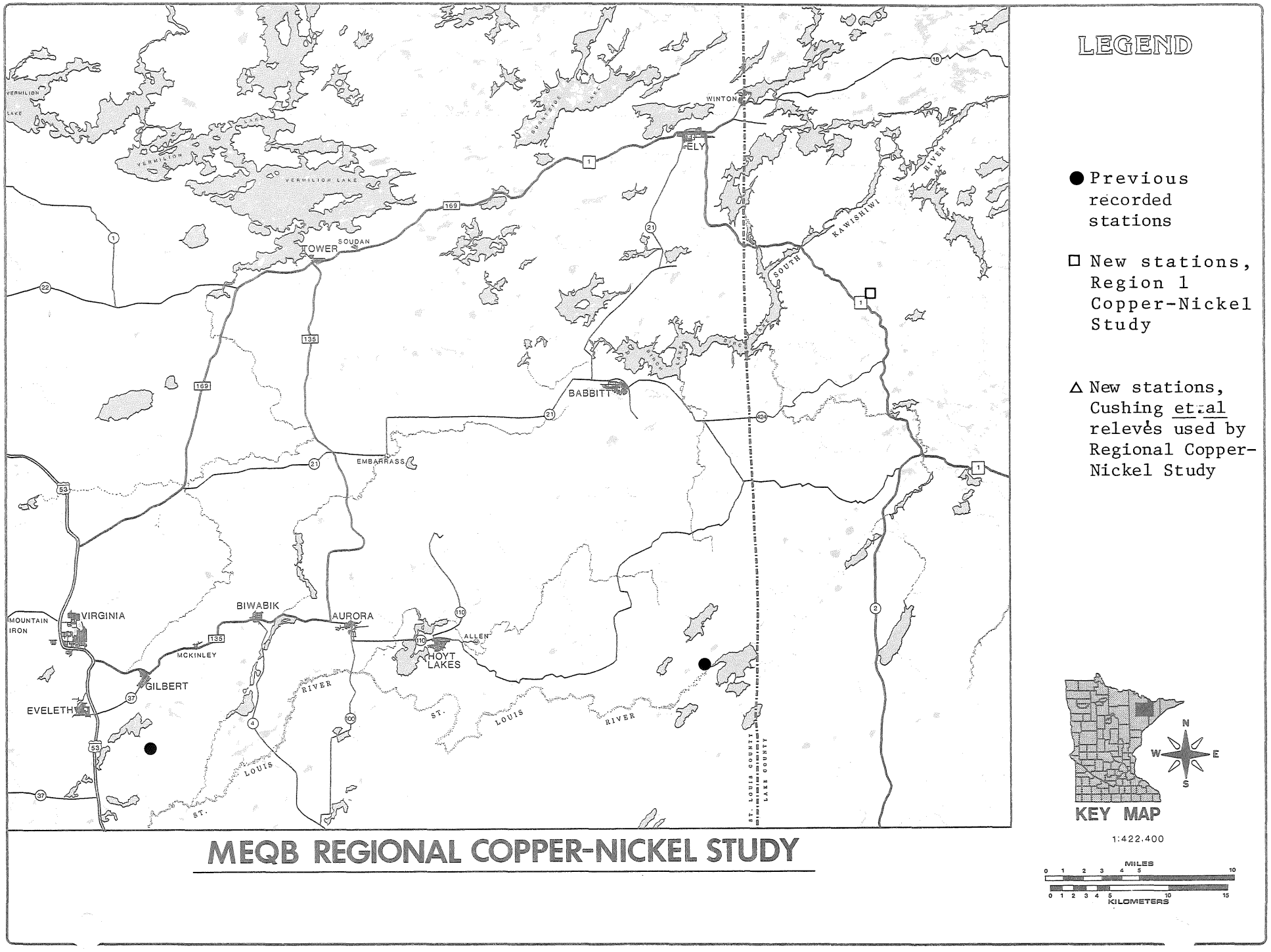


Figure 31

Protection status - Uncommon

Lycopodium annotinum v. acrifolium ●
Lycopodium Selago v. Selago ■
Lycopodium Selago v. patens △

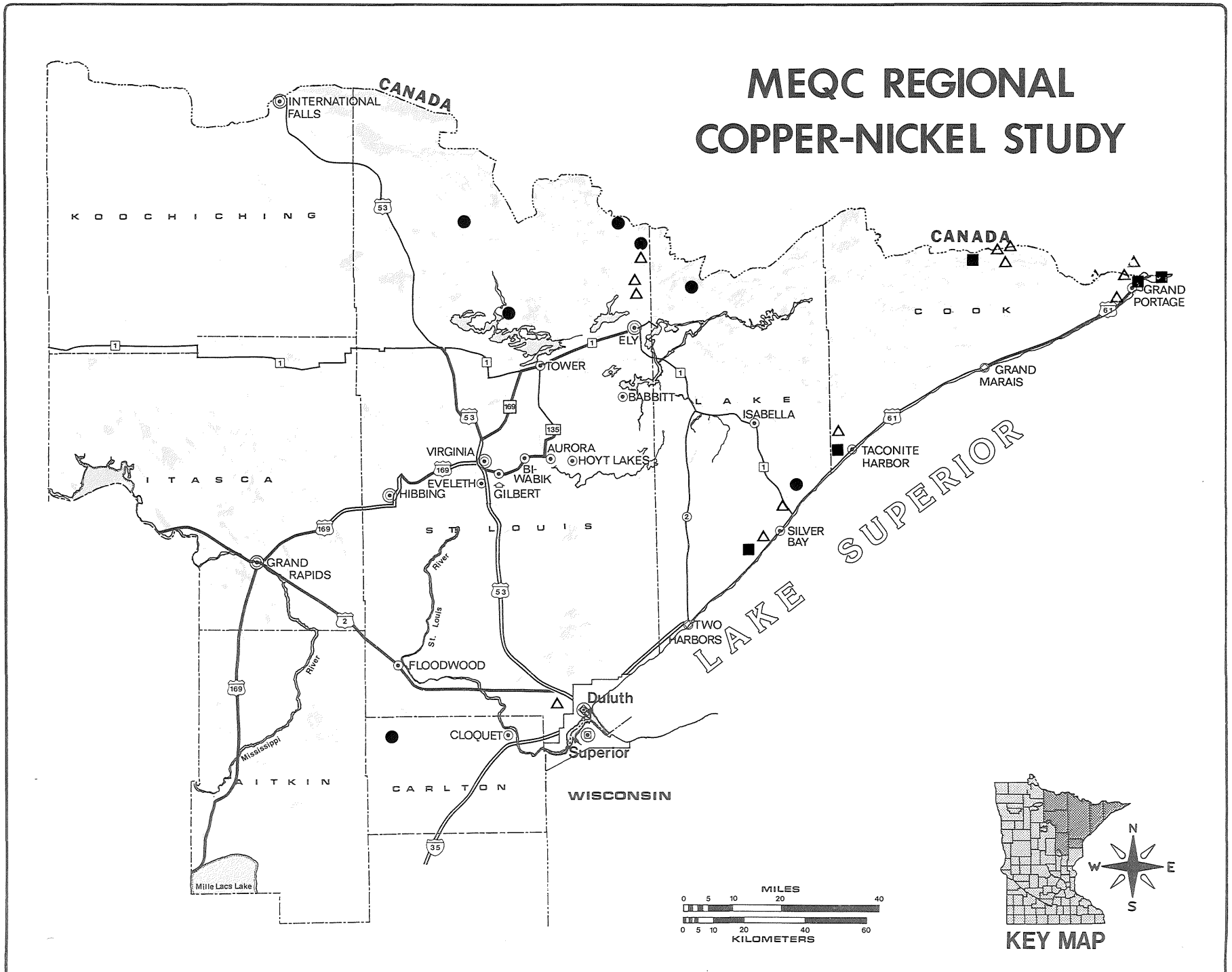


Figure 32

Lycopodium annotinum v. acrifolium

Protection status: Uncommon in study area and state

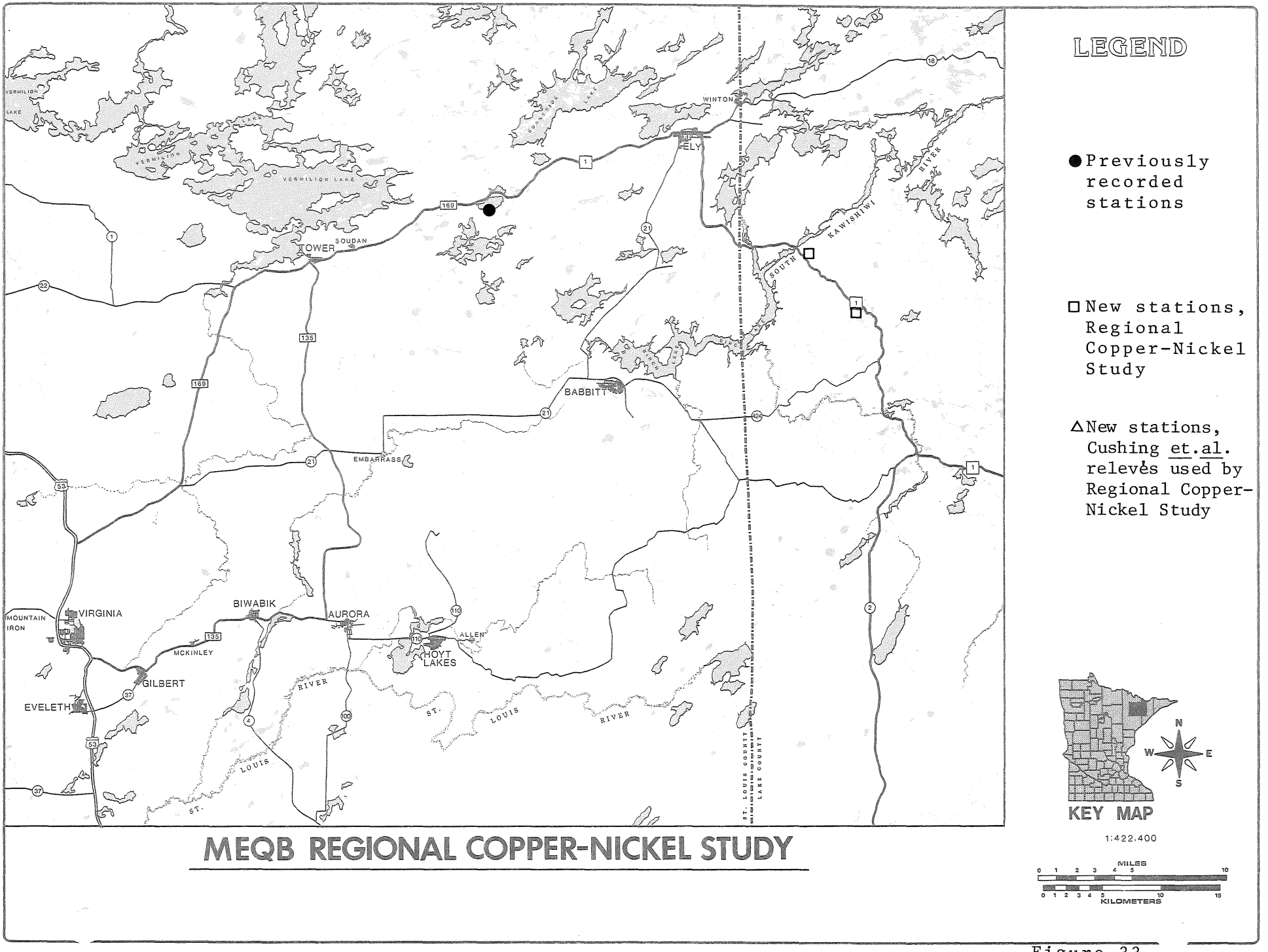


Figure 33

Pyrola minor

Protection status: Uncommon in study area

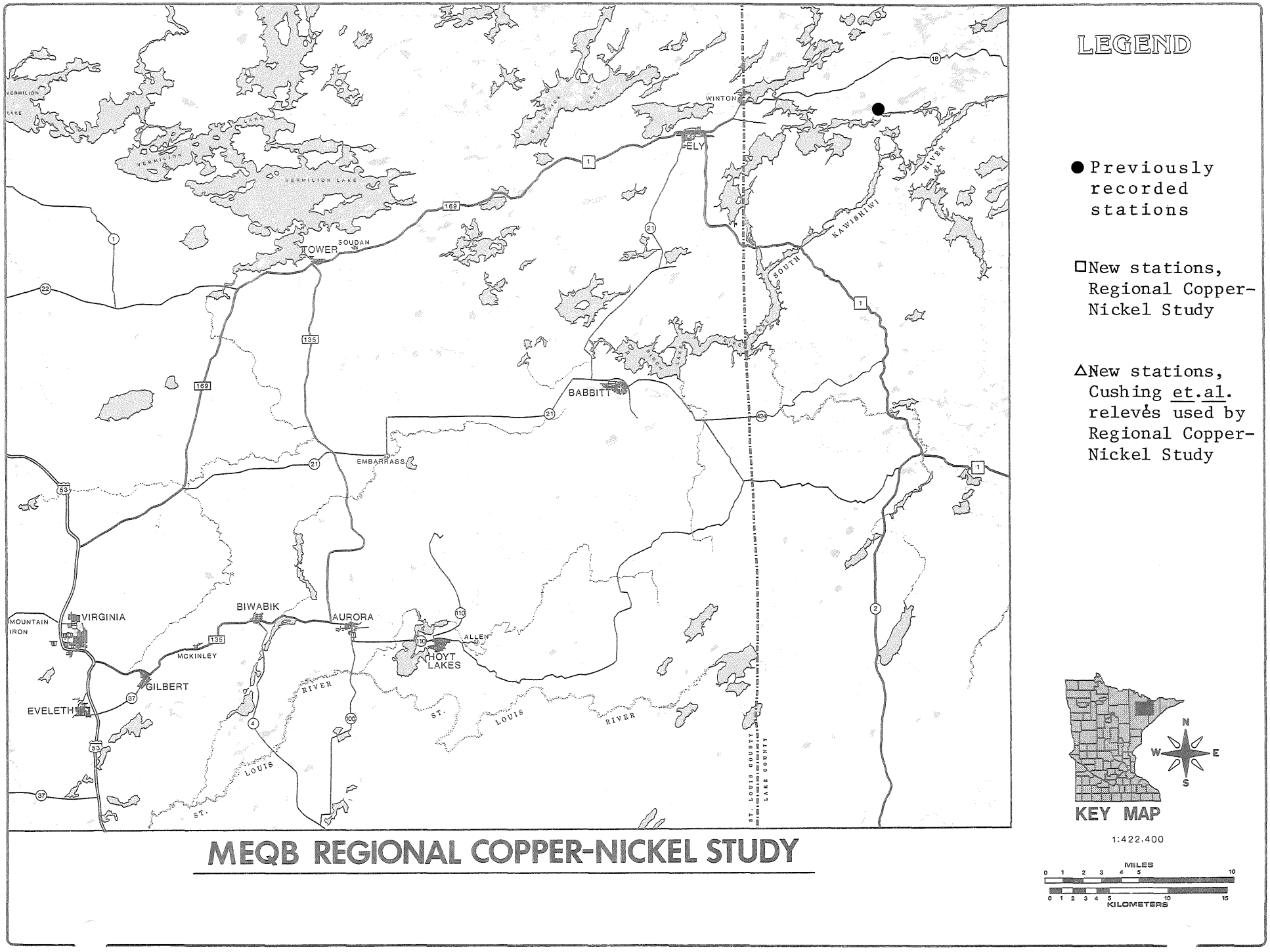


Figure 34

Pyrola rotundifolia

Protection status: Uncommon in study area

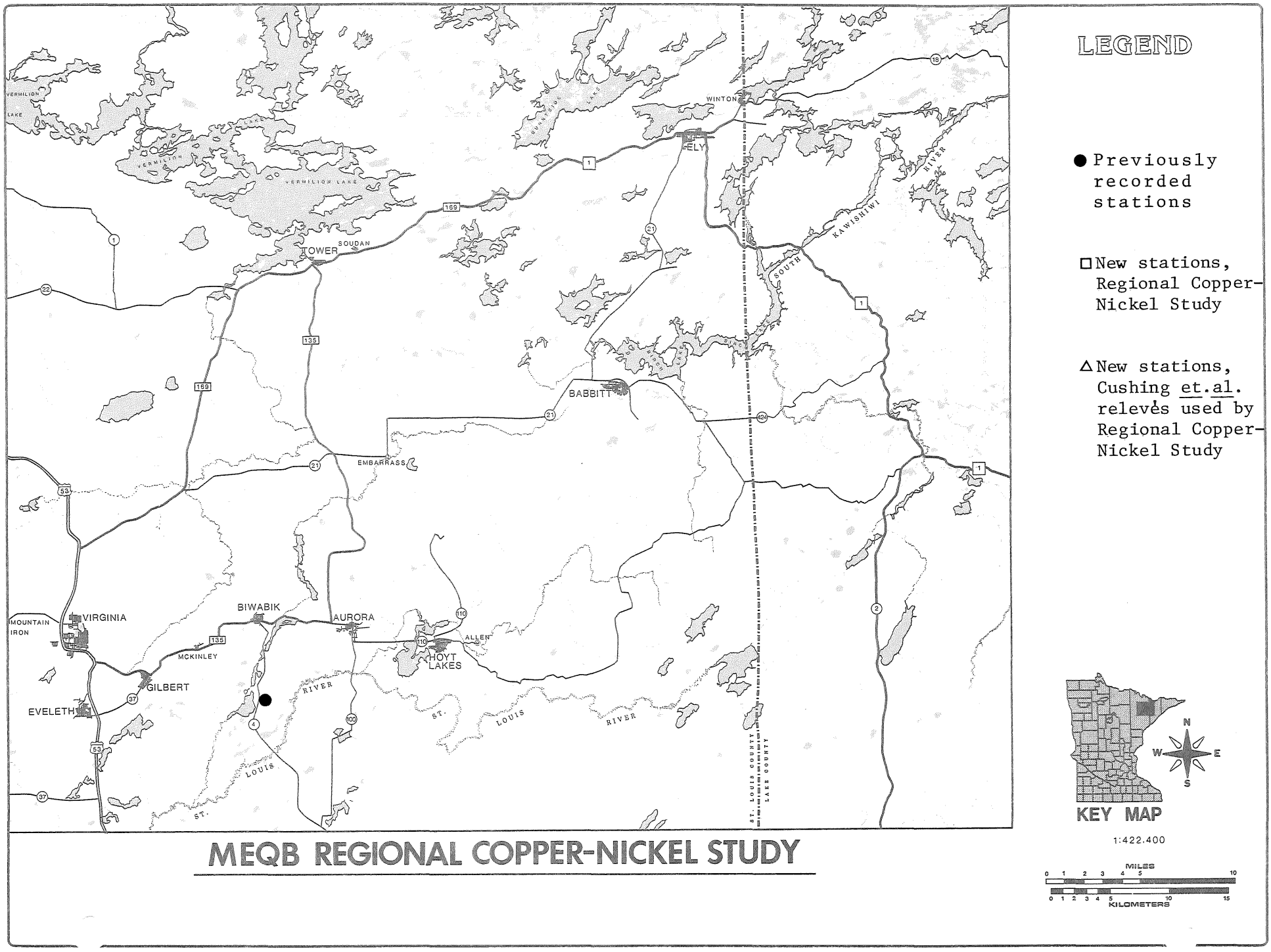


Figure 35

Rubus acaulis

Protection status: Uncommon in study area

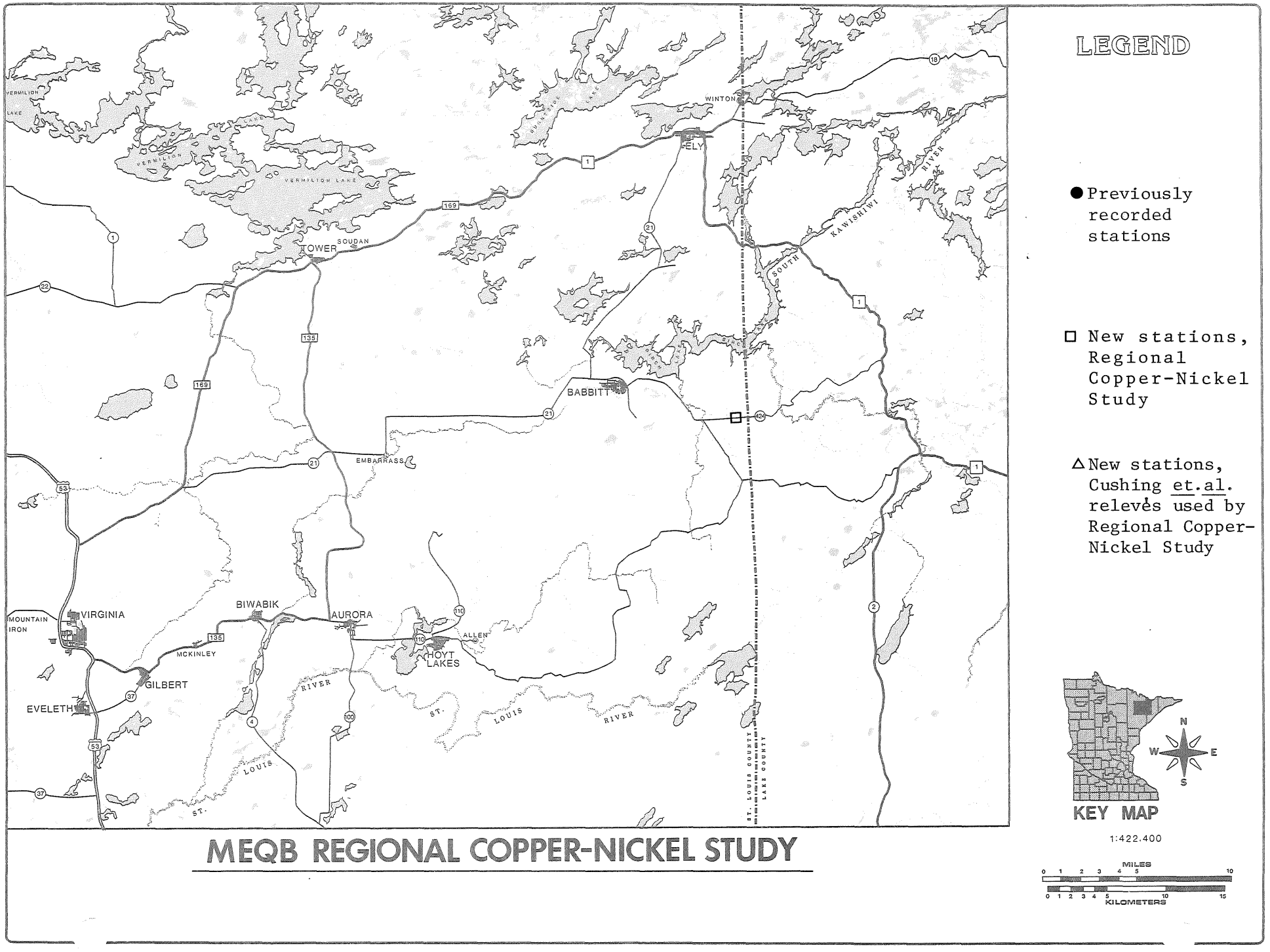


Figure 36

Silene cucubalus

Protection status: Uncommon in study area

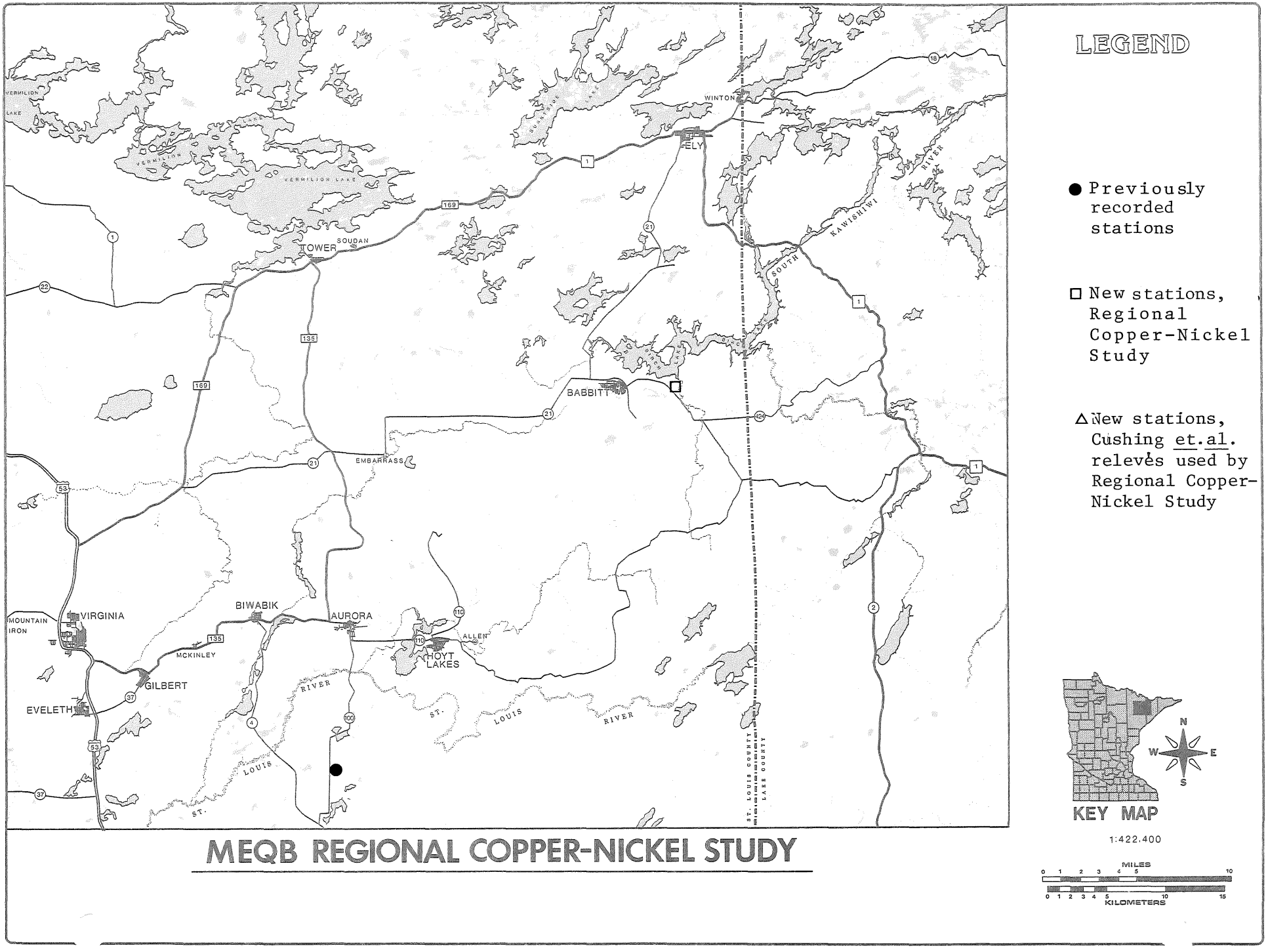


Figure 37

Physalis grandiflora

Protection status: Uncommon in study area

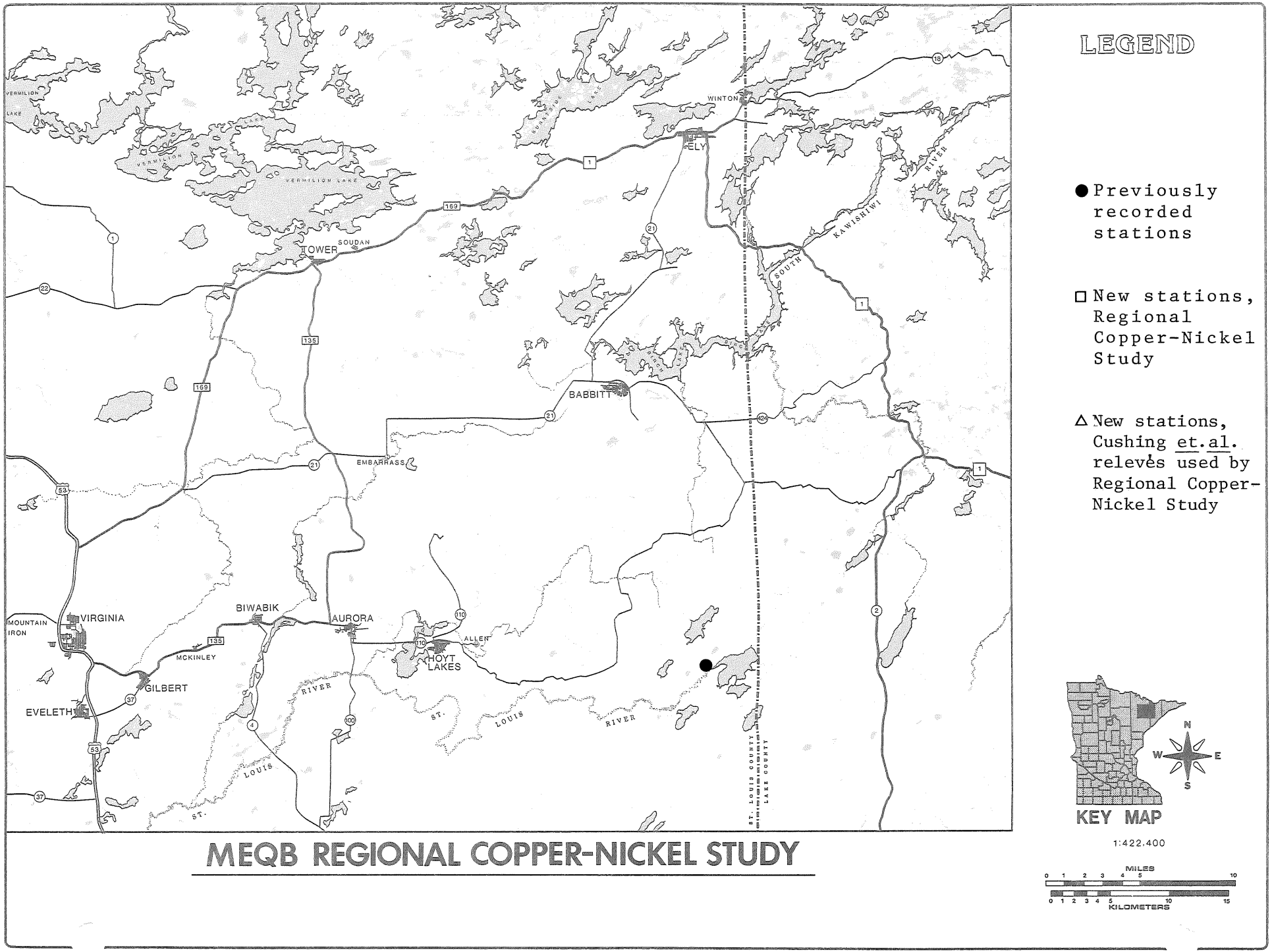


Figure 38

Protection status - rare in Minnesota (and recorded in study area by this study) Geocaulon lividum ●

Arenaria macrophylla ■

New stations ○ □

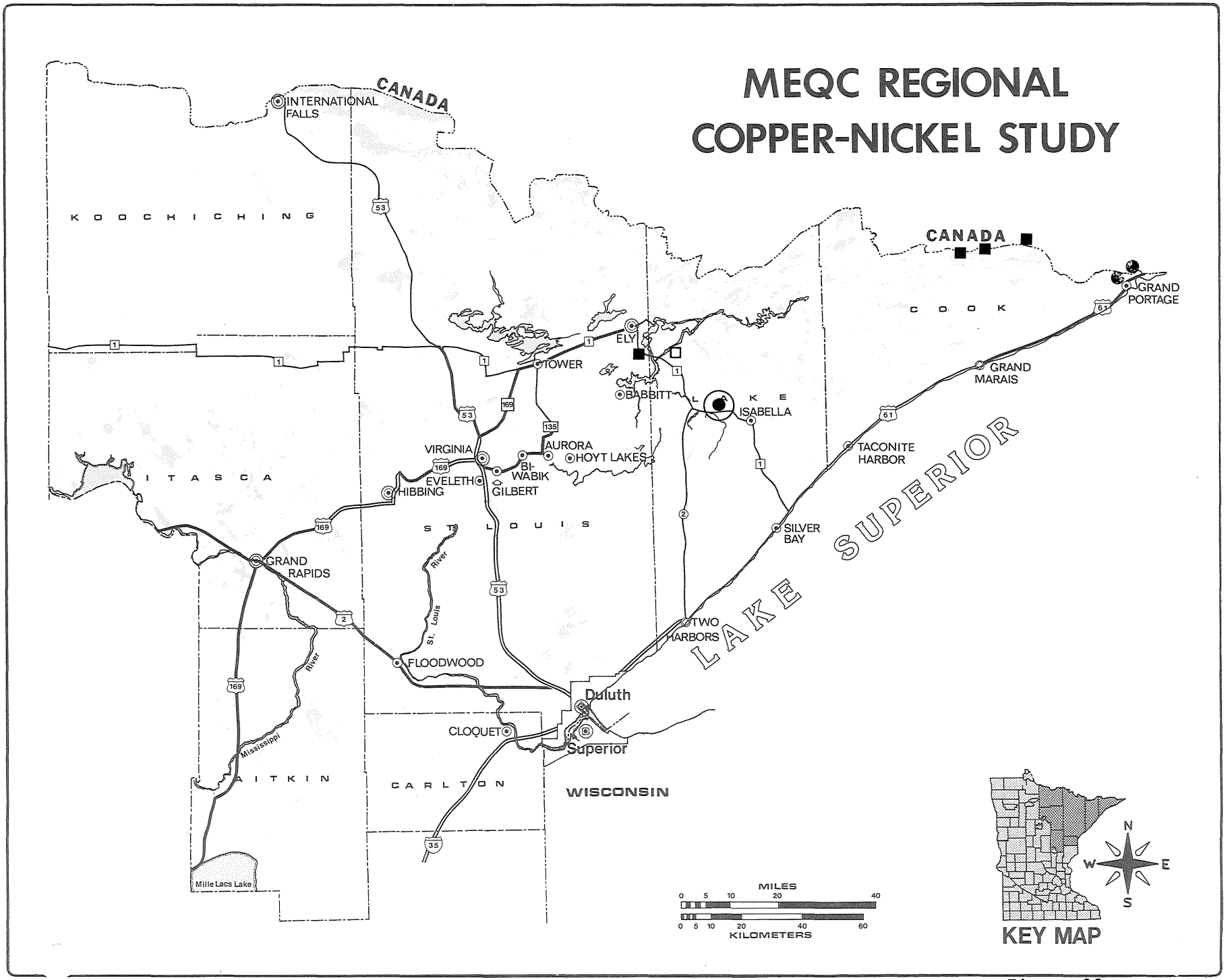


Figure 39

Ophioglossum vulgatum

Protection status: Rare in Minnesota
Morley, 1972)

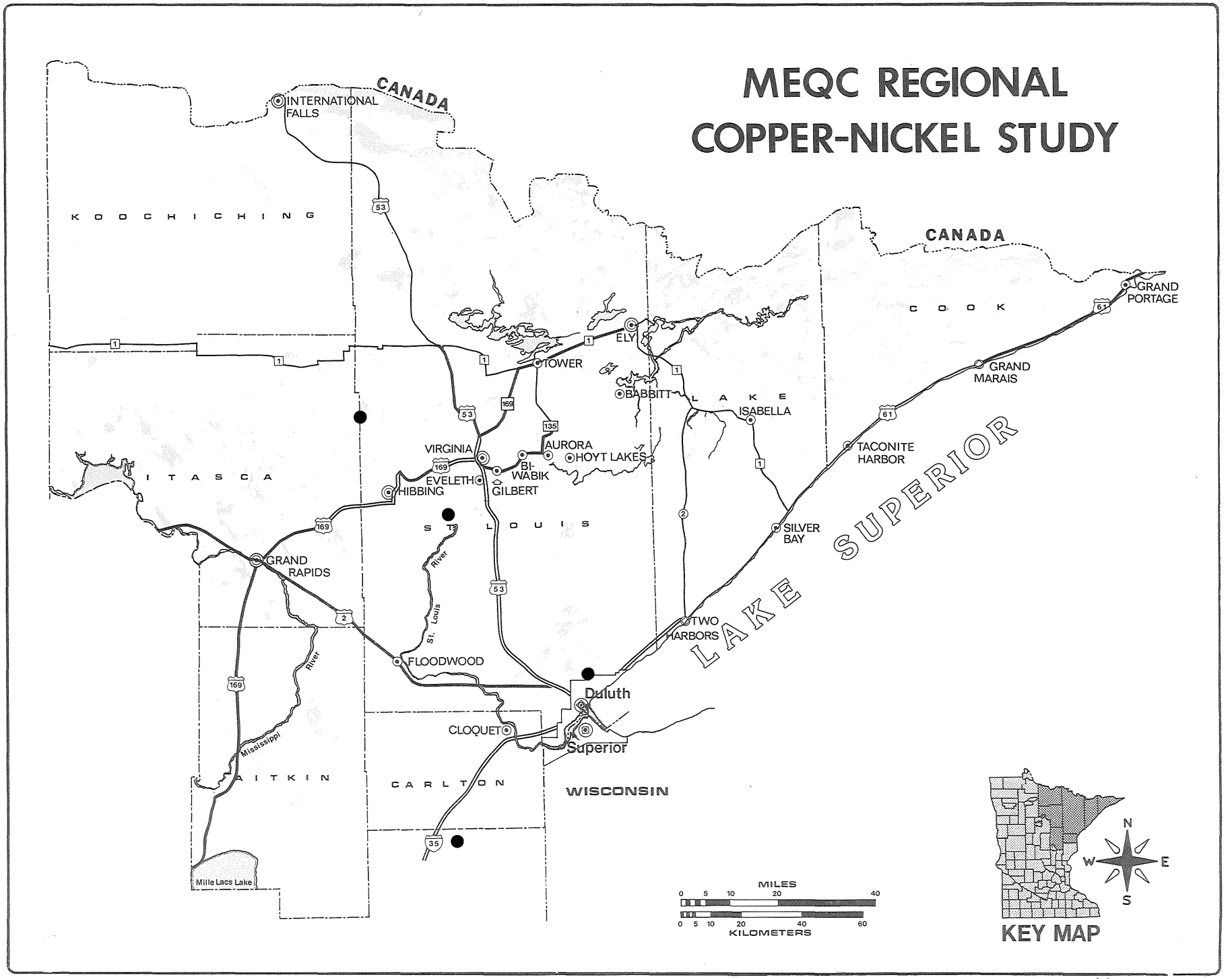


Figure 40

● Woodsia scopulina

■ Woodsia glabella

Protection status: Rare in Minnesota (Morley, 1972)

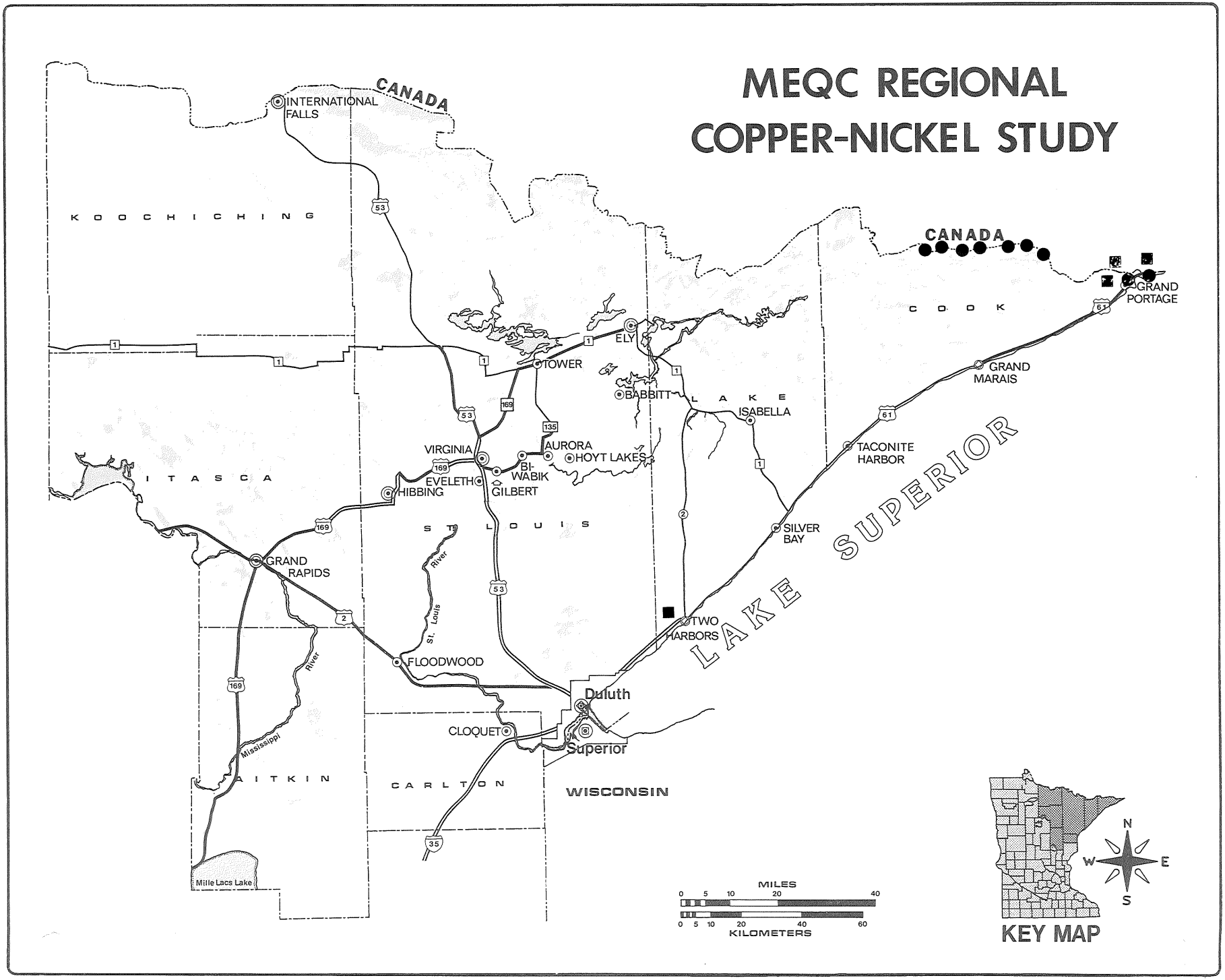


Figure 41

Arenaria macrophylla

Protection status: Rare in Minnesota (Morley, 1972)

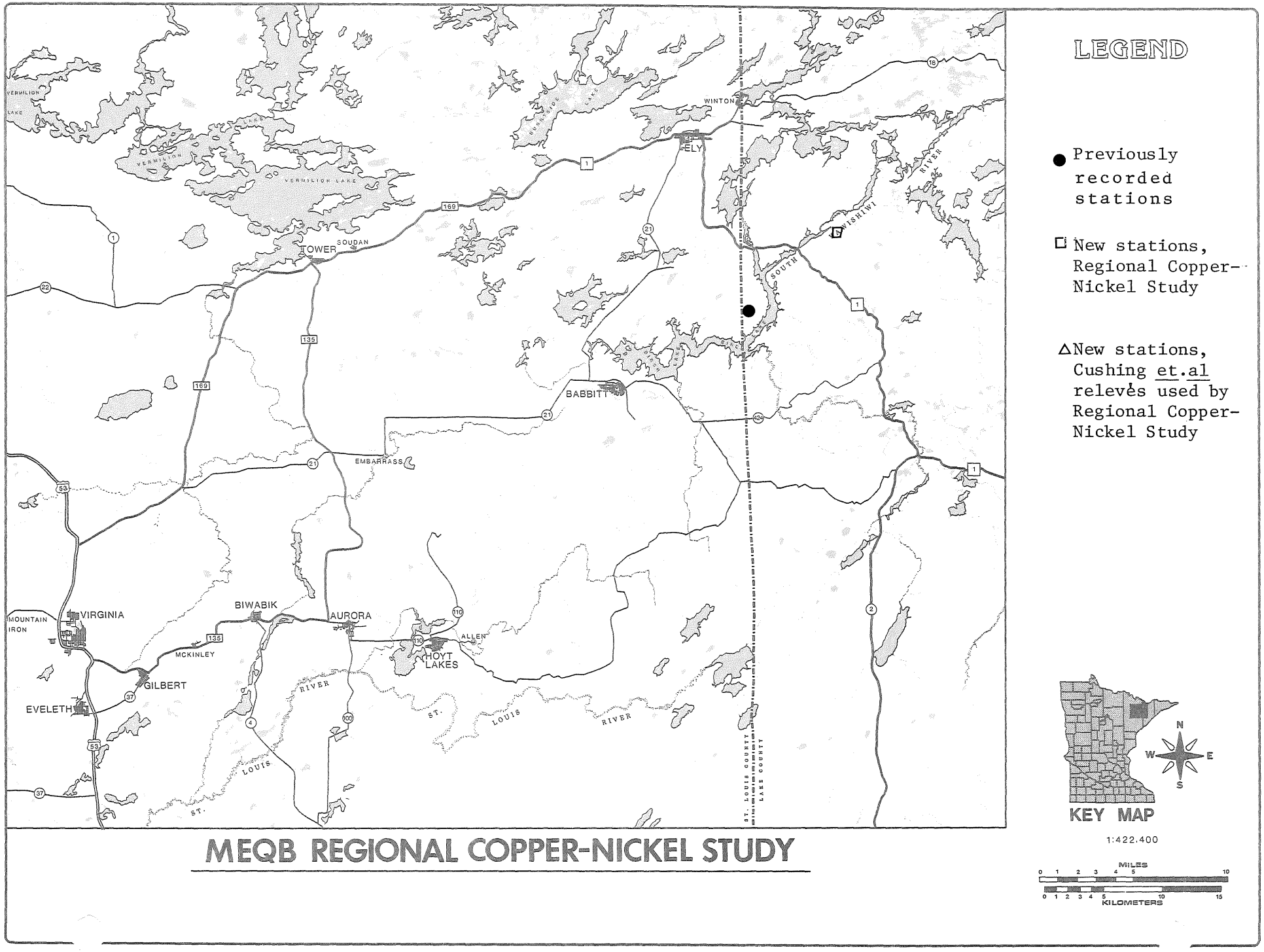


Figure 42

Bidens discoldea

Protection status: Rare in Minnesota (Morley, 1972)

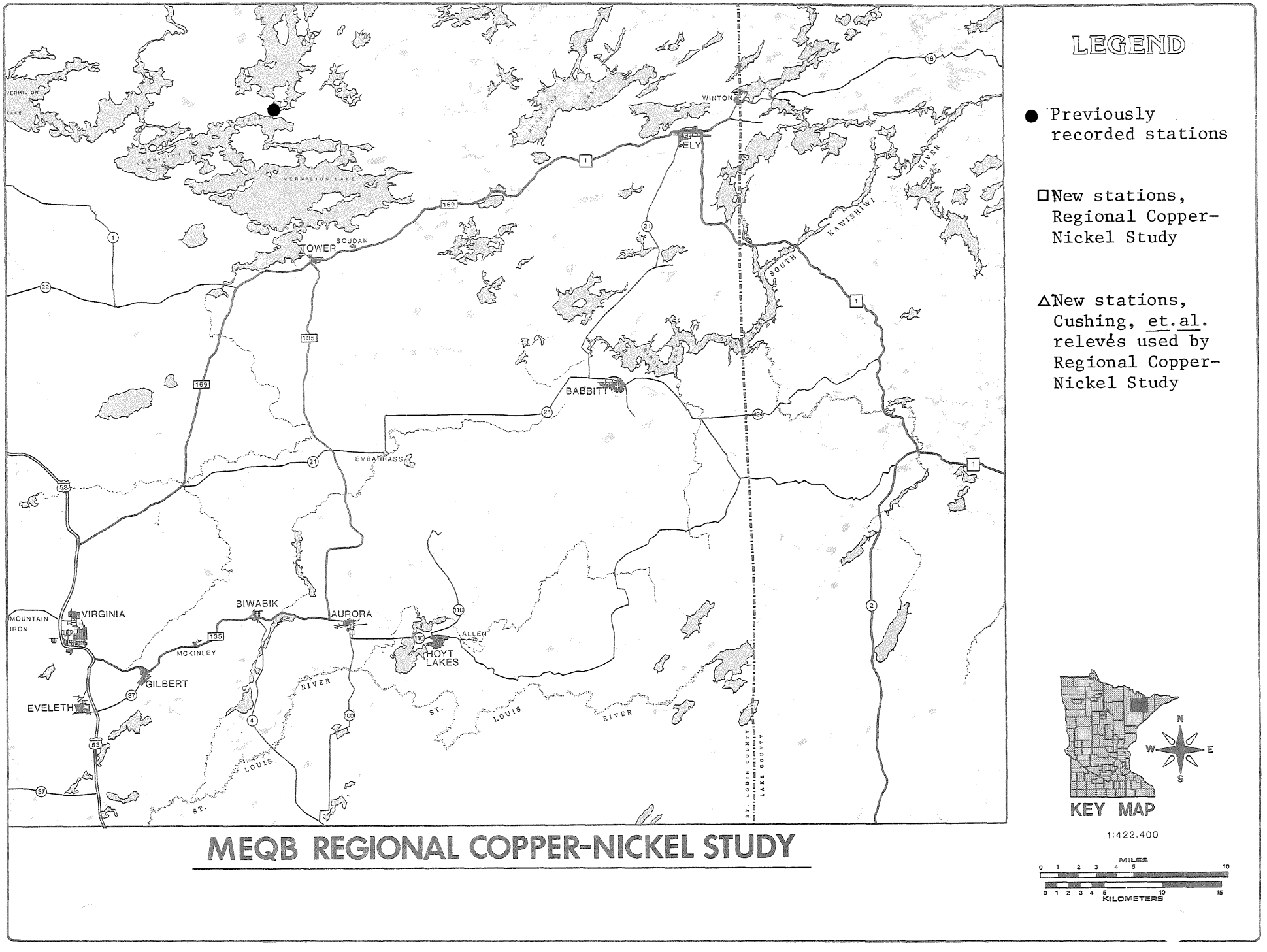


Figure 43

Caltha natans

Protection Status:
Rare in Minnesota
(Morley, 1972)

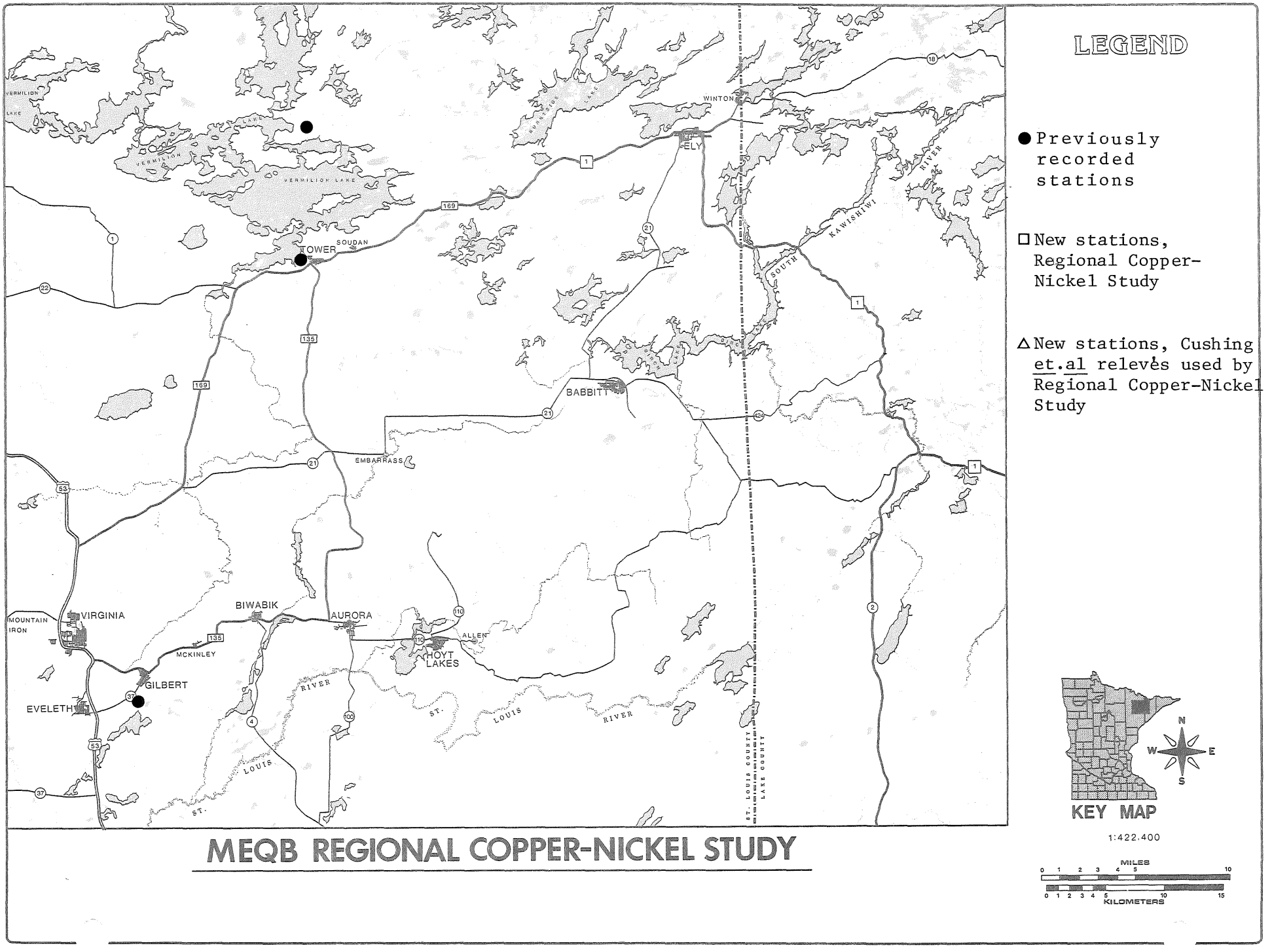


Figure 44

Geocaulon lividum

Protection status: Rare in Minnesota (Morley, 1972)

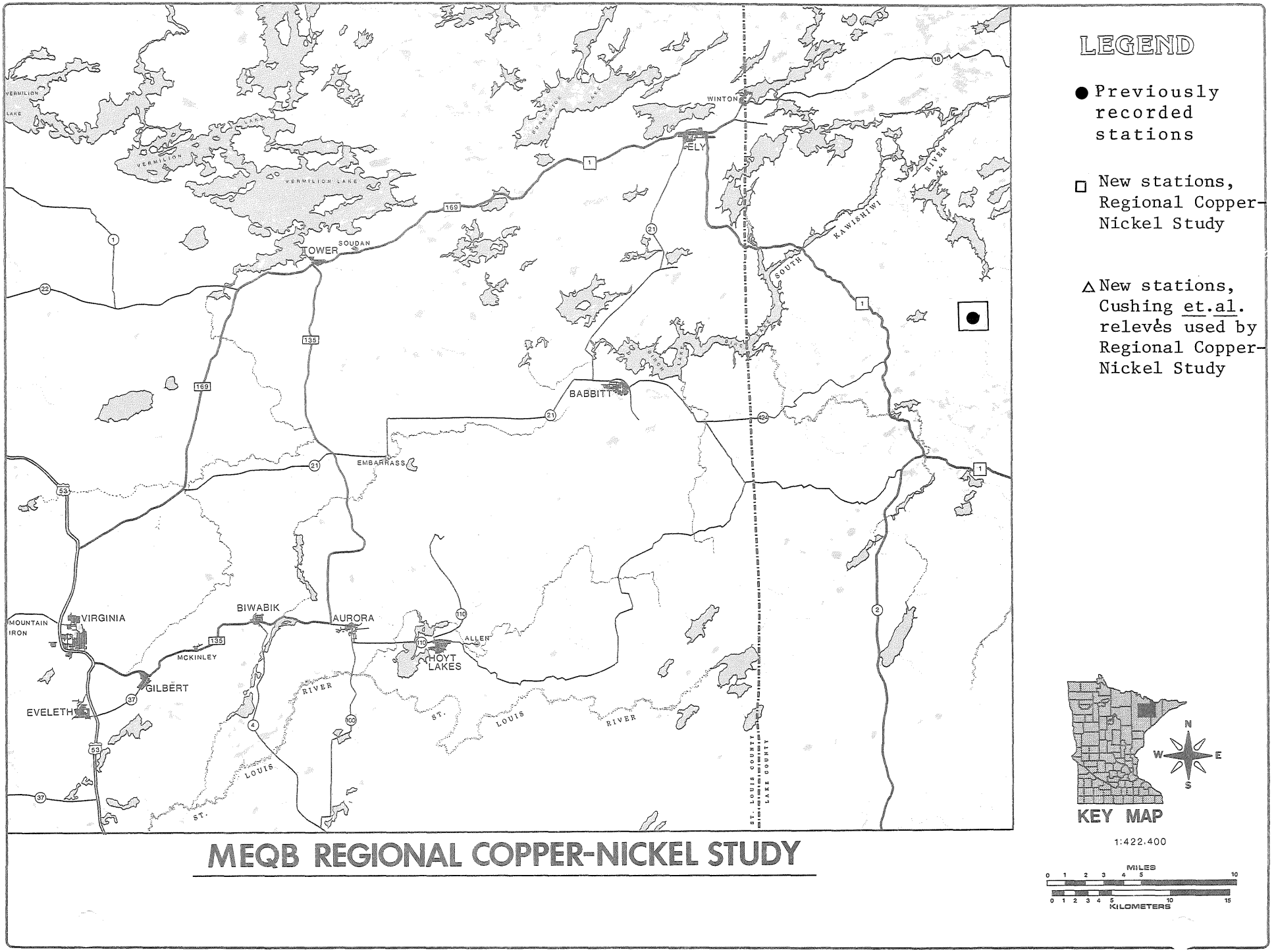


Figure 45

Glyceria pallida

Protection status: Rare in Minnesota (Morley, 1972)

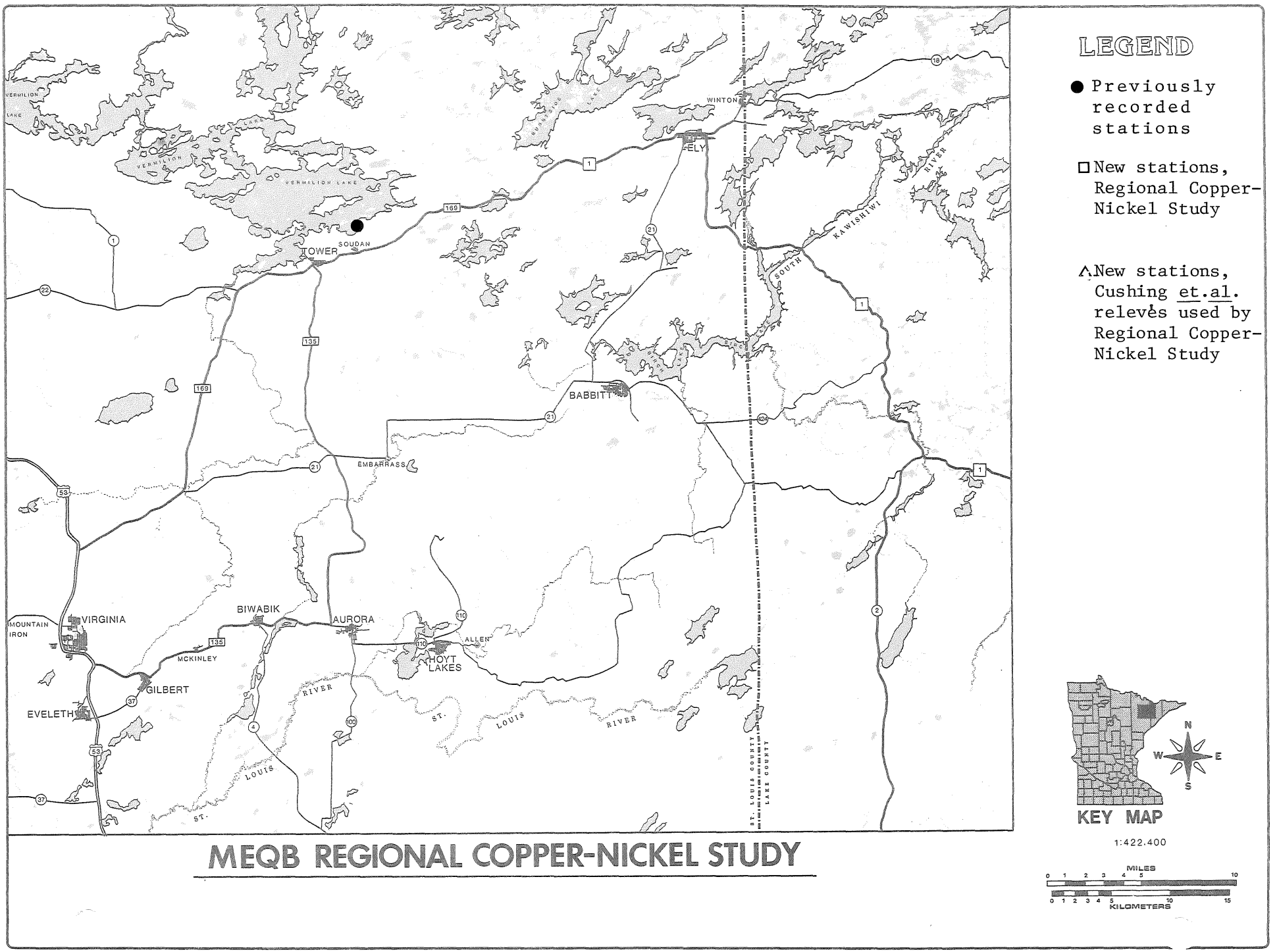


Figure 46

Juncus stygius

Protection status: Rare in Minnesota (Morley, 1972)

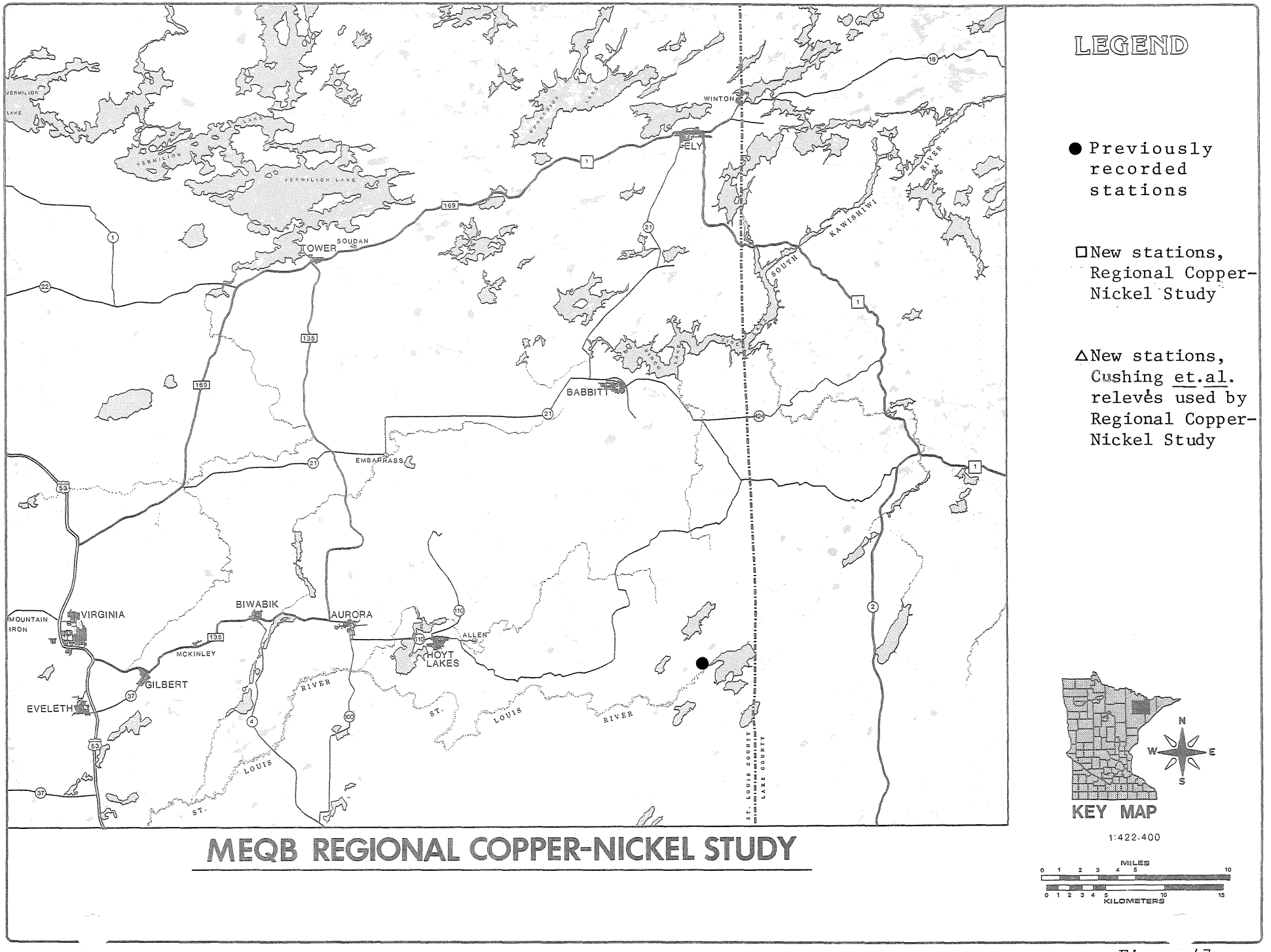


Figure 47

Muhlenbergia uniflora

Protection status: Rare in Minnesota (Morley, 1972)

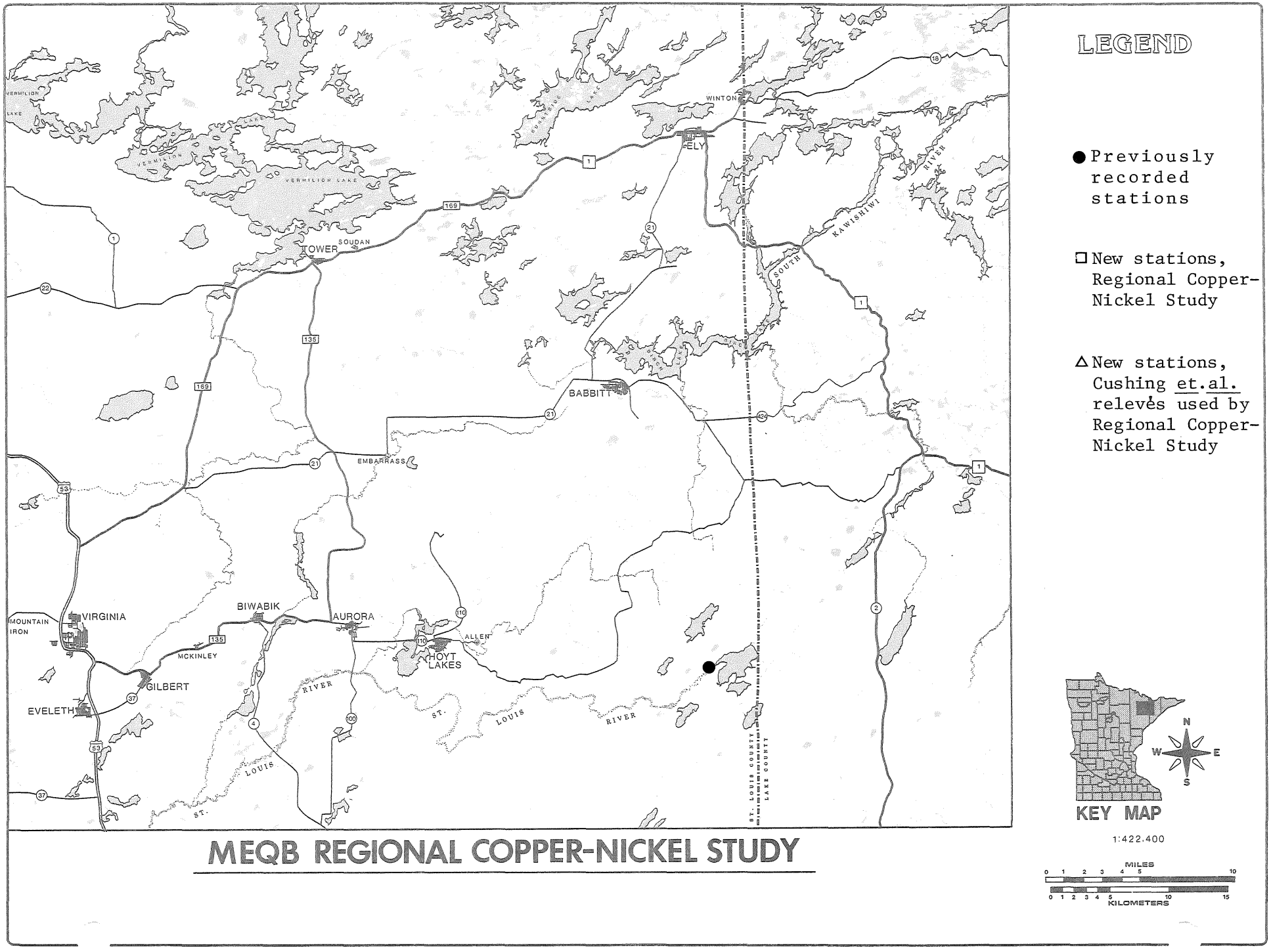


Figure 48

Nymphaea tetragona

Protection status: Rare in Minnesota (Morley, 1972)

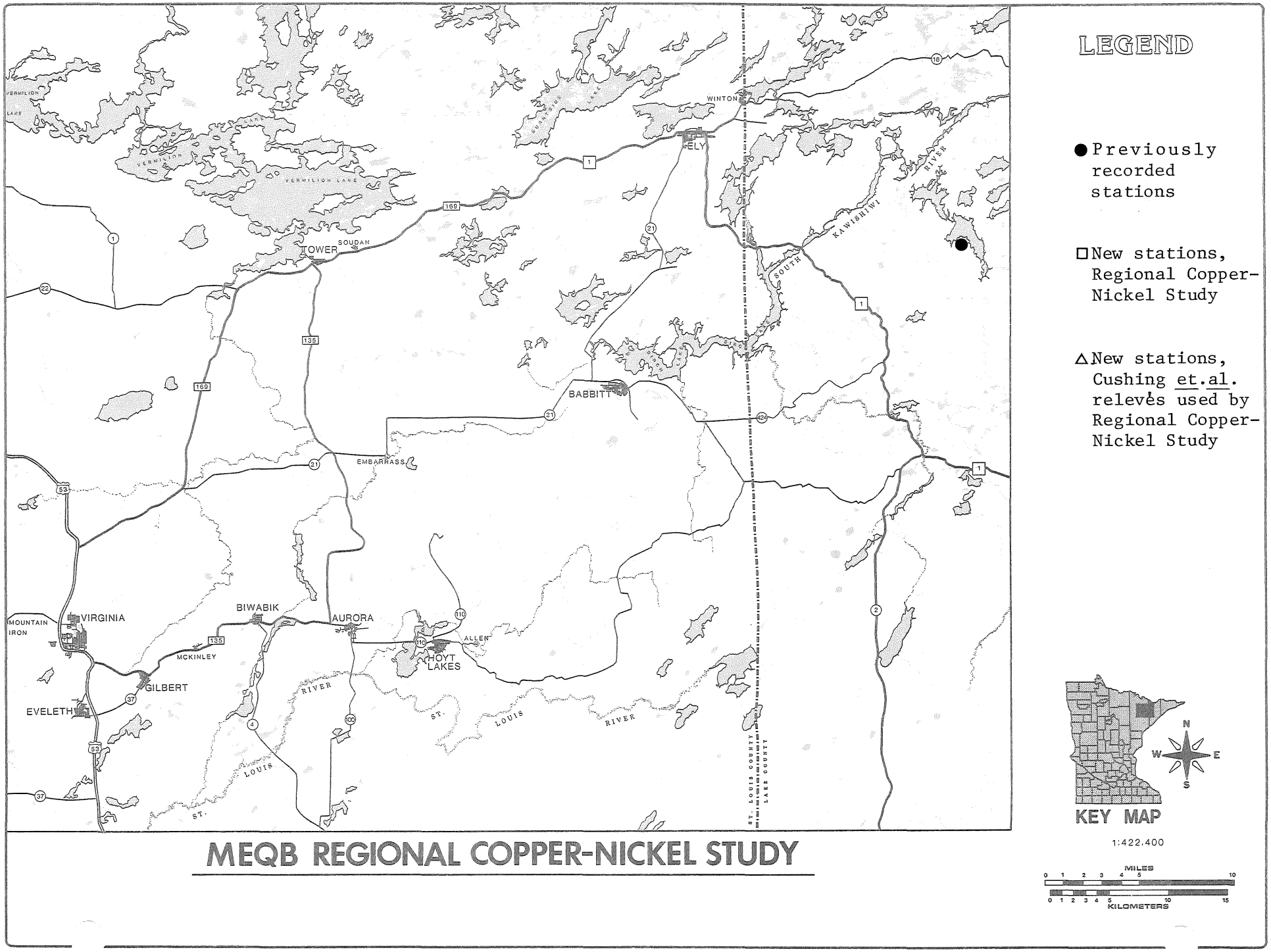


Figure 49

Poa sylvestris

Protection status: Rare in Minnesota (Morley, 1972)

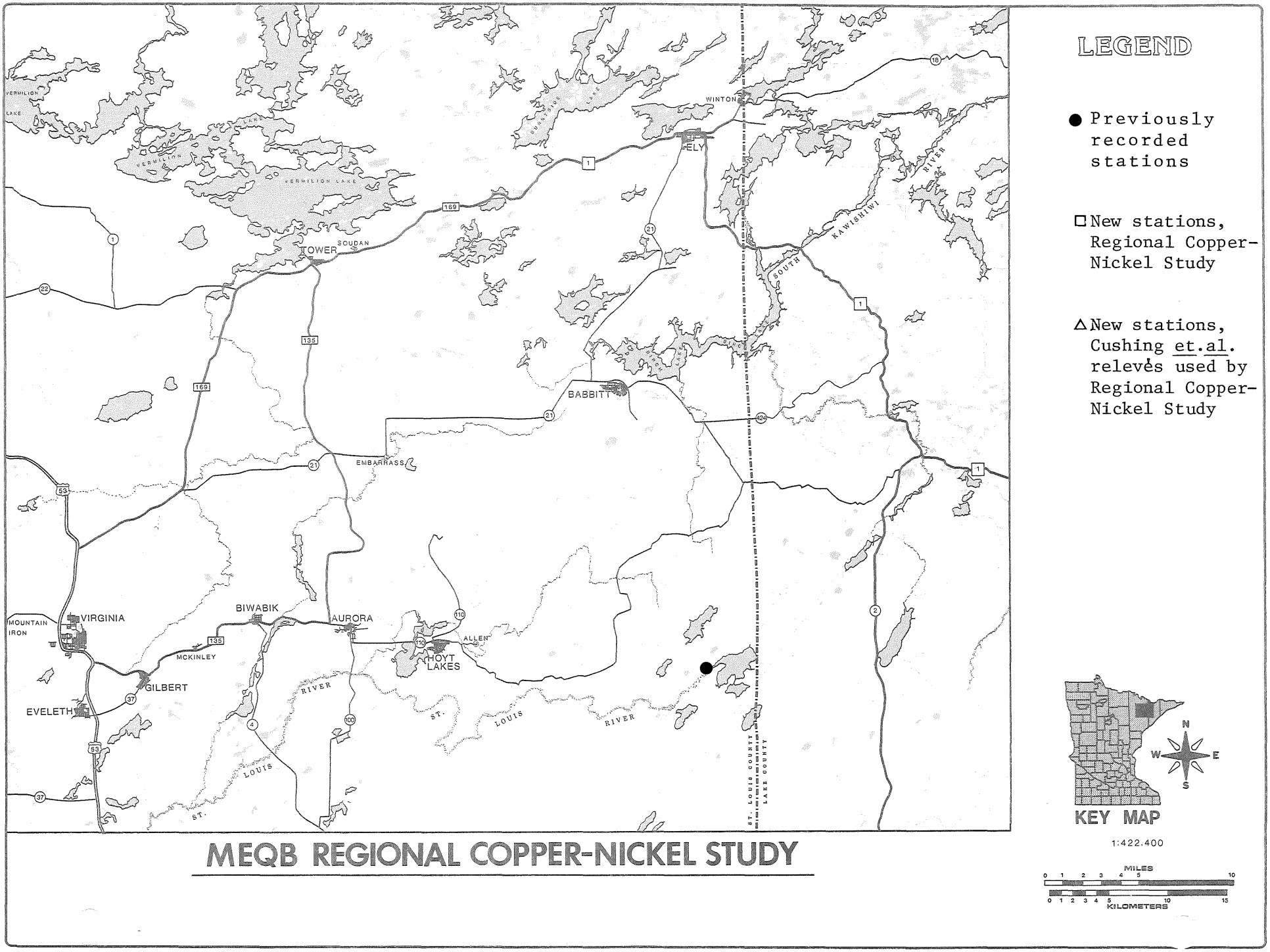
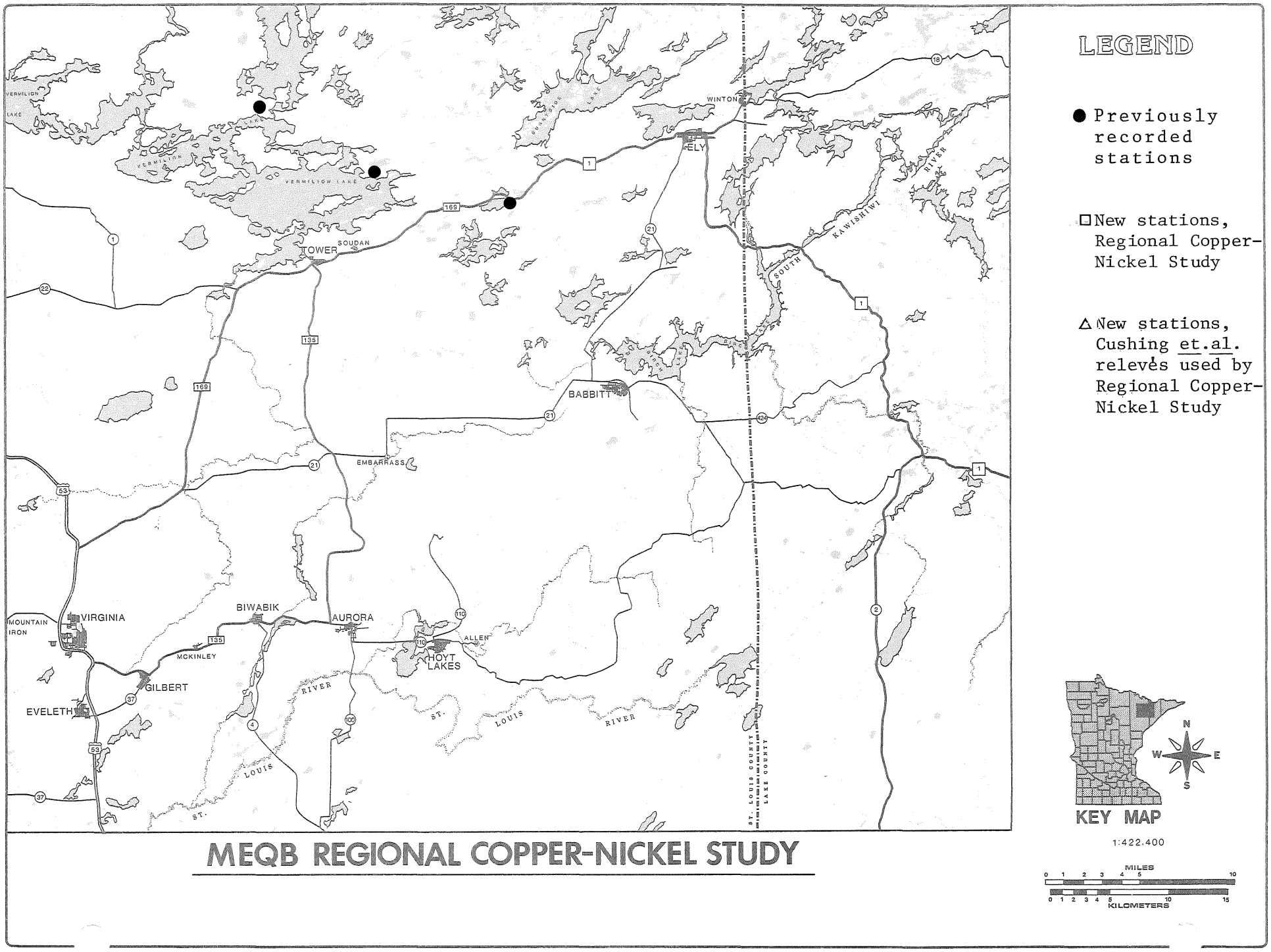


Figure 50

Ranunculus gmelini ●

Protection status: Rare in Minnesota (Morley, 1972)



MEQB REGIONAL COPPER-NICKEL STUDY

Figure 51

Ranunculus lapponicus

Protection status: Rare in Minnesota (Morley, 1972)

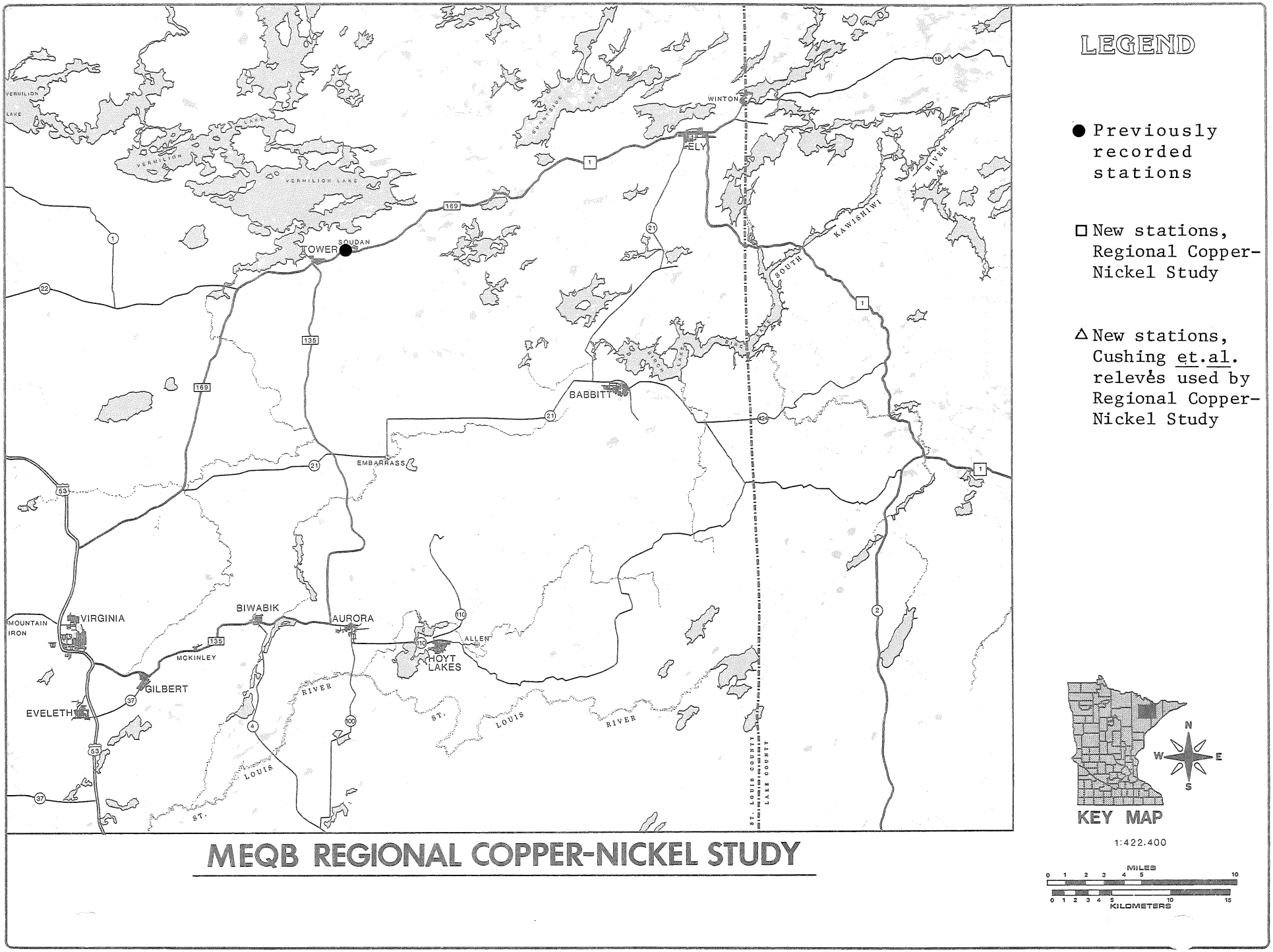
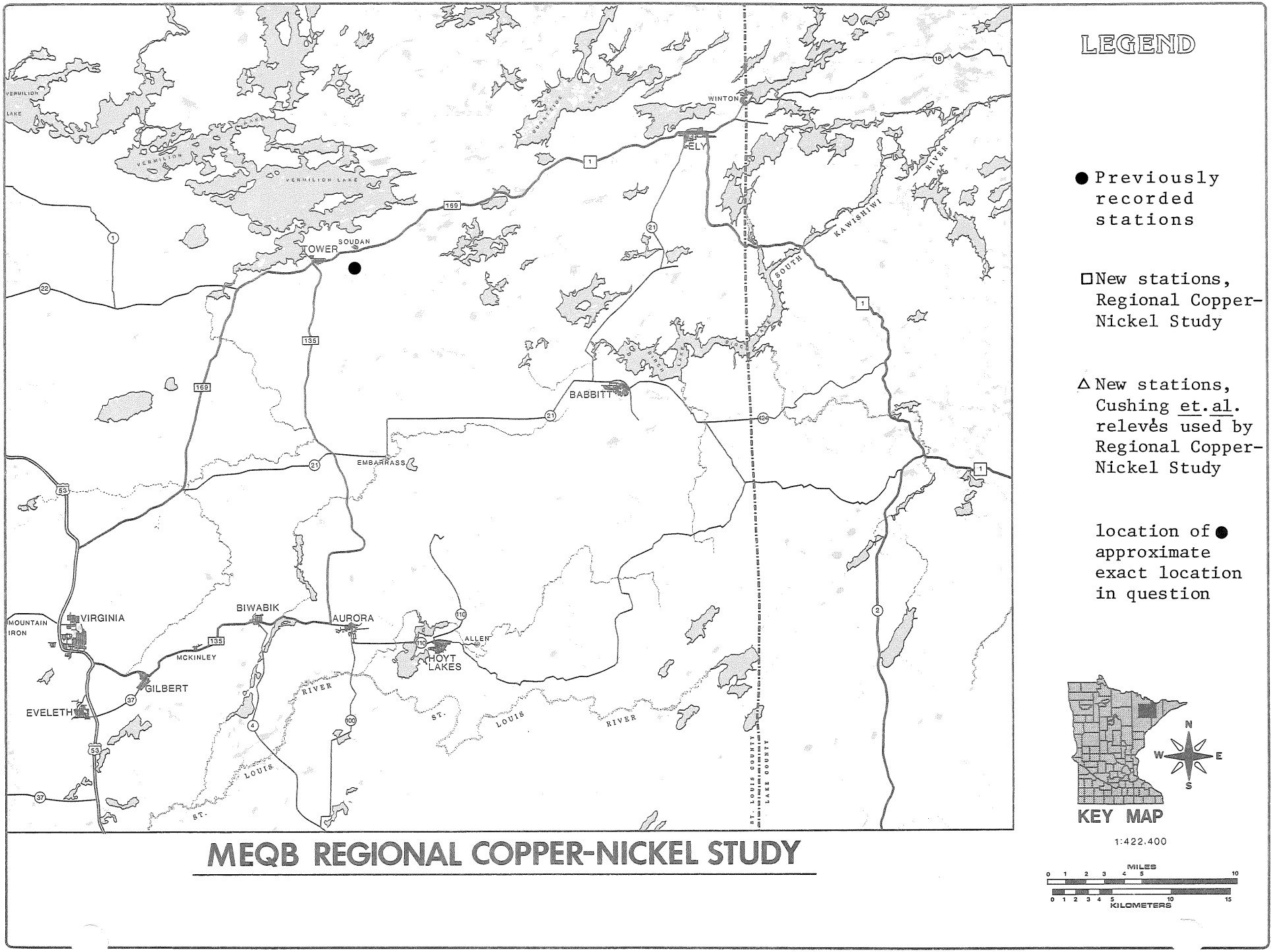


Figure 52

Rhynchospora fusca

Protection status: Rare in Minnesota (Morley, 1972)



MEQB REGIONAL COPPER-NICKEL STUDY

Figure 53

Waldsteinia fragariodes

Protection status: Rare in Minnesota (Morley, 1972)

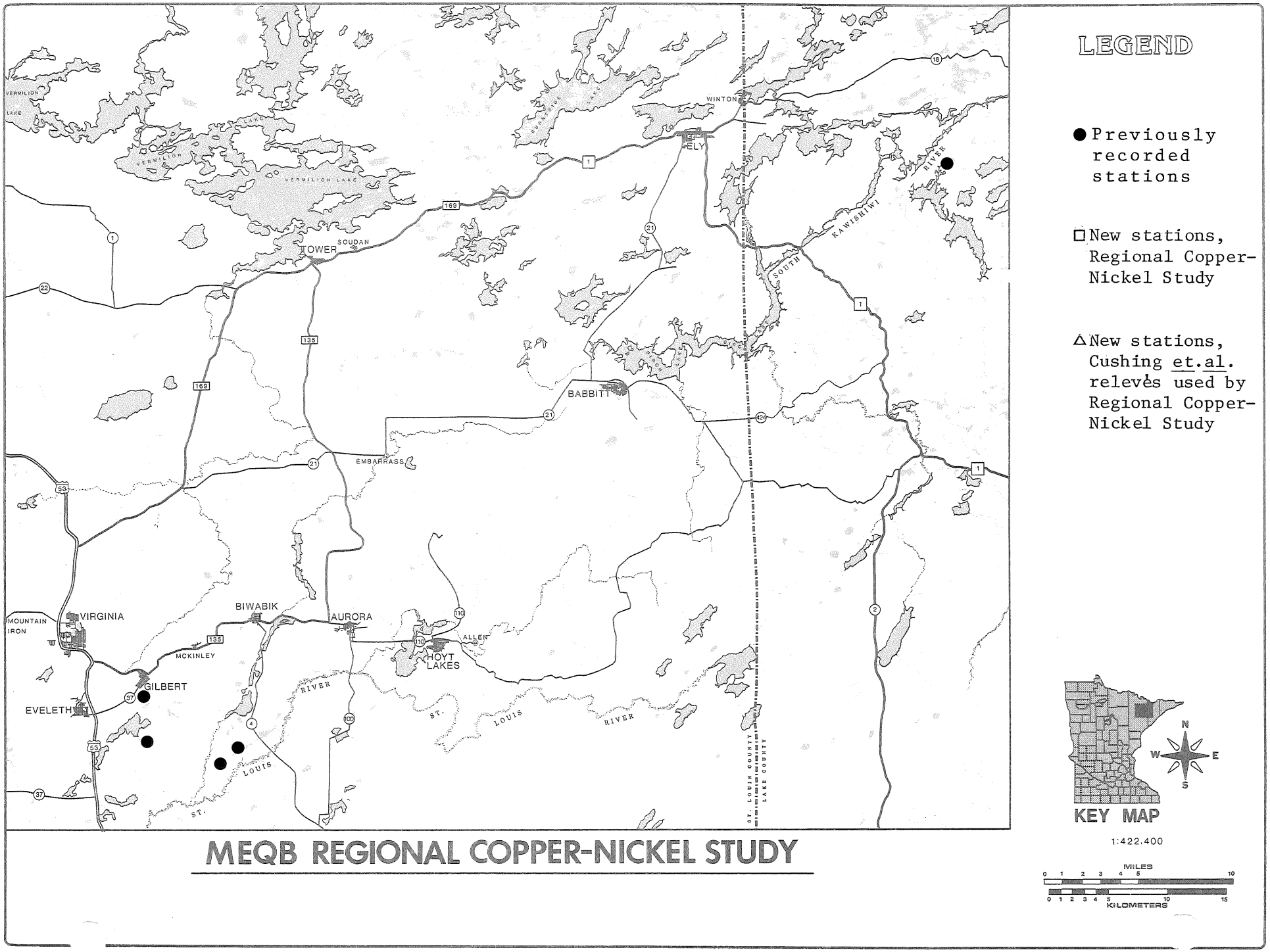


Figure 54

Juncus stygius

Protection status: Rare in Minnesota (Morley, 1972)

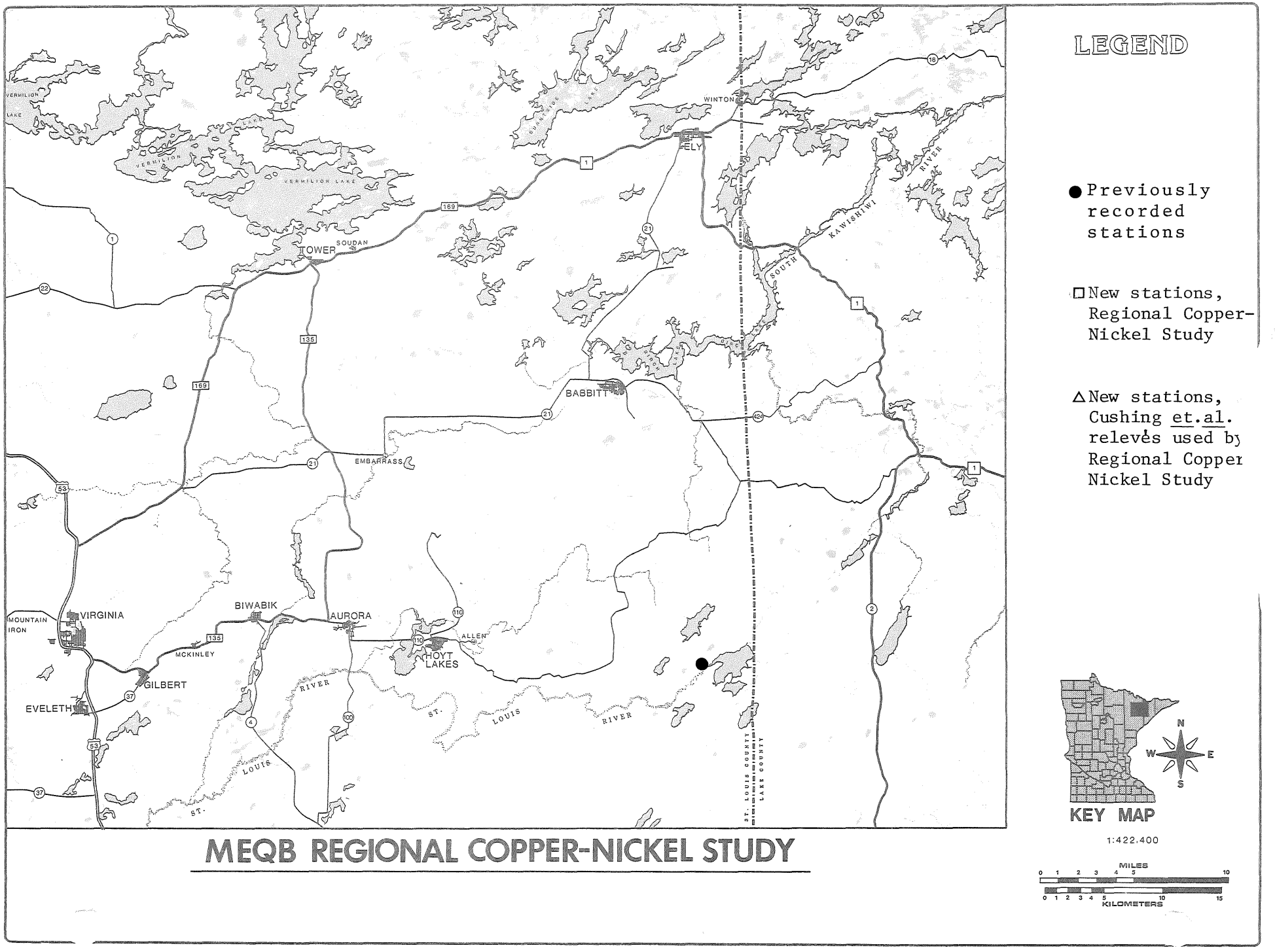


Figure 55