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REPORT ON THE STATUS OF CRITICAL PLANT SPECIES IN MINNESOTA

BY WELBY SMITH, BOTANIST

MINNESOTA NATURAL HERITAGE PROGRAM

JANUARY 1982

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Report on The Status of Critical Plant Species in Minnesota

This terminal report contains abstracts on plant species which are listed, proposed or under review for federal status in Minnesota. Submitted to the U.S. Fish and Wildlife Service in fulfillment of contract #14-16-0003-79-113

January 18, 1982

By

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Welby R. Smith, Program Botanist
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STATE OF MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

PHONE NO._____ FILE NO._____

January 18, 1982

Mr. James M. Engel
U.S. Fish & Wildlife Service
Federal Assistance (SE)
Federal Building, Fort Snelling
Twin Cities, MN 55111

Dear Jim:

The enclosed abstracts are submitted by the Minnesota Department of Natural Resources (Minnesota Natural Heritage Program) in fulfillment of contract #14-16-003-79-113. The abstracts represent detailed research on those plant species which occur in Minnesota and were listed, proposed, or under review by the U.S. Fish and Wildlife Service for federal status as of October 31, 1979. Two taxa (Saxifraga forbesii and Polemonium occidentale var. lacustre) are not treated because current taxonomic literature is not in agreement in regards to their taxonomic distictiveness. Furthermore, several species were recommended to the Fish and Wildlife Service for consideration after October 31, 1979, and are outside the scope of the present contract.

The following summaries and status recommendations are presented in addition to the abstracts. These summaries also include omitted species, and those for which detailed abstracts were not prepared.

Category 1

Erythronium propullans Gray. This species is endemic to Rice and Goodhue counties, Minnesota. It has been the subject of extensive field inventory and we are confident that few, if any, new populations will be discovered in the future. The majority of the extant populations occur in close proximity to urban areas, and there are demonstrable threats to the survival of this species throughout a significant portion of its range. Therefore, a status of threatened throughout its range is recommended.

Lespedeza leptostachya Engelm. This species is endemic to a relatively small area in the Upper Midwest, and has recently suffered a drastic decline in population. Its extant populations are limited to remnant habitats which are particularly susceptible to agricultural activities. A status of threatened throughout its range is recommended.

AN EQUAL OPPORTUNITY EMPLOYER

Platanthera leucophaea (Nutt.) Lindl. Although this species is relatively wide ranging, numerous local extirpations and population degredations pose a threat to its survival. The factors which threaten this species (i.e. agricultural activities) will likely intensify in the future, making the long-term survival of this species uncertain. Therefore, a status of threatened throughout its range is recommended.

Category 2

Besseya bullii (Eat.) Rydb. This species is a regional endemic with very specific habitat requirements. In Minnesota, it has been largely extirminated by urban development. Although its survival in Minnesota is certainly threatened, we know too little of its status outside of Minnesota to make a recommendation.

Chrysosplenium iowense Rydb. The survival of remnant populations in Iowa and Minnesota is apparently threatened by several types of human activities. However, there is no evidence that this species is threatened in the main portion of its range in northwestern North America. For this reason, no status recommendation is made.

Listera auriculata Wieg. There are only three known occurrences of this species in Minnesota, and none of them are known to be extant. Although this species is certainly very rare in Minnesota, there is no way to demonstrate threats to its survival. Therefore, no status recommendation can be made.

Poa paludigena Fern. & Wieg. At the time that agreement was reached between the U.S. Fish and Wildlife Service and the Minnesota Natural Heritage Program on the scope of the abstracts, this species was not known to occur in Minnesota. It has since been discovered to occur at a single location in Pine County, Minnesota. Because of the recent discovery of this species, an abstract has not been prepared and we are unable to recommend status.

Polemonium occidentale Green var. lacustre (Wherry) Lakela. This taxon is known only from its type locality in St. Louis County, Minnesota. Repeated efforts to relocate the site have been unsuccessful. It has not been located since the date of its original collection (1944). There has also been considerable skepticism about the validity of this taxon. For these reasons, no abstract has been prepared, and no status recommendation is proposed.

Potamogeton lateralis Morong. At the time that agreement was reached between the U.S. Fish and Wildlife Service and the Minnesota Natural Heritage Program on the scope of the abstracts, this species was not being considered for federal status. Therefore, an abstract has not been prepared. A preliminary investigation has been made, however, which reveals that this species has been collected only once in Minnesota (MIN). The location is Squaw Lake in Clearwater County, and the date of collection is 1974. Because of the apparent rarity of this species in Minnesota, its survival in the state may be threatened. Its status throughout its range, however, has not been determined and no status is recommended at this time.

Saxifraga forbesii Vasey. A preliminary investigation into the occurrences of this species in Minnesota reveals considerable confusion over the taxonomic treatment of this taxon. It was concluded that an abstract based on such uncertainties would not serve the purpose for which it would be intended. Therefore, no abstract has been prepared, and no status is proposed.

Viola novae-angliae House. At the time that agreement was reached between the U.S. Fish and Wildlife Service and the Minnesota Natural Heritage Program on the scope of the abstracts, this species was not being considered for federal status. Therefore, an abstract has not been prepared. A preliminary investigation has been made, however, which reveals that this species occurs frequently throughout portions of Minnesota. Furthermore, there appears to be no threat to the survival of this species in Minnesota. For these reasons, no status is recommended for this species.

Woodsia oregana D.C. Eaton var. cathcartiana (Robins.) Morton. At the time that agreement was reached between the U.S. Fish and Wildlife Service and the Minnesota Natural Heritage Program on the scope of the abstracts, this species was not being considered for federal status. Therefore, an abstract has not been prepared. A preliminary investigation has been made, however, which reveals this species to be widespread in Minnesota and in no apparent danger from human or natural threats. For these reasons, no status is recommended for this species.

No longer under review (3C)

Cypripedium arietinum R. Br. This species occurs very rarely in Minnesota, and most of the populations known to be extant face demonstrated threats to their survival. This situation warrants a threatened status in Minnesota, but a status range-wide cannot be recommended based on Minnesota occurrences.

Cypripedium candidum Muhl. This species is apparently more abundant in Minnesota than in other states. Many of the populations in Minnesota occur on public land and are in no apparent jeopardy. Therefore, it is recommended that this species not be considered for status.

Hydrastis canadensis L. Only a single population of this species is known to be extant in Minnesota. Although this species is clearly threatened in Minnesota, a recommendation of its status throughout its range cannot be made.

Panax quinquefolius L. This species is still relatively frequent in Minnesota, and its exploitation is being monitored by the DNR. It is recommended that this species not be considered for status.

Platanthera flava (l.) R. Br. var. herbiola (Lindl.) Ames & Correll. This species is extremely rare in Minnesota. It has not been collected since 1909 and may, in fact, be extinct in the state. Its status outside Minnesota, however, has not been analyzed and a recommendation of status cannot be made.

Primula mistassinica Michx. Although a detailed abstract has not been prepared for this species, a preliminary search of herbaria and the literature has been conducted. The results indicate that this species is widespread but local in Minnesota, and that most of the populations are not threatened.

Sullivantia renifolia Rosend. This species is endemic to a relatively small area in the Midwest. It has very specific habitat requirements and never occurs with great frequency. Our studies in Minnesota, however, have failed to demonstrate any threat to the survival of known populations. We are, therefore, unable to recommend a status for this species.

Category CB

Woodsia abbeae Butters and Gymnocarpium heterosporum Wagner. The Minnesota Natural Heritage Program concurs with the Fish and Wildlife Service that these taxa do not meet the act's definition of "species".

During the process of preparing the abstracts several additional research needs were recognized. Although the fulfillment of these needs was beyond the scope of the present contract, additional research could be designed for this purpose. With this goal in mind, I would like to propose a contract between the Minnesota Natural Heritage Program and the U.S. Fish and Wildlife Service, under which the Natural Heritage Program would perform the following work:

1. Prepare status reports for those plant species which have recently come under review by the U.S.F.W.S. for inclusion in the 1973 endangered species act, but which were not included in recent contract work.

2. Conduct detailed research on category 1 plant species of a type beyond the scope of recent contract work. This research could include:

   A. Detailed plant monitoring to determine population structure and dynamics, reproductive potential and population trends.

   B. Analysis of species biology to determine specific habitat requirements, cultural potential and management needs.

This proposed research would complete the series of status reports for species occurring in Minnesota, and provide a high level of data for those species of greatest priority. It is this high level of data that would best assist the Service in the final analysis of these species.

Sincerely,

Barbara Coffin
Coordinator

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STATUS SHEET

Taxon Name: *Besseya bullii* (Eaton) Rydberg

Common Name: None

Family: Scrophulariaceae

State Where Taxon Occurs: Minnesota, Wisconsin, Iowa, Illinois, Indiana, Ohio, Michigan

Author of This Report: Welby R. Smith

Date of This Report: December 3, 1981

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1. Classification and Nomenclature

A. Species

1. Besseya bullii (Eaton) Rydberg
2. Synonyms include: Wulfenia bullii (Eat.) Barnh.
3. Common Name: None

B. Family Classification

1. Scrophulariaceae

C. Major Group

1. Angiospermae

D. Current alternative taxonomic treatment

1. None

2. Present State Status

A. Legal. None

B. Advisory. Proposed by the Minnesota Natural Heritage Program as Endangered in Minnesota.

3. Geographic Distribution and Site Descriptions

A. Geographic range: Minnesota, Wisconsin, Iowa, Illinois, Indiana, Ohio and Michigan

B. Precise Occurrences

1. Populations currently or recently known extant

1a. Carver County. T114N R24W, section 20. Approximately five miles southwest of East Union on Route 40.
1b. U.S. Geological Survey 15 minute quadrangle map; Series V772, New Prague, 1957.
1c. Specimen was collected by Gerald A. Wheeler (MIN; #4415), July 17, 1979.
1d. The size of this population is not known. The habitat was described on Wheeler's specimen label as, "a dry hillside and fully exposed to sunlight." This population is presumed to be native.
1e. Ownership of this site is not known.
1f. Threats to this population have not been assessed.

2a. Carver County. T114N R24W, section 12. Approximately 3.5 miles south-southwest of Carver. Although the location of

the population within section 12 is not stated on the herbarium label, local topography would indicate that the site is in the NE1/4 SW1/4 of section 12.

2b. U.S. Geological Survey 15 minute quadrangle map; Series V772, New Prague, 1957.

2c. Specimen was collected by Gerald A. Wheeler (MIN; #4394), July 17, 1979.

2d. The size of this population is not known. The habitat was described on Wheeler's specimen label as, "in dry soil on the top of a rather steep wooded bank." This population is presumed to be native.

2e. Ownership of this site is not known.

2f. Threats to this population have not been assessed.

3a. Hennepin County. T116N R24W, SE1/4 NW1/4, section 21. In Anderson Park, along Nine-Mile Creek within the city of Bloomington.

3b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Bloomington, 1967.

3c. Specimen was collected by Thomas D. Trana, V. Bonnewell, K. Lustig and M. Berbee (MIN; #7456), May 18, 1979.

3d. The size of this population is not known. The habitat was described on the specimen label as, "Quercus woods - prairie on top of hill overlooking the creek." This population is presumed to be native.

3e. The current landowner appears to be the city of Bloomington.

3f. Threats to this population have not been assessed.

4a. Washington County. T28N R20W, SW1/4 section 34.

4b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Prescott, 1967

4c. Specimen was collected by Gerald B. Ownbey (MIN; #5143), May 23, 1976.

4d. The size of this population is not known. The habitat was described on Ownbey's specimen label as, "In broken shade, deciduous forest, cool, north-facing slope, sandy soil. Scattered plants." This population is believed to be native.

4e. This population occurs within Afton State Park, and is owned and managed by the Division of Parks and Recreation, Department of Natural Resources.

4f. Theats to this population have not been assessed.

5a. Goodhue County. T12N R18W, SE1/4 SE1/4 SW1/4 section 18

5b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Randolph, 1974.

5c. Specimen was collected by Welby Smith (MIN; #3726), April 28, 1981.

5d. Approximately 10 to 12 individuals were counted in an area 12 by 8 feet. About 10 to 20 additional individuals were seen scattered over an area of about 10 acres. They were occurring on level terrain and on north-facing slopes. The substrate was loose, gravelly soil. The habitat was exposed to direct sunlight, and can be best chracterized as a dry prairie. This popuation is believed to be native.

5e. This site is owned and managed by Carlton College of Northfield, Minnesota.

5f. There are no known existing or potential threats to this population.

2. Populations known or assumed extirpated

1a. This population is known only by a herbarium specimen (MIN), labeled: "Dakota County, Buck Hill, E.P. Sheldon #7512, June 4, 1894." Buck Hill is within the corporate boundaries of Burnsville, and is located at: T115N R21W, NW1/4 SE1/4 section 36. Buck Hill is currently managed as a commercial skiing area, and every slope has been converted to this use. Because of the intensive use of this area, it is assumed that B. bullii has been extirpated from the site.

1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Orchard Lake, 1974.

1c. This population has not been located since the date of the original collection (1894).

1d. The size and physical circumstances of this population (when extant) are not known. This population is believed to have been native.

1e. Ownership of this site has not been determined.

1f. This population is presumed extirpated.

2a. Scott County. T115N R23W, SW1/4 section 21. About 4.5 miles southwest of Shakopee on Highway 169. In 1981, this site was converted to industrial uses. It is believed that all of the native vegetation was destroyed.

2b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Shakopee, 1958.

2c. There are herbarium records of B. bullii from this site dated 1891 (MIN; Ballard), 1966 (MIN; J.G. Marshall), 1967 (MIN; G.K. Lee #29) and 1979 (MIN; G.A. Wheeler #3419). Included in this site is a specimen (MIN), labeled: "Shakopee, June 1891, C.A. Ballard."

2d. The size of the population (when extant) is not known. The habitat was a sandy prairie with frequent sandstone outcrops. This population is believed to have been native.

2e. Ownership of the site is not known.

2f. This population is presumed extirpated.

3. Historically known populations where current status is not known

1a. This population is known only by a herbarium specimen (MIN), labeled, "Stillwater. May 1894. A.P. Anderson #892." Stillwater is located in Washington County at: T30N R20W, sections 21,28,29,33,34. The relation of Stillwater to the original collection site is not known.
1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Stillwater, 1967.
1c. This population has not been located since the date of the original collection (1894).
1d. The size and physical circumstances of this population are not known. This population is believed to be native.
1e. Ownership of this site cannot be determined without additional locational information.
1f. Threats to this population (if extant) cannot be assessed without further data.

2a. This population is known only by a herbarium specimen (MIN), labeled: "Battle Creek, St. Paul. July 13, 1884. Dr. Thos. S. Roberts." Battle Creek is located in Ramsey County at: T28N R22W, SE1/4 SE1/4 section 3, and various portions of section 2. The exact relation of Battle Creek to the original collection site is not known.
2b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, St. Paul East, 1967.
2c. This population has not been located since the date of the original collection (1884).
2d. The size and physical circumstances of this population are not known. This population is believed to be native.
2e. Ownership of this site cannot be determined without additional locational information.
2f. Threats to this population (if extant) cannot be assessed without further data.

3a. This population is known only by a herbarium specimen (MIN), labeled: "Sandy hillside near fish hatchery, St. Paul, C.O. Rosendahl #1252, May 26, 1903." The fish hatchery is located in Ramsey County at: T28N R22W, section 3. The exact location of the original collection site cannot be determined from the available information.
3b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, St. Paul East, 1967.
3c. This population has not been located since the date of the original collection (1902).
3d. The size of this population is not known. The herbarium label describes the site as a, "sandy hillside." All the hillsides in the vacinity of the fish hatchery have a general south-facing aspect. This population is believed to be native.

3e. Ownership of this site cannot be determined without additional locational information.
3f. Threats to this population (if extant) cannot be asessed without further data.

4a. This population is known only by a herbarium specimen (MIN), labeled: "Dakota County, Lakeville Lake. June 1, 1894, E.P. Sheldon #7496." The corporate boundaries of Lakeville include portions of T114N R21W and T114N R20W. The populated portion of the town is located in section 29 of T114N R20W. There are several lakes in the town, but none are currently known as "Lakeville Lake". The exact location of the original collection site has not been determined.
4b. U.S. Geological Survey 7.5 minute quadrangle maps; Series V872, Orchard Lake, 1974 and Series V872, Farmington, 1974.
4c. This population has not been located since the date of the original collection (1894).
4d. The size and physical circumstances of this population are not known. This population is believed to be native.
4e. Ownership of this site cannot be determined without additional locational information.
4f. Threats to this population (if extant) cannot be assessed without further data.

5a. This population is known only by a herbarium specimen (MIN), labeled: "Hastings. June 22, 1909. H.L. Lyon #782." The town of Hastings is located in portions of T115N R17W, Dakota County. The exact relation of Hastings to the original collection site has not been determined.
5b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Hastings, 1974.
5c. This population has not been located since the date of the original collection (1909).
5d. The size and physical circumstances of this population are not known. This population is believed to be native.
5e. Ownership of this site cannot be determined without additional locational information.
5f. Threats to this population (if extant) cannot be assessed without futher data.

6a. This population is known only by a herbarium specimen (MIN), labeled: "Four Corners, Dakota County. John W. Moore, M.F. Moore #16225, May 26, 1944." I have been unable to locate the place name "Four Corners" on any map or in any published reference material. It probably refers

to a local feature rather than a municipality. For this reason, the exact location of the original collection site has not be determined.

6b. It is not known which U.S. Geological Survey quadrangle map the site occurs on.

6c. This population has not been located since the date of the original collection (1944).

6d. The size and physical circumstances of this population are not known. This population is believed to be native.

6e. Ownership of this site cannot be determined without additional locational information.

6f. Threats to this population (if extant) cannot be assessed without further data.

7a. This population is known only by a herbarium specimen (MIN), labeled: "Goodhue County, Red Wing, hillside. J.H. Sandberg #274, May 1886." Red Wing is located in portions of T113N R15W. The exact relation of Red Wing to the collection site is not known.

7b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Red Wing, 1974.

7c. This population has not been located since the date of the original collection (1886).

7d. The size and physical circumstances of this population are not known. This population is believed to be native.

7e. Ownership of this site cannot be determined wihout additional locational information.

7f. Threats to this population (if extant) cannot be assessed without futhter data.

8a. This population is known only by a herbarium specimen (MIN), labeled: "1/2 mile below Welch, along the railroad. J.W. Moore, M.F. Moore #12535. May 21, 1940." The town of Welch is located in Goodhue County, at T113N R16W, section 28. From the description on the herbarium label, it appears that the collection site was in the N1/2, SE1/4 of section 28.

8b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Welch, 1974.

8c. This population has not been located since the date of the original collection (1940).

8d. The size and physical circumstances of this population are not known. This population is believed to be native.

8e. Ownership of this site has not been determined. The statement by Moore that the collection was made "along the railroad" may imply that it was on the right-of-way of the railroad (Chicago and Northwestern Railway).

8f. Threats to this population (if extant) cannot be assessed without further data.

9a. This population is known only by a herbarium specimen (MIN), labeled: "Featherstone. Aug. 1893. A.P. Anderson #712." Featherstone township is located in Goodhue County at T112N R15W. There is no municipality mapped in this township, and the exact location of the collection site is not known.
9b. U.S. Geological Survey 7.5 minute quadrangle maps; Series V872, Red Wing, 1974 and Series V872, Welch, 1974.
9c. This population has not been located since the date of the original collection (1893).
9d. The size and physical circumstances of this population are not known. This population is believed to be native.
9e. Ownership of this site cannot be determined without additional locational information.
9f. Threats to this population (if extant) cannot be assessed without further data.

10a. This population is known by two herbarium specimens (MIN), labeled: "Near Minneapolis, G.B. Aiton, June 1891." and "Near Minneapolis, F.H. Burglehause, May 1892, dry prairie." It is possible that these specimens represent different populations. Because the label data are so similar, however, I am assuming that they were collected from the same population. Minneapolis is located in eastern Hennepin County, but the exact location of the collection site is not known.
10b. It is not known which U.S. Geological Survey quadrangle map the site occurs on.
10c. This population has not been located since the date of the most recent collection (1892).
10d. The size and physcial circumstances of this population are not known. One label, however, does say "dry prairie", presumably in reference to the habitat where the collection was made. This population is believed to be native.
10e. Ownership of this site cannot be determined without additional locational information.
10f. Threats to this population (if extant) cannot be assessed without further data.

11a. This population is known only by a herbarium specimen (MIN), labeled: "Dry hillside, open prairie. Fort Snelling. Lawrence Erickson." The specimen is not dated, but the aged appearance of the sheet and label indicate that it probably dates from the late 19th century. The

physical facilities of Fort Snelling are in Hennepin County at T28N R23W. Until recently, however, the Fort Snelling Reservation extended over portions of three counties and several hundred acres. The exact location of the collection site is not known.

11b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, St. Paul West, 1967.

11c. This population has not been located since the date of the original collection (believed to be sometime in the late 19th century).

11d. The size of this population is not known. The habitat as described on the specimen label is a "dry hillside, open prairie". This population is believed to be native.

11e. Original ownership was presumably the United States government. Current ownership, however, cannot be positively determined without additional locational information.

11f. Threats to this population (if extant) cannot be assessed without further data.

12a. This population is known only by a herbarium specimen (MIN), labeled: "Wild meadow, Copas, Minn. May 23, 1914. W. S. Beach." The town of Copas is located in Washington County at T32N R19W, section 30. The exact relation of Copas to the original collection site has not been determined.

12b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Marine on St. Croix, 1967.

12c. This population has not been located since the date of the original collection (1914).

12d. The size of this population is not known. The habitat is described on the specimen label as a "wild meadow". This population is believed to be native.

12e. Ownership of this site cannot be determined without additional locational information.

12f. Threats to this population (if extant) cannot be assessed without further data.

13a. This population is known only by a herbarium specimen (MIN), labeled: "Cedar Lake, Minn. T.L. Holtz, May 1890". Cedar Lake is located in Scott County at T113N R22W, section 14. The exact relation of Cedar Lake to the original collection site has not been determined.

13b. U.S. Geological Survey 7.5 quadrangle map; Series V872, Veseli, 1974.

13c. This population has not been located since the date of the original collection (1890).

13d. The size and physical circumstances of this population are not known. This population is believed to be native.

13e. Ownership of this site cannot be determined without additional locational information.
13f. Threats to this population (if extant) cannot be assessed without further data.

14a. This population is known only by a herbarium specimen (MIN), labeled: "Prior Lake, Minn. C. MacMillan. May 1895." Prior Lake is located in Scott County at T115N R22, section 2. The exact relation of Prior Lake to the original collection site is not known.
14b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Prior Lake, 1974.
14c. This population has not been located since the date of the original collection (1895).
14d. The size and physical circumstances of this population are not known . This population is believed to be native.
14e. Ownership of this site cannot be determined without additional locational information
14f. Threats to this population (if extant) cannot be assessed without further data.

4. General Environment and Habitat Descriptions

Of the 21 documented occurrences of Besseya bullii in Minnesota, 10 have some habitat description accompanying them. Of these 10 sites, 4 are described as dry hillside prairies; 3 are described as dry soils on open-wooded slopes; one as a sandy prairie with sandstone outcrops; one as a dry prairie and one as a wild meadow.

This would indicate the Besseya bullii requires sandy or gravelly soil which is neutral or acidic but not calcareous. It seems to prefer slopes rather than level terrain, and possibly north-facing aspect rather than south-facing. It also seems to prefer direct sunlight, but tolerates broken shade.

These habitat preferences exhibited by B. bullii in Minnesota appear to be quite similar to its preferences in Wisconsin (Salanum 1951), Indiana (Deam 1940) and throughout its range (Fernald 1950).

There is only one site of B. bullii in Minnesota for which we have associated species information. This site is a dry prairie knoll located in Goodhue County at T112N R18W, SE1/4 SE1/4 SW1/4 section 18. The associated species include: Andropogon scoparius, Stipa spartea, Sporobolus heterolepis, Geum triflorum, Carex heliophylla, Ranunculus rhomboideus, Astragalus crassicarpus, Anemone patens, Amorpha canescens, Euphorbia corollata, Aster sericeus, Lithospermum canescens, Lespedeza leptostachya, Solidago rigida

5. Population Biology of Species

A. General summary of population biology

A general survey of the literature has failed to locate any substantive data on the population biology of this species.

B. Demography

Very little is known about the demography of this species in Minnesota. There is only one site for which we have any information at all. This site is a dry prairie knoll in Goodhue County at T112N R18W, SE1/4 SE1/4 SW1/4 section 18. There were about 10 to 12 individuals counted in an area of 12 by 8 feet. About 10 to 20 more individuals were seen scattered throughout the drier portion of the 20 acre prairie. Some plants had 3 or 4 flowering stems, but most had only 1 or 2.

6. Current Land Ownership Summary

Of the 21 documented occurrences of B. bullii in Minnesota, ownership is known for only 2. The site in Goodhue County at T112N R18W, SE1/4 SE1/4 SW1/4 section 18 is designated as "McKnight Prairie", and is owned and managed by Carlton College in Northfield, MN. The site in Washington County at T28N R20W, SW1/4 section 34, is within Afton State Park and is owned and managed by the Division of Parks and Recreation, Minnesota Department of Natural Resources, St. Paul, MN.

7. Evidence of Threats to Survival - Summary

Because of the lack of current data, threats to populations of Besseya bullii in Minnesota cannot be accurately assessed. It should be noted, however, that 12 of the 21 historical occurrences of this species in Minnesota are located in what is now the metropolitan area of Minneapolis-St. Paul and surrounding suburbs. The remaining 9 occurrences are within an area considered valuable for development because of its proximity to the Metropolitan Area. Furthermore, the average date of the documentation of the occurrences is 1923; well before the expansion of the Metropolitan Area. It therefore appears that this species has probably undergone a recent and drastic loss of habitat and populations in Minnesota. It also appears that this loss will continue and that the extirpation of this species from Minnesota is a matter of immediate concern.

II. ASSESSMENT AND RECOMMENDATIONS

8. Recommended Status

Because of the continuing destruction of habitat and the accompanying loss of populations, I recommend a status of threatened for Besseya bullii in Minnesota.

9. Interested Parties

1. Barbara Coffin
Coordinator, Minnesota Natural Heritage Program
Department of Natural Resources
St. Paul, MN 55155

III. INFORMATION SOURCES

10. Sources of Information

A. Publications

Deam, C.C. 1940. Flora of Indiana. Department of Conservation, Division of Forestry. Indianapolis, Ind.

Fernald, M.L. 1950. Gray's Manual of Botany, eighth edition. D. Van Nostrand Company, New York

Mickelson, L.H. and H.H. Iltis. 1966. Preliminary reports on the flora of Wisconsin. Wisc. Acad. Sci. Arts and Letters, 55:217.

Salamun, P.J. 1951. Preliminary reports on the flora of Wisconsin #36. Wisc. Acad. Sci. Arts and Letters, 40(2):133.

B. Museum collections

1. Herbaria searched: University of Minnesota, St. Paul
University of Minnesota, Duluth
University of Wisconsin, Madison
North Dakota State University, Fargo
St. Cloud State University, St. Cloud, MN
Winona State University, Winona, MN

C. Field Work

Most of the herbarium specimens which formed the basis of this report did not supply accurate enough locational information to justify a field search. Heritage staff did, however, investigate one unconfirmed report which led to the documentation of the population in Goodhue County at T112N R18W, SE1/4 SE1/4 SW1/4 section 18 (MIN; Smith #3726). All data collected at this site were recorded on standardized survey forms and are on file in the office of MNHP.

D. Knowledgeable individuals

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University of Minnesota
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Dr. Gerald Wheeler
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IV. AUTHORSHIP

Welby R. Smith
Minnesota Natural Heritage Program
Section of Wildlife
Department of Natural Resources
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STATUS REPORT

Taxon Name: *Chrysosplenium iowense* Rydb.

Common Name: None known

Family: Saxifragaceae

States Where Taxon Occurs: Minnesota, Iowa, Canada

Author of This Report: Welby R. Smith

Date of This Report: December 23, 1981

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I. SPECIES INFORMATION

1. Classification and Nomenclature

   A. Species

      1. *Chrysosplenium iowense* Rydb.

      2. Synonyms include: *Chrysosplenium alternifolium* L.
         Chrysosplenium alternifolium L. f. *iowensis* (Rydb.) Rosend.
         Chrysosplenium alternifolium L. var. *sibiricum* Ser.
         Chrysosplenium tetrandrum (Lund) Fries.

      3. Common Name: None known

   B. Family classification

      1. Saxifragaceae

   C. Major group

      1. Angiospermae

   D. Current alternative taxonomic treatment

      1. Included in *Chrysosplenium tetrandrum* (Lund) Fries. by many researchers.

2. Present State Status

   A. Legal. None.

   B. Advisory. Proposed by the Minnesota Natural Heritage Program as threatened in Minnesota.

3. Geographic Distribution and Site Descriptions

   A. Geographic range. Minnesota, Iowa, Alberta northwest territories, Saskatchewan

   B. Precise occurrences

      1. Populations currently or recently known extant

         1a. Fillmore County. T103N R12W; SE1/4 SE1/4 NE1/4 section 19.
         1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Wykoff, 1965.
         1c. A specimen was collected at this location by Dr. Thomas Morley (#1348) on June 14, 1978 and is on deposit in the herbarium of the University of Minnesota, St. Paul.
         1d. According to Morley's specimen label, this popultion (size unknown) occurs at the summit of a steep, moist, springy north-facing slope just south of Spring Valley Creek, at the west end of the slope. Morley notes that *Cryptogramma stelleri* was also present.

1e. This site is in private ownership (multiple owners).
1f. The survival of this population is potentially threatened by residential development.

2a. Fillmore County. T103N R12W; SW1/4 SW1/4 SW1/4 section 17.
2b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Wykoff, 1956.
2c. A specimen was collected at this location by Dr. Thomas Morley (#1390) on June 25, 1978 and is on deposit in the herbarium of the University of Minnesota, St. Paul.
2d. According to Dr. Morley's specimen label, this population (size unknown) occurs as scattered patches on the east half of a steep, moist north-facing slope above the bank of Spring Valley Creek. Morley noted associated species as: Mnium, Cystopteris bulbifera, Impatiens.
2e. This site is in private ownership (multiple ownership).
2f. The survival of this population is potentially threatened by residential development.

2. Populations known or assumed extirpated

1a. None.

3. Historically known populations where current status is not known

1a. None.

4. General Environment and Habitat Description

Both of the two known extant populations in Minnesota occur in the same type of habitat. It is characterized by a steep, north-facing slope which is kept moist by water seeping from the substrate. This is essentially the same habitat in which the species is reported to occur in Iowa (Roosa and Eilers 1978; Thorne 1953).

5. Population Biology of Species

A. General summary of population biology

Both apomictic and amphimictic reproduction have been observed to occur in this species. Natural populations have been observed to flower on 10-13 c and 8-11 c substrates in the fall and spring respectively. Maximum flower production in the laboratory is reported to be at 11-12 c and significant seed production has been observed only in the presence of insects (Weber 1978).

B. Demography

No significant data on the demography of this species have been found.

6. Current Land Ownership Summary

Both of the two known occurrences of this species in Minnesota are on privately owned land.

7. Evidence of Threats to Survival - Summary

This site (which includes both populations of C. iowense) has been nominated as a state Scientific and Natural Area. As a result of this nomination, acquisition procedures have been initiated. Until such time that the site comes into public ownership, both populations of C. iowense will face a potential threat from residential development.

II. ASSESSMENT AND RECOMMENDATIONS

8. Recommended Status

Because of the extreme rarity of this species and the relict nature of its populations, I recommend a status of threatened for Chrysosplenium iowense in Minnesota.

9. Interested Parties

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   St. Paul, MN 55155

2. Geoffrey Barnard
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   328 E. Hennepin Ave.
   Minneapolis, MN 55414

3. Dr. Thomas Morley
   Department of Botany
   University of Minnesota
   St. Paul, MN

III. INFORMATION SOURCES

10. Sources of Information

A. Publications

Packer, J.G. 1963. The taxonomy of some North American species of Chrysosplenium L., section alternifolia Franchet. Can. Jour. Bot. 41:85-103.

Roosa, D.M. and L.J. Eiters. 1978. Endangered and threatened Iowa vascular plants. Special Report No. 5 State Preserves Advisory Board. Des Moines, Iowa.

Rosendahl, C.O. 1947. Studies in Chrysosplenium, with special reference to the taxonomic status and distribution of C. iowense. Rhodora 49:25-35.

Thorne, R.F. 1953. Notes on rare Iowa plants. Proc. Iowa Acad. Sci. 60:260-274.

Weber, M. 1978. Reproduction in Chrysosplenium iowense. Eleventh annual meeting of the Mississippi River Research Consortium, University of Wisconsin-LaCrosse.

B. Museum collections

1. Herbaria searched: University of Minnesota, St. Paul
University of Minnesota, Duluth
University of Wisconsin, Madison
University of North Dakota, Fargo
St. Cloud State University, St. Cloud, MN
Winona State University, Winona

C. Field work

Because of the recent and intensive field work done by Dr. Thomas Morley on this species, it was thought unnecessary for Heritage staff to do additional field work.

D. Knowledgeable individuals

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2. Dr. Thomas Morley
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University of Minnesota
St. Paul, MN

IV. AUTHORSHIP

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STATUS REPORT

Taxon name: *Cypripedium arietinum* R.Br.

Common name: Ram's head ladyslipper

Family: Orchidaceae

States Where Taxon Occurs: Maine, New Hampshire, Vermont, Massachusetts, New York, Michigan, Wisconsin, Minnesota, Canada

Author of This Report: Welby R. Smith

Date of This Report: October 26, 1981

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2c. The existence of this population has not been verified since the date of the original collection. Because of the vague locational data, no attempt has been made by Heritage staff to relocate the population.
2d. The size of the population and the habitat in which it occurs are not known. This population of C. arietinum is believed to be native.
2e. Land ownership cannot be determined without additional locational information.
2f. Existing and potential threats to this population cannot be assessed without further data.

3a. The only knowledge we have of this population is based on a specimen in the herbarium of the University of Minnesota, St. Paul. The label on the specimen reads: "About 50 feet east of shore of Sandy Lake, about 1/4 mile south of Prairie River, McGregor. In leaf mold overlying sand; under jack pine and small birches, little brush. Common very locally, rare in general area. Peter J. Schmidt, June 14, 1957."

The topographic map of the area shows the Prairie River entering a small unnamed lake east of Sandy Lake. It is the smaller lake rather than Sandy Lake where the population is presumed to occur. The actual location is interpreted to be: Aitkin County, T49N R23W; W1/2 section 3.
3b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Balsam, 1970.
3c. The existence of this population has not been confirmed since the date of the original collection (June 14, 1957). No attempt has been made by Heritage staff to relocate the population.
3d. The label on the original collection describes the species as "Common very locally, rare in the area." It describes the habitat as, "in leaf mold overlying sand; under jack pine and small birches; little brush." This population of C. arietinum is believed to be native.
3e. This site is within Savanna Portage State Park, and is owned and managed by the Division of Parks and Recreation, Minnesota DNR.
3f. There are no known existing or potential threats to this population.

4a. The only knowledge we have of this population is a specimen in the herbarium of the University of Minnesota, St. Paul. The label on the specimen reads: "Tamarack swamp. Annandale. A.L. Schaum, June 1927." A tamarack (Larix) swamp occurs adjacent to the western end of Annandale. It is the only extant tamarack swamp in the vacinity, and is presumed to be the site of the original collection. Based on this interpretation, the location is believed to be: Wright County, T121N R28W; S1/2 section 24 and N1/2 section 25.
4b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, South Haven, 1974.

4c. The existence of this population has not been verified since the date of the original collection (June, 1927). An attempt to relocate the population was made by Welby Smith on June 1, 1980, but no plants were found. There has been much encroaching and degredation of the habitat, but potential habitat does still exist. It is possible that the species may be extant at this site as a small isolated population.

4d. The size of the population is not known, but the label on the original collection describes the habitat as a "tamarack swamp". This population of C. arietinum is believed to be native.

4e. The site is privately owned.

4f. The site is currently threatened by an encoraching residential development, and cattle grazing.

5a. The only knowledge we have of this population is a series of three specimens in the herbarium of the University of Minnesota, St. Paul. The labels on these specimens reads as follows: "Peat soil along logging road north of Decodon Pond. M.L. Buell, H.F. Buell #692, August 3, 1933." "Cedar swamp, Anoka County, Robert N. Humphery, May 22, 1930." "Decodon Swamp, north of Minneapolis, O.Lakela #788, May 26, 1934."

Decodon Pond is a small bog lake in Cedar Creek Natural History Area. The only cedar swamp in Anoka County is adjacent to this pont. For this reason, all three collections are believed to have come from the same population. The site is located at: Anoka County, T34N R23W; NW1/4 section 27.

5b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Isanti, 1974.

5c. The existence of this population has not been verified since the date of the most recent collection (May 26, 1934; O.Lakela #788). An attempt to relocate the population was made by Welby Smith on May 30, 1980. Portions of the cedar (Thuja) swamp in SW1/4 section 22 and NW1/4 section 27 were searched, but no plants were found. Because the habitat at this site has not been disturbed since before 1934 (date of the most recent collection), the population may still be extant in spite of the failure to relocate it.

5d. The size of this population is unknown. Based on herbarium labels, the habitat is presumed to be a wet, swampy woods dominated by northern white cedar (Thuja occidentalis). This population of C. arietinum is believed to be native.

5e. This site is owned by the University of Minnesota.

5f. There are no known existing or potential threats to this population.

6a. The only knowledge we have of this population is based on two specimens in the herbarium of the University of Minnesota, St. Paul. The labels on the specimens read: "Lake Detroit, tamarack. Clarence Waldron, June 23, 1909." and "Lake Detroit, Nevada Evans. June 7, 1913." These collections may be from two distinct sites, but because of the similarity of the label data, it seems more likely that they were collected at the same site.

The description "Lake Detroit" refers to a large lake located at: Becker County, T138N R41W. The exact relation of the lake to the collection sites is unknown.

6b. U.S. Geological Survey 7.5 minute quadrangle map; Detroit Lakes, 1959.

6c. The existence of this population has not been verified since the date of the most recent collection (June 7, 1913; Evans). Because of the insufficient locational information, no attempt has been made by Heritage staff to relocate the population.

6d. The size of the population is not known, but the label on one of the two collections implies that the habitat is characterized by tamarack (Larix laricina). This population of C. arietinum is believed to be native.

6e. Land ownership cannot be determined without additional locational information.

6f. It is not possible to assess threats to the population without more locational data.

4. Locations not yet investigated, but believed likely to support additional natural populations.

1a. Beltrami County. T154N R38W; N1/2, NW1/4 section 32.

1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V8720, Shotley Brook, 1974.

1c. Observed by Roger Eliason in 1978 while conducting a survey of breeding birds. Although Mr. Eliason photographed the plants, he did not collect a specimen. Therefore, it is considered by Heritage Program to be an unverified occurrence.

1d. Mr. Eliason remembers seeing only one plant with 4 or 5 stems. It was in a well shaded Sphagnum bog dominated by Thuja occidentalis (white cedar).

1e. This site is within the statutory boundaries of the Red Lake State Forest, but current land ownership is not known.

1f. This site is easily accessible from an improved road, and is therefore potentially threatened by logging.

4. General Environment and Habitat Description

In Minnesota there are five recently confirmed populations of C. arietinum. All occur within the forested region of the state, and in currently forested sites. Two of the five occur in Sphagnum swamps dominated by Thuja occidentalis (northern white cedar). One of the five occurs in a Sphagnum bog dominated by Picea mariana (black spruce). The two remaining populations occur in dry, sandy forest land dominated in one case by Pinus banksiana (jack pine) and in the other case by Pinus resinosa (red pine).

There are eight occurrences that have not been recently confirmed or are presumed extirpated. Four of these eight are from Larix laricina (tamarack) bogs; two are from Thuja occidentalis swamps; one is from a Pinus banksiana forest on sand substrate, and one is from an unknown habitat.

5. Population Biology of the Species

A. General summary of population biology

Although much has appeared in the literature about the floral biology of C. arietinum, this author has found no significant studies on the population biology of this species.

B. Demography

The total number of plants occurring at all five recently confirmed sites is estimated to be about 46. Two of the five populations may consist of a single plant each. Although it is probable that some specimens were overlooked at these sites, it is unquestionable that the known populations have extremely few individuals. These populations also appear to occupy a small area (usually less than 1/2 acre each) even if there is an abundance of apparently suitable habitat.

There is insufficient data to characterize the historical collections in regards to demography. However, inferential evidence indicates similarly small and local populations.

6. Current Land Ownership Summary

Of the five recently confirmed sites, one is on county land managed for timber production; one is in a state scientific and natural area; one is in a state park; one is on state forest land managed for timber production and one is within the statutory boundaries of a state forest but exact ownership is unknown.

Ownership of historical sites cannot be determined with any degree of accuracy because of vague locational information.

7. Evidence of Threats to Survival - Summary

A. Present or threatened destruction, modification, or curtailment of habitat or range

1. The populations in Cass and Hubbard Counties face an existing threat from clearcutting. In this type of forestry practice, the soil is customarily disked after removal of all vegetation. This particularly destructive activity would unquestionably destroy the populations of C. arietinum.

2. The population in Lake of the Woods County faces a potential threat from logging and mining operations.

B. Overutilization for commercial, sporting, scientific or educational purposes

1. The populations in Cass County and at Itasca State Park in Clearwater County have been significantly reduced by illegal or imprudent removal of plants for non-scientific purposes. There is no indication that this threat will diminish.

II. ASSESSMENT AND RECOMMENDATIONS

8. Recommended Status

Because of the generally small size of the confirmed populations, and the considerable threats to their survival, I recommend a status of threatened for Cypripedium arietinum in Minnesota.

9. Recommended Critical Habitat

Because of the publicity-sensitive nature of this species, critical habitat cannot be recommended. Past events have proven that public knowledge of the precise location of populations of Cypripedium arietinum may lead to the damage or destruction of such populations. Documentation in the form of personal interviews conducted by Heritage staff tells the history of two of the five confirmed sites in Minnesota being depleted by illegal or imprudent removal of plants for non-scientific purposes. It is therefore believed that recommended in critical habitat would pose an unnecessary rish to surviving populations.

10. Interested Parties

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Dr. David Parmalee
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Mr. Tom Witkowski
County Land Commissioner
Land and Timber Department
Hubbard County Courthouse
Park Rapids, MN

John Matheson
Wildlife Biologist
Chippewa National Forest
U.S. Forest Service
Bemidji, MN

III. INFORMATION SOURCES

11. Sources of Information

A. Publications

Ayensu, E.S. 1975. Endangered and threatened orchids of the United States. American Orchid Society Bulletin, 44:384-399.

Case, F.W. 1964. Orchids of the Western Great Lakes Region. Cranbrook Institute of Science Bulletin Number 48.

Correll, D.S. 1950. Native Orchids of North America North of Mexico. Chronica Botanica Company, Waltham, Mass. 399pp.

Luer, Carlyle A. 1975. The native orchids of the United States and Canada. The New York Botanical Garden, New York, NY 361pp.

B. Museum Collections

1. Herbaria searched: University of Minnesota-St Paul
   University of Minnesota-Duluth
   North Dakota State University-Fargo
   University of Wisconsin-Madison
   St Cloud State University-St Cloud,MN
   Winona State University-Winona, MN
   Bemidji State University (in part)-Bemidji, MN

C. Field Work

Field verification was conducted by Heritage staff botanist Welby Smith between May 30 and June 18, 1980. During that time five of the nine historically known populations were investigated, two of which were rediscovered. In addition, two previously undocumented populations were located. The four remaining historical sites were not investigated because of insufficient locational data or inaccessibility of the site.

Specimens of C. arietinum and associated plant species were collected and later deposited in the herbarium of the University of Minnesota, St Paul.

All field data collected during the course of this investigation were recorded on standardized survey forms and are on file in the office of the Minnesota Natural Heritage Program.

D. Knowledgeable individuals

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STATUS REPORT

Taxon Name: Cypripedium candidum Muhl.

Common Name: Small White Lady's-slipper

Family: Orchidaceae

States Where Taxon Occurs: Minnesota, Illinois, Wisconsin, Michigan, Indiana, Iowa, Ohio, New York, North Dakota, Nebraska, Kentucky and formerly Missouri, South Dakota, New Jersey, Pennsylvania

Author of This Report: Welby R. Smith

Date of This Report: December 20, 1981

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I. SPECIES INFORMATION

1. Classification and Nomenclature

   A. Species

      1. Cypripedium candidum Muhl.
      2. Synonyms include: Calceolus candidus (Muhl.) Nieuwland

   B. Family Classification

      1. Orchidaceae

   C. Major group

      1. Angiospermae

   D. Current alternative taxonomic treatment

      1. None

2. Present State Status

   A. Legal. Under the jurisdiction of the Minnesota Wild Flower Protection Law

   B. Advisory. None.

3. Geographic Distribution and Site Descriptions

   A. Geographic range. This species is known to occur in: Minnesota, Illinois, Wisconsin, Michigan, Indiana, Iowa, Ohio, New York, North Dakota, Nebraska, Kentucky and formerly Missouri, South Dakota, New Jersey and Pennsylvania. It also occurs in Manitoba and Ontario.

   B. Precise occurrences

      1. Populations currently or recently known extant

      1a. Becker County. T142N R43W; E1/2 SW1/4 section 16. Zimmerman Prairie
      1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Tilde Lake, 1966.
      1c. A specimen was collected by the Scientific and Natural Areas (SNA) inventory team in 1980 (date and collector unknown at this time). The specimen is currently in the possession of the SNA, but will eventually be deposited in the herbarium of the University of Minnesota, St. Paul.
      1d. The population (size unknown) occurs in an 80 acre tract of native prairie (complete inventory data will soon be available from SNA).
      1e. This site is a designated SNA (Zimmerman Prairie) and is owned and managed by the Department of Natural Resources.

1f. There are no known threats to the survival of this population.
2a. Big Stone County. T124N R49W; SW1/4 NE1/4 NW1/4 section 10. On the right-of-way of County Highway #28.
2b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Browns Valley, S. Dak.-Minn., 1971.
2c. A specimen was collected at this location on June 4, 1980 by Welby Smith (#2344) and later deposited in the herbarium of the University of Minnesota, St. Paul.
2d. Sixteen plants were counted in 100 feet of roadside ditch. This population is believed to be native.
2e. This population occurs on the right-of-way of County Highway #28, and is presumably owned by the county.
2f. This population is currently threatened by highway maintenance procedures such as mowing and spraying. It is potentially threatened by road improvement, road salting, dredging of the ditch, auto emissions and encroachment by a clone of Phragmites communis.

3a. Blue Earth County. T108N R28W; SW1/4 NW1/4 NW1/4 secton 3.
3b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Judson, 1974.
3c. A specimen was collected at this location by Welby Smith (#2316) on June 3, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.
3d. Five plants were counted in a 10 acre native prairie. This population is believed to be native.
3e. Ownership of this site has not been determined.
3f. Threats to this population cannot be assessed without additional information.

4a. Chippewa County. T119N R42W; SW1/4 NW1/4 section 36.
4b. U.S. Geological Survey 7.5 minute quadrangle map; Milan, 1958.
4c. A specimen was collected at this location by Welby Smith (#4197) on June 10, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.
4d. Only 2 plants were seen in a 5 acre sedge meadow-native prairie habitat. This population is believed to be native.
4e. Ownership of this site has not been determined.
4f. This population is in a remnant habitat at the low end of a cultivated field. For this reason, the population may be currently threatened by herbicide and fertilizer run-off from the field.

5a. Clay County. T141N R45W; NE1/4 section 5. Blazing Star Prairie.
5b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Ulen, 1966.
5c. A specimen was collected by S. Ottoson (#39) on June 22, 1979 and is on deposit in the herbarium of the University of Minnesota, St. Paul.

5d. The population (size unknown) occurs in a 180 acre tract of native prairie. This population is believed to be native.
5e. This site is a designated Scientific and Natural Area (Blazing Star Prairie). It is managed by the Department of Natural Resources under a long-term lease agreement with the Minnesota Chapter of The Nature Conservancy.
5f. There are no known threats to the survival of this population.

6a. Clay County. T139N R46W; section 15, E1/2 of section 22, W1/2 section 23 and portions of SE1/4 section 10 south of the Buffalo River. This area is designated "Bluestem Prairie". The exact location of the population(s) is not known.
6b. U.S. Geological Survey 7.5 minute quadrangle map; series V872, Downer, 1966.
6c. A specimen was collected at this site by the Scientific and Natural Areas (SNA) inventory team in 1980 (date and collector unknown at this time). The specimen is currently in the possession of the SNA, but will eventually be deposited in the herbarium of the University of Minnesota, St. Paul.
6d. This population (size unknown) occurs in a 1296 acre tract of native prairie (complete inventory data will soon be available from SNA). This population is believed to be native.
6e. This site is in the process of being designated a Scientific and Natural Area (Bluestem Prairie). It will be managed by the Department of Natural Resources under a long-term lease agreement with the Minnesota Chapter of The Nature Conservancy.
6f. There are no known threats to the survival of this population.

7a. Clay County. T139N R45W; NW1/4 SW1/4 section 32. Audubon Prairie.
7b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Downer, 1966.
7c. A specimen was collected at this location by the Scientific and Natural Areas (SNA) inventory team in 1980 (date and collector unknown at this time). The specimen is currently in the possession of the SNA, but will eventually be deposited in the herbarium of the University of Minnesota, St. Paul.
7d. This population (size unknown) occurs in a 240 acre tract of native prairie (complete inventory data will soon be available from SNA). This population is believed to be native.
7e. This site is known as "Audubon Prairie" and is owned by the Minnesota Chapter of The Nature Conservancy. It is currently being managed under a lease agreement between The Nature Conservancy and the Department of Natural Resources.
7f. There are no known threats to the survival of this population.

8a. Dakota County. T27N R24W; NE1/4 NE1/4 NW1/4 section 34.
8b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Bloomington, 1967.

8c. A specimen was collected at this location by Welby Smith (#2383) on June 8, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.
8d. Approximately 30 plants were counted in a 3 acre portion of a calcareous fen. This population is believed to be native.
8e. Portions of this site are owned individually by the M.T. Astleford Construction Company and the City of Burnsville.
8f. The Minnesota Natural Heritage Program, on behalf of the SNA Program, is currently negotiating the acquisition of the fen. If the negotiations are unsuccessful, the fen area will be developed for industrial purposes by the present owners.

9a. Douglas County. T127N R39W; NW1/4 SW1/4 NE1/4 section 32.
9b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Farwell, 1966.
9c. A specimen was collected at this location by Welby Smith (#2407) on June 10, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.
9d. More than 500 plants were estimated to occur in a 2 acre portion of a 100 acre tract of native prairie and marsh. This population is believed to be native.
9e. This site is owned by Grace McDowell, but is managed under lease agreement by the U.S. Fish and Wildlife Service as a Waterfowl Production Area.
9f. There are no known threats to the survival of this population.

10a. Douglas County. T129N R40W; NW1/4 NE1/4 NW1/4 section 13. The population occurs between State Highway 52 and the Great Northern Railroad tracks.
10b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Quam Lake, 1966.
10c. A specimen was collected at this location by Welby Smith (#2420) on June 10, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.
10d. Approximately 20 plants were counted along a 30 meter stretch of railroad right-of-way. The habitat is native prairie, and this population is believed to be native.
10e. The owner of the site is the Great Northern Railroad Company.
10f. Because of the location of this population, it is potentially threatened by maintenance activity relating to: Highway 52, the rail bed of the Great Northern Railroad, the overhead utility lines. Such maintenance activity could threaten the population by direct destruction of the habitat or through erosion or misuse of potentially damaging materials (i.e. road salt, oil, herbicides).

11a. Fillmore County. T103N R10W, NE1/4 SE1/4 section 19. Along the Root River Trail, about 20 meters west of the railroad bridge.

11b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Preston, 1965.

11c. A specimen was collected at this location by Welby Smith (#4146) on June 8, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.

11d. The population consists of about 10 plants occurring in a prairie-like area with occasional Quercus and Populus. Another 8 or 10 plants occur in an adjacent wooded area among typical woodland plant species. The woodland portion of the population occurs in thin, loose, sandy soil over rock. They occur on a 20 degree NE facing slope in filtered sunlight under Celtis occidentalis and Juniperus virginia. This population is believed to be native.

11e. This site is owned and managed by the Department of Natural Resources. It occurs along a designated state trail.

11f. This population is in close proximity to a recently established trail. Although the aspect of the terrain should prevent trail users from casually walking through the population, there could be a potential threat from the illegal removal of plants for horticultural purposes.

12a. Freeborn County. T102N R21W; SE1/4 NE1/4 NE1/4 section 23. About 10 meters west of County Road 38.

12b. U.S. Geological Survey 15 minute quadrangle map; Series V772, Albert Lea, 1954.

12c. A specimen was collected at this location by Welby Smith (#2883) on July 18, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.

12d. About 30 plants were estimated to occur in an area 30 x 20 feet, in a native prairie habitat. This population is believed to be native.

12e. This site is in Helmer Myre State Park, and is owned and managed by the Department of Natural Resources, Division of Parks and Recreation.

12f. This site is known to be visited by park users for the purpose of viewing specimens of C. candidum. Because of this public knowledge, the population may be potentially threatened by illegal removal of plants for horticultural or commercial purposes.

13a. Grant County. T128N R41W; NW1/4 SW1/4 SE1/4 section 12.

13b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Erdahl, 1973.

13c. A specimen was collected at this location by Welby Smith (#2372) on June 5, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.

13d. 142 plants were counted in a 10 x 10 meter plot in the center of this population. Based on this, more than 500 plants were estimated to occur in a 2 acre native prairie portion of this 176 acre tract. This population is believed to be native.
13e. This site is currently owned by the Grant County Historical Society, but is managed under a lease agreement by the U.S. Fish and Wildlife Service as a Waterfowl Production Area.
13f. This population faces a potential threat from herbicide drift and run-off from an adjacent cultivated field.

14a. Grant County. T129N R41W; NW1/4 NW1/4 NW1/4 section 17.
14b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Erdahl, 1973.
14c. A specimen was collected at this location by Welby Smith (#2367) on June 5, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.
14d. 108 plants were counted in a 10 x 10 meter plot in the center of this population. Based on this, more than 1,000 plants were estimated to occur in a 3 acre native prairie portion of this 40 acre tract. This population is believed to be native.
14e. This site is currently owned by Nelson D. Williams, but is managed under a lease agreement by the U.S. Fish and Wildlife Service as a Waterfowl Production Area.
14f. Because this population is in close proximity to a township road, it is potentially threatened by maintenance activity or upgrading of the road. It is also potentially threatened by encroachment from Phragmites communis.

15a. Grant County. T127N R41W; SE1/4 SW1/4 NW1/4 section 29.
15b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Hoffman, 1973.
15c. A specimen was collected at this location by Welby Smith (#4067) on June 3, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.
15d. 5 to 10 plants were seen in a 50 acre portion of a 300 acre tract of native prairie. This population is believed to be native.
15e. This site is currently owned by Clifford Noid, but is managed under a lease agreement by the U.S. Fish and Wildlife Service as a Waterfowl Production Area.
15f. There are no known threats to the survival of this population.

16a. Grant County. T130N R43W; SE1/4 SE1/4 NE1/4 section 22.
16b. U.S. Geological Survey 7.5 minute quadrangle map. Series V872, Wendell, 1973.
16c. A specimen was collected at this location by Welby Smith (#4066) on June 3, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.

16d. 6 plants were counted in the ditch on the wet side of County State Aid Highway 15. Three additional plants were counted in a two acre portion of a 30 acre native prairie tract which borders Highway 15 on the west side. This population is believed to be native.

16e. This site is currently owned by Roydon V. Foss, but is managed under a lease agreement by the U.S. Fish and Wildlife Service as a Waterfowl Production Area. Part of the population occurs in the right-of-way of a county state aid highway.

16f. Because this population is in close proximity to County State Aid Highway 15, it is potentially threatened by maintenance activities such as spraying, mowing, grading and widening of the road, and by use of the right-of-way for utility lines or pipelines.

17a. Grant County. T128N R43W; NW1/4 NW1/4 SE1/4 section 26. About 50 meters due east of County Road 13.

17b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Niemackl Lakes, 1973.

17c. A specimen was collected at this site by Welby Smith (#2357) on June 5, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.

17d. About 30 plants were counted in a 1 acre area of native prairie. The entire tract is 40 acres. This population is believed to be native.

17e. This site is currently owned by Arthur Kloas, but is managed under a lease agreement by the U.S. Fish and Wildlife Service as a Waterfowl Production Area.

17f. This site is potentially threatened by encroachment of Salix and Phragmites.

18a. Grant County. T130N R43W; SW1/4 SW1/4 SE1/4 section 14.

18b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Wendell, 1973.

18c. A specimen was collected at the location by Welby Smith (#2362) on June 5, 1980 and deposited in the herbarium of the University of Minnesota, St. Paul.

18d. Approximately 15 plants were counted in an area of native prairie 40 x 150 feet in size. The entire unit is 50 acres. This population is believed to be native.

18e. This site is currently owned by Harald A. Ingvaldson, but is managed under a lease agreement by the U.S. Fish and Wildlife Service as a Waterfowl Production Area.

18f. There is a township road about 5 meters south of the population. Normal maintenance activity associated with this road could potentially threaten the survival of this population.

19a. Kandiyohi County. T122N R33W; NW1/4 NE1/4 NE1/4 section 16.
19b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Lake Henry, 1967.
19c. A specimen was collected at this location by Welby Smith (#2397) on June 10, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.
19d. About 10 plants were counted in a 10 acre native prairie remnant. This population is believed to be native.
19e. Current ownership of the site has not been determined.
19f. This population is potentially threatened by agricultural activity such as ditching and plowing.

20a. Lac Qui Parle County. T118N R45W; SE1/4 NW1/4 NW1/4 section 35.
20b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Mount Wickham, 1967.
20c. A specimen was collected at the location by Welby Smith (#5077) on July 26, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.
20d. A single plant was found in a 110 acre tract of native prairie. There were probably more plants present, but the late date of my visit made locating them difficult. This population is believed to be native.
20e. This population occurs on the Keman Wildlife Management Area. It is owned and managed by the Department of Natural Resources, Section of Wildlife.
20f. The survival of this population is currently threatened by a county ditch which will soon be dug through the southern portion of this unit.

21a. Lac Qui Parle County. T120N R45W; SW1/4 SE1/4 section 14.
21b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Bellingham, 1971.
21c. A specimen was collected at the location by Welby Smith (#4060) on June 2, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.
21d. More than 1,000 plants were estimated to occur in a 36 acre native prairie habitat. This population is believed to be native.
21e. This site is owned by the Menzel brothers who live about 1 mile west.
21f. This site is currently being mowed for wild hay which appears to pose no threat to the population. The site is, however, suited to other agricultural uses such as livestock grazing which would be very destructive to the population.

22a. Mahnomen County. T146N R42W; SE1/4 NE1/4 section 10.

22c. A specimen was collected at this location by Welby Smith (#4222) on June 11, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.

22d. About 10 plants were counted in a 50 x 30 foot area of native prairie. This unit consists of about 1500 acres of native prairie and very little of it was searched. It seems likely, therefore, that the population at this site is actually much larger than the 10 plants counted. This population is believed to be native.

22e. This unit was signed as a National Waterfowl Production Area. It is unknown, however, if the U.S. Fish and Wildlife Service holds fee title to the land or if they manage it under a lease agreement.

22f. There are no known threats to the survival of this population.

23a. Mahnomen County. T145N R41W; portions of sections 6 and 7. This tract is referred to as "Santee Prairie". The exact location of the population is unknown.

23b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Bejou, 1969.

23c. A specimen was collected at this site by the Scientific and Natural Areas (SNA) inventory team in 1979 (date and collector unknown at this time). The specimen is currently in the possession of the SNA, but will eventually be deposited in the herbarium of the University of Minnesota, St. Paul.

23d. This population (size unknown) occurs in a 448 acre tract of native prairie (Complete inventory data will soon be available from SNA). This population is believed to be native.

23e. This tract (Santee Prairie) is owned and managed by the Minnesota Chapter of The Nature Conservancy, 328 E. Hennepin Ave, Minneapolis, MN.

23f. Threats to the survival of this population cannot be assessed without further data.

24a. McLeod County. T115N R29W, SE1/4 section 34.

24b. U.S. Geological Survey 15 minute quadrangle map; Winthrop, 1958.

24c. A specimen was collected at this location by Mark Heitlinger (#553) on May 30, 1972 and is on deposit in the herbarium of the University of Minnesota, St. Paul.

24d. The herbarium label on Heitlinger's specimen describes the species as "abundant", and describes the habitat as "wet shoreline around the marshy area in the eastern prairie." This population is believed to be native.

24e. This site is part of a 160 acre tract known as Schaefer Prairie. It is owned and managed by the Minnesota Chapter of The Nature Conservancy, 328 E. Hennepin Ave, Minneapolis, MN.

24f. There are no known threats to the survival of this population.

25a. Mower County. T104N R18W; SE1/4 NE1/4 section 6. Between State Highway 218 and the Milwaukee Line railroad tracks. Most of the population occurs on the railroad right-of-way.
25b. U.S. Geological Survey 7.5 minute quadrangle map; V872, Blooming Prairie, 1967.
25c. A specimen was collected at this location by Welby Smith (#3929) on May 26, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.
25d. Between 100 and 500 plants were estimated to occur in a strip of native prairie 50 x 600 feet. This population may extend further to the southeast, and the number of plants may be much greater. This population is believed to be native.
25e. The site is currently owned by the Milwaukee Line Railroad Company.
25f. A very large portion of the prairie strip occurring on the right-of-way has recently been plowed by adjacent landowners and planted to corn. This activity is an immediate threat to the survival of this population.

26a. Mower County. T103N R16W; SW1/4 SW1/4 NE1/4 section 16. This site is designated as "Wild Indigo Prairie".
26b. U.S. Geological Survey 15 minute quadrangle map; Series V772, Austin, 1954.
26c. A specimen was collected at this location by Welby Smith (#5008) on July 21, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.
26d. A single plant with 12 stems was seen in a 100 acre tract of native prairie. It is believed that an intensive search would locate additional plants. This population is believed to be native.
26e. This site is a designated Scientific and Natural Area (Wild Indigo Prairie) and is owned and managed by the Department of Natural Resources.
26f. There are no known threats to the survival of this population.

27a. Norman County. T144N R43W; NW1/4 SE1/4 section 26.
27b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Faith, 1966.
27c. A specimen was collected at this location by Welby Smith (#4204) on June 11, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.
27d. More than 100 plants were estimated to occur in a 10 acre tract of native prairie. This population is believed to be native.
27e. Current ownership of this site has not been determined.
27f. Threats to the survival of this population cannot be assessed without further data.

28a. Norman County. T143N R44W; NW1/4 NE1/4 section 30.
28b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Syre, 1965.
28c. A specimen was collected at this location by Welby Smith (#4220) on June 11, 1981 and later deposited in the herbarum of the University of Minnesota, St. Paul.
28d. Thee was no way to accurately estimate the number of plants in this population, but a conservative guess would be 10,000. They appear to be evenly spread over a 2,000 acre tract of native prairie. This population is believed to be native.
28e. This site is owned and managed by the Department of Natural Resources, Section of Wildlife.
28f. There are no known threats to the survival of this population.

29a. Norman County. T143N R45W; NW1/4 and E1/2 of SW1/4 section 23. This tract is designated "Twin Valley Prairie".
29b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Syre, 1965.
29c. A specimen was collected at this site by S. Ottoson (#20) on June 13, 1979 and is on deposit in the herbarium of the University of Minnesota, St. Paul.
29d. The size and physical circumstances of this population are not known. This population is believed to be native.
29e. This site is a designated Scientific and Natural Area (Twin Valley Prairie). It is managed by the Department of Natural Resources under a long-term lease agreement with the Minnesota Chapter of The Nature Conservancy.

30a. Ottertail County. T136N R44W; S1/2 NW1/4 NE1/4 section 6.
30b. U.S. Geological Survey 15 minute quadrangle map; Barnesville, 1952.
30c. A specimen was collected at this location by Welby Smith (#4019) on June 1, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.
30d. A single plant with 9 stems was found in a 10 acre tract of native prairie. There are believed to be more plants which were not discovered. This population is believed to be native.
30e. Current ownership of this site has not been determined. It is, however, being managed by the U.S. Fish and Wildlife Service as a Waterfowl Production Area.
30f. The survival of this population is being potentially threatened by encroachment from Symphoricarpos occidentalis

31a. Otter Tail County. T133N R43W; SE1/4 SW1/4 NE1/4 section 19.
31b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Carlisle, 1973.

31c. A specimen was collected at this location by Welby Smith (#2431) on June 11, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.
31d. More than 500 plants were estimated to occur in a 10 acre native prairie portion of an 82 acre tract. This population is believed to be native.
31e. This site is owned by Walter H. Wildung, but is managed under a lease agreement by the U.S. Fish and Wildlife Service as a Waterfowl Production Area.
31f. There are no known threats to the survival of this population.

32a. Otter Tail County. T132N R42W; SW1/4 SE1/4 NE1/4 secion 29. On the right-of-way of the Burlington Northern Railroad line.
32b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Dalton, 1973.
32c. A specimen was collected at this location by Welby Smith (#2430) on June 10, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.
32d. Only 2 plants were found in a strip of native prairie 100 x 50 feet. More plants are suspected of occurring along this right-of-way. This population is believed to be native.
32e. This site is on the right-of-way of the Burlington Northern Railroad Company.
32f. This population occurs directly under utility lines. Any maintenance or repair work on the lines which require the use of heavy machinery could potentially threaten the survival of this population.

33a. Otter Tail County. T131N R44W; NW1/4 SE1/4 SE1/4 section 17.
33b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Orwell Lake, 1973.
33c. A specimen was collected at this location by Welby Smith (#2413) on June 10, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.
33d. More than 50 plants were estimated to occur in a 320 acre tract of native prairie, but considerably more may occur in parts of the prairie which were not investigated.
33e. This tract is owned and managed by the Minnesota Chapter of The Nature Conservancy (Ottertail Prairie).
33f. There are no known threats to the survival of this population.

34a. Polk County. T149N R48W; W1/2 NW1/4 secton 16. This tract has been designated, "Malmberg Prairie".
34b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Eldred, 1964.
34c. A specimen was collected at this site by Marianne Severson and Peter Farrell (#10) in 1980, and is on deposit at the herbarium of the University of Minnesota, St. Paul.

34d. This population (size unknown) occurs in an 80 acre tract of native prairie (complete inventory data will soon be available from SNA). This population is believed to be native.
34e. This site is a designated Scientific and Natural Area (Malmberg Prairie) and is managed by the Department of Natural Resources under a lease agreement with The Nature Conservancy.
34f. There are no known threats to the survival of this population.

35a. Polk County. T149N R45W; S1/2 section 8. This tract has been designated, "Pankratz Prairie-North".
35b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Harold, 1965.
35c. A specimen was collected at this site by C. Keller and M. Severson (#16) in 1979, and is on deposit in the herbarium of the University of Minnesota, St. Paul.
35d. This population (size unknown) occurs in a 320 acre tract of native prairie (complete inventory data will soon be available from SNA). This population is believed to be native.
35e. This site is a recommended Scientific and Natural Area (Pankratz Prairie-North) and is owned and managed by the Minnesota Chapter of The Nature Conservancy.
35f. There are no known threats to the survival of this population.

36a. Polk County. T149N R45W; SE1/4 section 17 and NE1/4 section 20. This tract has been designated, "Pankratz Prairie-South".
36b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Harold, 1965.
36c. A specimen was collected at this site by C. Keller and M. Severson (#20) in 1979, and is on deposit in the herbarium of the University of Minnesota, St. Paul.
36d. This population (size unknown) occurs in a 320 acre tract of native prairie (complete inventory data will soon be available from SNA). This population is believed to be native.
36e. This site is a recommended Scientific and Natural Area (Pankratz Prairie-South) and is owned and managed by the Minnesota Chapter of The Nature Conservancy.
36f. There are no known threats to the survival of this population.

37a. Polk County. T149N R45W; NE1/4 SE1/4 SE1/4 section 25. This tract has been designated, "Pembina Trail Preserve".
37b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Dugdale, 1965.
37c. A specimen was collected at this location by Welby Smith (#2967) on July 28, 1980 and later deposited in the herbarium of the University of Minnesota, St. Paul.
37d. Several thousand plants are estimated to occur in this 1,660 acre tract of native prairie. This population is believed to be native.

37e. This tract is a designated Scientific and Natural Area (Pembina Trail Preserve), and is managed by the Department of Natural Resources under a lease agreement with The Nature Conservancy.
37f. There are no known threats to the survival of this population.

38a. Scott County. T115N R21W; NE1/4 NE1/4 section 17.
38b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Bloomington, 1967.
38c. A specimen was collected at this location by Welby Smith (#3901) on May 25, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.
38d. Approximately 20 plants were counted in a 12 acre native prairie habitat. An addition 10 to 30 plants were counted 200 meters south in a 40 acre calcareous fen. This population is believed to be native.
38e. This site is owned by Ray Formanek, 8141 12th Avenue S., Suite 1, Bloomington, MN 55420.
38f. The survival of this population is threatened by the imminent construction of a county road and an industrial park.

39a. Stearns County. T123N R32W; SW1/4 NW1/4 section 35. This tract is designated, "Roscoe Prairie".
39b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Paynesville, 1967.
39c. A specimen was collected at this site by Sister Remberta Westkaemper in 1965 and is on deposit in the herbarium of the University of Minnesota.
39d. This population (size unknown) occurs in a 57 acre tract of native prairie (complete inventory data will be available soon from SNA). This population is believed to be native.
39e. This site is a designated Scientific and Natural Area (Roscoe Prairie), and is managed by the Department of Natural Resources under a lease agreement with The Nature Conservancy.
39f. There are no known threats to the surivival of this population.

40a. Steele County. T106N R19W; SE1/4 SE1/4 section 17. Between State Highway 218 and the Milwaukee Road railroad tracks.
40b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Steele Center, 1967.
40c. A specimen was collected at this location by Welby Smith (#3880) on May 20, 1981 and later deposited in the herbarium of the University of Minnesota.
40d. Approximately 20 plants were counted in a strip of native prairie 50 x 200 feet. This population is believed to be native.

40e. This site is owned by the Milwaukee Road Railroad Company.
40f. A very large portion of the prairie strip occurring on this right-of-way has recently been plowed by adjacent landowners and planted to corn.

41a. Steele County. T107N R20W; SW1/4 SW1/4 section 24. Between State Highway 218 and the Milwaukee Road railroad tracks.
41b. U.S. Geological Survey 7.5 minute quadrangle map; Owatonna, 1962.
41c. A specimen was collected at this location by Welby Smith (#3921) on May 26, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.
41d. Approximately 20 plants were counted in a strip of native prairie 50 x 300 feet. This population is believed to be native.
41e. This site is owned by the Milwaukee Road Railroad Company.
41f. A very large portion of the prairie strip occurring on this right-of-way has recently been plowed by adjacent landowners and planted to corn.

42a. Steele County. T107N R19W; NE1/4 SW1/4 section 21. Between Highway 80 and the Northwestern Railroad tracks.
42b. U.S. Geological Survey 7.5 minute quadrangle map; Owatonna, SE, 1962.
42c. A specimen was collected at this location by Welby Smith (#3930) on May 26, 1981 and later deposited in the herbarium of the University of Minnesota.
43d. Approximately 15 plants were counted in a strip of native prairie 50 x 150 feet. This population is believed to be native.
42e. This site is owned by the Northwestern Railroad Company.
42f. At the time of the most recent visit (May 26, 1981), there were construction crews actively ditching the right-of-way approximately 1/2 mile east of the population. It is not known if their ditching operations ever reached the population; but if it did, the population was probably destroyed.

43a. Stevens County. T125N R43W; NW1/4 SE1/4, SW1/4 section 15.
43b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Donnelly, 1973.
43c. A specimen was collected at this site by Welby Smith (#2387) on June 5, 1980 and deposited in the herbarium of the University of Minnesota, St. Paul.
43d. A single plant with 4 stems was observed in a 15 acre tract of native prairie. This population is believed to be native.
43e. This site is privately owned (current owner unknown).
43f. Threats to the survival of this population have not been assessed.

44a. Wilkin County. T134N R45W; SE1/4 SW1/4 section 15.
44b. U.S. Geological Survey 15 minute quadrangle map; Rothsay, 1951.
44c. A specimen was collected at this location by Douglas Benson (#41) on June 3, 1981 and is on deposit in the herbarium of the University of Minnesota, St. Paul.
44d. This population (size unknown) occurs in a 160 acre tract of native prairie. This population is believed to be native.
44e This site is owned and managed by the Minnesota Chapter of The Nature Conservancy (Town Hall Prairie).
44f. There are no known threats to the survival of this population.

45a. Wilkin County. T133N R45W; SW1/4 NE1/4 section 24.
45b. U.S. Geological Survey 15 minute quadrangle map; Rothsay, 1951.
45c. A specimen was collected at this location by Douglas Benson (#49) on June 3, 1981 and is on deposit in the herbarium of the University of Minnesota, St. Paul.
45d. This population (size unknown) occurs in a 240 acre tract of native prairie. This population is believed to be native.
45e. This site is owned and managed by the Minnesota Chapter of The Nature Conservancy.
45f. There are no known threats to the survival of this population.

46a. Wilkin County. T134N R45W; the center of SE1/4 section 9.
46b. U.S. Geological Survey 15 minute quadrangle map; Rothsay, 1951.
46c. A specimen was collected at this site by Douglas Benson (#64) on June 5, 1981 and is on deposit in the herbarium of the University of Minnesota, St. Paul.
46d. This population (size unknown) occurs in a 760 acre tract of native prairie. This population is believed to be native.
46e. This site is owned and managed by the Minnesota Chapter of The Nature Conservancy.
46f. There are no known threats to the survival of this population.

47a. Wilkin County. T133N R45W; NW1/4 NW1/4 section 12.
47b. U.S. Geological Survey 15 minute quadrangle map; Rothsay, 1951.
47c. A specimen was collected at this site by Douglas Benson (#78) on June 10, 1981 and is on deposit in the herbarium of the University of Minnesota, St. Paul.
47d. This population (size unknown) occurs in a 200 acre tract of native prairie. This population is believed to be native.
47e. This site is owned and managed by the Minnesota Chapter of The Nature Conservancy.
47f. There are no known threats to the survival of this population.

48a. Wilkin County. T136N R45W; E1/2 (except E1/2, E1/2, NE1/4) section 17. This unit is designated "Western Prairie North".

48b. U.S. Geological Survey 15 minute quadrangle map; Barnesville, 1952.
48c. A specimen was collected at this site by the Scientific and Natural Areas (SNA) inventory team in 1980 (date and collector unknown at this time). The specimen is currently in the possession of SNA, but will eventually be deposited in the herbarium of the University of Minnesota, St. Paul.
48d. This population (size unknown) occurs in a 280 acre tract of native prairie (complete inventory data will be available soon from SNA). This population is believed to be native.
48e. This site is a designated Scientific and Natural Area (Western Prairie North) and is owned and managed by the Department of Natural Resources.
48f. There are no known threats to the survival of this population.

49a. Wilkin County. T135N R46W; W1/2 section 12. This unit is designated "Western Prairie South".
49b. U.S. Geological Survey 15 minute quadrangle map; Barnesville, 1952.
49c. A specimen was collected at this site by the Scientific and Natural Areas (SNA) inventory team in 1980 (date and collector unknown at this time). The specimen is currently in the possession of the SNA, but will eventually be deposited in the herbarium of the University of Minnesota, St. Paul.
49d. This population (size unknown) occurs in a 320 acre tract of native prairie (complete inventory data will be available soon from SNA). This population is believed to be native.
49e. This site is a designated SNA (Wester Prairie South) and is owned and managed by the Department of Natural Resources.
49f. There are no known threats to the survival of this population

50a. Yellow Medicine County. T114N R46W; NW1/4 SW1/4 SW1/4 section 17.
50b. U.S. Geological Survey 7.5 minute quadrangle map; Series V782, Canby N.W., 1967.
50c. A specimen was collected at this location by Welby Smith (#4032) on June 2, 1981 and later deposited in the herbarium of the University of Minnesota, St. Paul.
50d. Approximately 150 plants were counted in a calcareous fen habitat of about 5 acres in size. In addition, more than 1,000 plants were estimated to occur in 300 acres of native prairie adjacent to the fen. This population is believed to be native.
50e. This site is a State Wildlife Management Area, and is owned and managed by the Department of Natural Resources, Section of Wildlife.
50f. There are no known threats to the survival of this population.

2. Populations known or assumed extirpated

1a. Blue Earth County. This population is known only by a herbarium specimen (MIN), labelled, "Growing in spring bog along the railroad right-of-way one mile north of Good Thunder. John W. Moore #25947. May 22, 1962." The railroad referred to is the Chicago, Milwaukee St. Paul and Pacific. The site one mile north of Good Thunder is located at T106N R27W; NW1/4 section 3. This railroad line has since been abandoned and the right-of-way sold to adjacent land owners. The tracks have been removed and the entire length of the original line from Good Thunder north to Mankato has been plowed and planted to small grain.

1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Good thunder, 1974.

1c. The only known record of this population is represented by a herbarium specimen (MIN) collected by John W. Moore (#25947) on May 22, 1962. The site was visited by Welby Smith on June 5, 1980, but the population had been destroyed previous to that time.

1d. The size of the population (when extant) is not known. The habitat was described on the herbarium specimen as "spring bog", and is interpreted by the author to be a calcareous fen. This population is believed to have been native.

1e. Current ownership of this site has not been determined.

1f. This population is known to be extirpated.

3. Historically known populations where current status is not known

1a. Blue Earth County. This population is known only be a herbarium specimen (MIN), labeled: "Near Garden of the Gods. D.L. Jacobs #456. May 23, 1948." The place name "Garden of the Gods" is apparently a local term which I could not find on any map or directory. There is, however, a Minnesota Environmental Resources inventory "Project 80" proposal for a site in Blue Earth County called "Garden of the Gods". The site is noted for unusual limestone formations and is said to be located at T109N R26W; section 19.

1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Mankato East, 1974.

1c. This population has not been located since the date of the original collection (1948).

1d. The size and physical circumstances of this population are not known. This population is believed to be native.

1e. At the time of the Project 80 nomination, the owners were Walter Dodge and Harvey Brooks (addresses unknown). Current ownership has not been determined.

1f. Threats to the survival of this population (if extant) cannot be assessed without further data.

2a. Blue Earth County. This population is known only by a herbarium specimen (MIN), labeled, "Blue Earth County. John Leiberg. 1883." Leiberg collaborated with Conway MacMillan on The Metaspermae of the Minnesota Valley (1892). His responsibilities included a floristic survey of that portion of the Minnesota Valley which occurs in Blue Earth County. Within this geographical area, Leiberg is known to have collected several plant species which are typical associates of C. candidum in what he described as a, "peat bog between Mankato and Kasota". It seems likely that this was also the site where he collected C. candidum. This site is believed to have been a calcareous fen located somewhere in T109N R26W; sections 19, 20, 29, 30, 31, 32 and T108N R26W; sections 5 and 6.

2b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Mankato East, 1974.

2c. This population has not been located since the date of the original collection (1883).

2d. The size and physical circumstances of this population are not known. It is believed, however, that the habitat was a calcareous fen. This population is believed to be native.

2e. Ownership of the site cannot be determined without additional locational information.

2f. Threats to the survival of this population (if extant) cannot be assessed without further data.

3a. Chippewa County. This population is known only by a herbarium specimen (MIN), labeled, "Meadows, Montevideo, June 1894." The collector is unknown. Montevideo is located in T117N R40W; portions of section 7, 17 and 18. The exact relation of Montevideo to the collection site is unknown.

3b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Montevideo, 1965.

3c. This population has not been located since the date of the original collection (1894).

3d. The size and physical circumstances of this population are not known. This population is believed to be native.

3e. Current ownership of this site cannot be determined without additional locational information.

3f. Threats to the survival of this population (if extant) cannot be assessed without further data.

4a. Chippewa County. This population is known only by a herbarium specimen (MIN), labeled; "Section 23, Sparta, moist prairie. On natural meadows. Abundant in suitable locations. G. & L. #1091. May 30, 1885." The identifity of the collectors is not known, but the label bears an impressed library mark which says, "from the herbarium of L. R. Moyer". The exact location of the original collection, within section 23, is not known.

4b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Montevideo, 1965.

4c. This population has not been located since the date of the original collection (1885). The site was, however, visited by Welby Smith on June 4, 1980. Suitable habitat was found to exist in portions of the SE1/4 of the section. This area was searched, but no plants were found. It is possible that a remnant population may still persist in spite of the failure to locate any plants.

4d. The description on the herbarium label gives some indication of the size and habitat of the population at the time of the original collection. It reads, "Abundant in suitable locations. On natural meadows. Moist prairie." This population is believed to be native.

4e. Ownership of this site has not been determined.

4f. Threats to the survival of this population (if extant), cannot be assessed without further data.

5a. Clay County. This population is known by a series of three herbarium specimens (MIN), labeled, "Muskoda, low meadow. O.A. Stevens. June 2, 1942." "Muskoda, low prairie. O.A. Stevens #805. June 3, 1945." "Growing in meadow near the Buffalo River at Muskoda. John W. Moore #22829. June 11, 1956." Because of the similarity of label data, all three vouchers are assumed to represent the same population. Muskoda (estimated population 20) is located at T139N R45W; extreme SW corner of section 8. The exact geographic relation of Muskoda to the population represented by the herbarium specimens is not known.

5b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Downer, 1966.

5c. This population has not been located since the date of the most recent collection (1956).

5d. The size and physical circumstances of this population are not known. The habitat has been described variously as, "meadow", "low meadow", and "low prairie". This population is believed to be native.

5e. Current ownership of this site cannot be determined without additional locational information.

5f. Threats to the survival of this population (if extant) cannot be assessed without further data.

6a. Dakota County. This popultion is known only by a herbarium specimen (MIN), labeled, "Fort Snelling Reservation with Zizia, Castilleja and valerian. C.O. Rosendahl #2458, May 25, 1910." Fort Snelling Reservation is currently limited to a small area in Hennepin County. It previously covered a larger area of Hennepin County as well as portions of Ramsey and Dakota counties. Most of the native vegetation which persists within the old reservation boundaries is in what is now Fort Snelling State Park (outside the current boundaries of the reservation). There is a calcareous fen known to occur in the park, and there is an unverified sight record C. candidum occurring in the fen. It is possible that this is a remnant of the same population represented by Rosendahl's collection. The fen is located in Dakota County, T27N R23W, S1/2 NW1/4 section 4.

6b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, St. Paul, 1967.

6c. The only documented record of this population is the collection by Rosendahl which was previously cited. The unverified sight record was reported by DNR Parks employee Craig Cox in 1978.

6d. The size and physical circumstances of this population have not been determined. From the associated species listed by Rosendhal and the sight record reported by Cox, the habitat is presumed to be a clacareous fen. This population is believed to be native.

6e. The fen in Fort Snelling State Park is currently owned and managed by the Department of Natural Resources, Division of Parks and Recreation.

6f. This population (if extant in the fen) is potentially threatened from effects of a recently constructed highway which crosses the park in the vacinity of the fen.

7a. Dakota County. This population is known only by a herbarium specimen (MIN), labeled: "Woodhulls Grove, Dakota County. Sheldon, E. P. #7458, May 29, 1894." I have been unable to locate "Woodhulls Grove" on any map or in any directory. I am unable to speculate about the location of the original collection site.

7b. It is not known which U.S. Geological Survey quadrangle map the site of the original collection occurs on.

7c. This population has not been located since the date of the original collection (1894).

7d. The size and physical circumstances of this population are not known. This population is believed to be native.

7e. Ownership of this site cannot be determined without additional locational information.

7f. Threats to the survival of this population (if extant) cannot be assessed without further data.

8a. Goodhue County. This population is known only by a herbarium specimen (MIN), labeled, "Cannon Falls, dry plains. J. H. Sandberg. May 1882." The town of Cannon Falls is located in Goodhue County at T112N R17W; section 7 and 8. The exact relation of Cannon Falls to the original collection site is not known.

8b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Cannon Falls, 1974.

8c. This population has not been located since the date of the original collection (1882).

8d. The size and physical circumstances of this population are not known. The herbarium label implies that the specimen was collected on a "dry plain". This population is believed to be native.

8e. Ownership of this site cannot be determined without additional locational information.

8f. Threats to the survival of this population (if extant) cannot be assessed without further data.

9a. Hennepin County. This population is known by two herbarium specimens (MIN), labeled, "Minneapolis. J. C. Kassube. June 1878." "Minneapolis. Addison Gage Jr. #59. June 8, 1876." These two specimens may represent two distinct populations, but because of the similarity of label data I am assuming that they were both collected from the same population. Minneapolis, in the 1870's was a small town in Hennepin County located at T29N R28W. Minneapolis now occupies approximately 40 square miles in portions of T29N R24W; T29N R23W; T28N R24W; T28N R23W. The exact location of the original collection site has not been determined.

9b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Minneapolis South, 1967; Series V872, Minneapolis North, 1967.

9c. This population has not been located since the date of the most recent collection (1878).

9d. The size and physical circumstances of this population are not known. This population is believed to be native.

9e. Ownership of this site cannot be determined without additional locational information.

9f. Threats to the survival of this population (if extant) cannot be assessed without further data.

10a. Houston County. This population is represented by a herbarium specimen (MIN), labeled, "Winnebago Valley, Houston County. Wm. A. Wheeler #20." The entry in Wheeler's collection book describes the site as follows, "at 2 o'clock started out on first and second bluffs east of station in section 25. Mostly northern exposure." The entry describing his collection of C. candidum at this site says, "Rare, June 3, 1900." Based on this information, the location of the original collection site appears to be in Houston County, T101N R5W, NW1/4 SE1/4 section 25.

10b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Eitzen, 1980.

10c. This population has not been located since the date of the original collection (1900).

10d. Based on the description in Wheeler's collection book, the species was rare and occurred on a north-facing wooded bluff. This population is believed to be native.

10e. Current ownership of this site has not been determined.

10f. Threats to the survival of this population (if extant) cannot be determined without further data.

11a. Houston County. This population is represented by a herbarium specimen (MIN), labeled, "Winnebago Valley, Houston County. W. A. Wheeler #1030. May 1901." The entry in Wheeler's collection book describes the collection site as, "Point of bluff below Stevens H." The following entry for a collection of Crataegus says, "near water tank in valley of school house where Minnie Stevens teaches." It appears that the original collection site was in Houston County, T101N R5W; somewhere near the school house where Minnie Stevens taught or near her place of residence. The exact location has not been determined.

11b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Eitzen, 1980.

11c. This population has not been located since the date of the original collection (1901).

11d. The size and physical circumstances of this population are not known. This population is believed to be native.

11e. Current ownership of this site has not been determined.

11f. Threats to the survival of this population (if extant) cannot be assessed without further data.

12a. Mahnomen County. This population is known only by a herbarium specimen (MIN), labeled, "Mahnomen County, 4 miles east of Beaulieu. C. O. Rosendahl #2021 m, June 21, 1935." These directions locate the site at T145N R40W; the intersection of sections 26, 27, 34 and 35.

12b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, North Twin Lake, 1969.

12c. This population has not been located since the date of the original collection (1935).

12d. The size and physical circumstances of this population are not known. This population is believed to be native.

12e. Current ownership of this site cannot be determined without more precise locational information.

12f. Threats to the survival of this population (if extant) cannot be assessed without further data.

13a. Marshall County. This population is known only by a herbarium specimen (MIN), labeled, Marshall County. Growing in wet original prairie 10 1/2 miles east of Warren. John W. Moore #17303, June 19, 1945." These directions locate the site at T155N R46W; somewhere in section 3 or 34.

13b. U.S. Geological Survey 7.5 minute quadrangle map; Radium, 1961.

13c. This population has not been located since the date of the original collection (1945).

13d. The size and physical circumstances of this population are not known. This population is believed to be native.

13e. Current ownership of this site cannot be determined without more precise locational information.

13f. Threats to the survival of this population (if extant) cannot be assessed without further data.

14a. McLeod County. This population is known only by a herbarium specimen (MIN), labeled, "Wild meadow, rich soil, Hutchinson. W.S. Beach, June 16, 1913." The town of Hutchinson is located in McLeod County in T116N R30W, section 1; T116N R29W, section 6 and T117N R29W, section 31. The exact relation of Hutchinson to the original collection site is not known.

14b. U.S. Geological Survey 15 minute quadrangle map; Hutchinson, 1958.

14c. This population has not been located since the date of the original collection (1913).

14d. The size and physical circumstances of this population are not known. This population is believed to be native.

14e. Current ownership of this site cannot be determined without additional locational information.

14f. Threats to the survival of this population (if extant) cannot be assessed without further data.

15a. Pipestone County. This population is known only by a herbarium specimen (MIN), labeled, "Pipestone County. Growing in swale along the railroad 2 miles southwest of Ruthton. John W. Moore #25969." These directions locate the site in T108N R44W; section 22.

15b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Ruthton, 1967.

15c. This population has not been located since the date of the original collection (1962). The site was visited on June 3, 1980 by Welby Smith, but no plants were found. Since habitat for this species still exists, it is possible that the population still survives but was overlooked.

15d. The size and physical circumstances of this population are not known.

15e. Current ownership of the site cannot be determined without additional locational information. The population may occur on the right-of-way of the Great Northern Railroad Company.

15f. Threats to the survival of this population (if extant) cannot be assessed without further data.

16a. Ramsey County. This population is known only by a herbarium specimen (MIN), labeled, "Ramsey County, E. B. Fischer." This specimen was remounted in 1967 and the original label was not retained. It is not possible to determine the date or location of the original collection.

16b. It is not known which U.S. Geological Survey quadrangle map the site occurs on.

16c. The date and nature of the most recent visit to this population is not known.

16d. The size and physical circumstances of this population are not known.

16e. Current ownership of this site cannot be determined without additional locational information.

16f. Threats to the survival of this population (if extant) cannot be assessed without further data.

17a. Streans County. This population is known only by a herbarium specimen (IOW), labeled, "St. Cloud, Mn. R. Gmelin s.n., June 1875." The city of St. Cloud is located in Stearns county in T124N R28W, portions of sections 10,11,12,13,14 and 23. The exact relation of St. Cloud to the original collection site is not known.
17b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, St. Cloud, 1974.
17c. This population has not been located since the date of the original collection (1875).
17d. The size and physical circumstances of this population are not known.
17e. Ownership of this site cannot be determined without additional locational information.
17f. Threats to the survival of this population (if extant) cannot be assessed without further data.

18a. Stevens County. This specimen is known only by a herbarium specimen (MIN), labeled, "Growing in meadow, SW1/4 section 22, Donnelly twp. John W. Moore #20606, June 8, 1950."
18b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Donnelly, 1973.
18c. This population has not been located since the date of the original collection (1950).
18d. The size and physical circumstances of this population are not known. The habitat was described by Moore as, "growing in a meadow".
18e. Current ownership of this site has not been determined.
18f. Threats to the survival of this population cannot be assessed without further data.

19a. Swift County. This population is known only by a herbarium specimen (MIN), labeled, "Appleton, MN. prairie, Frank O. Payne. June 1890." Appleton is located in Swift County, portions of sections 14,15,22,23; T120N R43W. The exact relation of Appleton to the original collection site is not known.
19b. U.S. Geological Survey 7.5 minute quadrangle map; Appleton, 1958.
19c. This population has not been located since the date of the original collection (1890).
19d. The size and physical circumstances of this population are not known. The specimen label describes the habitat as, "prairie". This population is believed to be native.
19e. Ownership of this site cannot be determined without additional locational information.
19f. Threats to the survival of this population (if extant) cannot be assessed without further data.

20a. Winona County. This population is known only by a herbarium specimen (MIN), labeled, "Winona County, Cemetery Bluff. J.M. Holzinger. June, 1901." "Cemetery Bluff" is believed to occur near Woodlawn Cemetery, which is located at T107N R11W; SW1/4, SW1/4 section 27.

20b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Winona West, 1972.

20c. This population has not been located since the date of the original collection (1901).

20d. The size and physical circumstances of this population are not known. This population is believed to be native.

20e. Ownership of this site cannot be determined without additional locational information.

20f. Threats to the survival of this population (if extant) cannot be assessed without further data.

21a. Yellow Medicine County. This population is known only by a herbarium specimen (MIN), labeled, "Granite Fallls, L.R. Moyer. June 5, 1909." Granite Falls is located in Yellow Medicine County at T115N R35W, section 4. The exact relation of Granite Falls to the original collection site is not known.

21b U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Granite Falls, 1965.

21c. This site has not been located since the date of the original collection (1909).

21d. The size and physical circumstances of this population are not known. This population is believed to be native.

21e. Ownership of this site cannot be determined without additional locational information.

21f. Threats to the survival of this population cannot be assessed without further data.

4. General Environment and Habitat Description

Of the 50 known extant populations, 44 occur in prairies, 3 in calcareous fens, 2 in roadside ditches and one in a woodland.

The prairie populations occur primarily at the narrow ecotone between mesic prairie and wet prairie or marsh. This zone is usually dominated by various species of Carex and is often referred to as a sedge meadow. Often this condition is simulated in large, flat habitats where the soil is poorly drained. In this situation C. candidum will occur scattered throughout the habitat and populations may number thousands of individuals. The water table is frequently at the surface and rarely more than 10 to 12 inches below the surface. The water is highly calcareous, with pH between 7.0 and 8.1 and ca+ concentrations as high as 218 mg/L. Associated species for prairie populations occurring in western Minnesota include: Carex tetanica, Carex lanuginosa, Carex interior, Carex buxbaumii, Carex sartwellii, Amorpha nana, Camandra richardsiana,

Astragalus agrestis, Galium boreale, Anemone canadensis, Senecio pseudaureus var. semicordatus, Zizia aurea, Polygala senega, Zygadenus elegans, Crepis runcinata, Plantago eriopoda, Hypoxis hirsuta, Platanthera hyperborea, Euthamia graminifolia, Muhlenbergia richardsonis, Solidago ridellii, Pedicularis lanceolata, Aster umbellatus, Liatris ligulistylis, Prenanthes racemosa, Gentiana procera. Assocaited species for prairie populations occurring in southeastern Minnesota include: Carex bebbii, Carex bicknellii, Carex praegracilis, Carex buxbaumii, Carex vulpinoidea, Carex haydenii, Zizia aptera, Zizia aurea, Hypoxis hirsuta, Hierochloe odorata, Valeriana edulis, Saxifraga pensylvanica, Oxypolis rigidior, Asclepias sullivantia, Vicia americana, Phlox maculata, Cacalia tuberosa, Juncus dudleyi.

Populations of C. candidum in calcareous fens occur in a saturated peat substrate which is highly calcareous in nature. The pH will frequently be over 8.0 and ca+ occasionally over 200 mg/L. Associated species for fen populations include: Carex sterilis, Carex aquatilis var. altior, Carex prairea, Triglochin palustris, Triglochin maritima, Scirpus cespitosus, Rhynchospora capillacea, Parnassia glauca, Lobelia kalmii, Liparis loeselii, Scleria verticillata, Tofieldia glutinosa, Cypripedium reginae, Eleocharis compressa, Muhlenbergia glomerata.

Numerous cases have been seen where C. candidum will invade habitat that has been disturbed but which has been nearly restored to prairie by natural revegetation (as in roadside ditches). Such invasion, however, usually occurs from the margins of a large population which is established in undisturbed habitat. Populations occurring in roadside ditches are believed to be remnants of larger populations that once inhabited adjacent land. The center of the population is destroyed when the adjacent land is plowed, leaving a small remnant of the population surviving in the ditch.

Only a single population is known to occur in a woodland, although 2 historical records are believed to have come from woodlands. The single known population occurs on a 20 degree northeast facing bluff in the forested region of the state. It occurs in filtered sunlight under the shade of Juniperus virginiana, Celtis occidentalis and Physocarpus opulifolius. It occurs with such typical wood and plants as Asarum candenis and Taenidia integerrima, as well as such prairie species as Phlox pilosa, Amorpha canescens and Polygola senega. The substrate is 10 inches of loose, sandy soil over limestone or sandstone.

5. Population Biology of Species

A. General summary of population biology

Population biology is affected by the symbiotic relationship between individual plants of C. candidum and a mycorrhizal fungi. Only one such fungi has been reported, Rhizoctonia subtilis (Curtis 1939), but other fungi are probably involved also.

Pollination studies indicate that Andrena plaucida may be involved in the pollination of C. candidum. Pollinators are attracted to the flower which has lateral sepels and petals that are yellow-green while the white labellum is flecked with purple around the opening and in the interior. The odor is sweet and pungent or spicy, similar to that of C. calceolus but not as strong as in that species. Most of the odor is produced in the lateral sepals and petals, with the labellum playing a minor role (Stoutamire 1967).

Because of the close phylogenetic relationship between C. candidum and C. calceolus, these two species will often hybridize when they occur in close proximity (Fuller 1932).

B. Demography

There are 50 extant populations of C. candidum known in Minnesota. The plants occurring in 32 of these populations have been counted or estimated. The total number in these 32 popultions is more than 15,000 or an average of 475 plants per population (ranging from 1 to 10,000). The total number of plants occurring in all 50 known extant sites is estimated to be greater than 30,000. This may represent 1/3 to 1/2 of those plants extant in Minnesota.

The total acreage of native habitat in which these 50 populations occur is approximately 13,000 (nearly all prairie), or an average of 255 acres per population (ranging from 5 to 2,000 acres). Within each of these general habitats, suitable microhabitat for C. candidum may cover only a few acres. Densities as great as 150 plants per 100 square meters are not uncommon when local conditions are ideal. Densities of 5 to 20 plants per 100 square meters are more frequent. Accurate counts of this species are very difficult because of the rhizomatous nature of the plants. It is often very difficult to distinguish individual plants amid numerous clump growing in close proximity.

6. Current Land Ownership Summary

Of the 50 known extant populations of C. candidum in Minnesota, the ownership can be broken down in the following manner:

DNR (Scientific and Natural Areas)	7
DNR (Other)	5
The Nature Conservancy	9
The Nature Conservancy/DNR (lease agreement)	3
U.S. Fish and Wildlife Service	8
County governments	2
Railroad companies	6
Other private	4
Unknown	6

The DNR is in the process of inventorying state Wildlife Management Areas. It is believed that when this inventory is complete, more than 40 of these units will be found to have populations of C. candidum. A thorough inventory of all state park lands and U.S. Wildlife lands would likewise discover numerous populations not currently known.

7. Evidence of Threats to Survival - Summary

Of the 50 known extant populations of C. candidum in Minnesota, 23 are known to face exiting or potential threats to their survival, 22 are not known to face any existing or potential threats, and 5 have not been assessed for threats. Threats to specific populations are detailed under section on precise occurrences.

A. Present or threatened destruction, modification or cutailment of habitat or range

1. Because of their proximity to roads, 5 populations are potentially threatened by road maintenance activities. Such activities include salting and oiling of road surfaces, spraying and mowing of right-of-ways, shoulder upgrading and road widening. Direct destruction of plants may also result from maintenance equipment being driven on lands adjacent to the right-of-ways, and improper use of hazardous substances.

2. The major portions of 4 populations occur beneath utility lines, and are potentially threatened by maintenance activity associated with those lines.

3. Six populations occur on railroad right-of-ways and are potentially threatened by the upgrading of rail beds, the abandonment of rail beds (and the subsequent sale to adjacent land owners) and unauthorized use of the righ-of-way for agricultural activities. Populations occurring on right-of-ways are also potentially threatened by the use of these areas for pipelines.

4. Seven populations are potentially threatened by various agricultural activities. Specifically, plowing and herbicide application.

5. Two popultions face existing threats from industrial development.

6. Two populations are potentially threatened by overuse of the recreational potential of their habitat. One is along a state trail and another is in a high-use area of a state park.

7. Two populations are potentially threatened by vegetational changes within their habitat caused by the invasion of certain aggressive plant species; specifically Phragmites communis, Salix sp., Cornus sp., Symphoricarpos occidentalis.

B. Other natural or manmade factors

1. As many as 5 populations may be potentially threatened because of critically low numbers. These populations are believed to be remnants of larger populations which have suffered severe depletions from unknown causes.

II. ASSESSMENT AND RECOMMENATIONS

8. Recommended Status

Based on the evidence presented in the report, it is recommended that Cypripedium candidum not be assigned status as endangered or threatened in Minnesota. Although it will continue to undergo population reductions, its survival in Minnesota is not threatened at this time or in the foreseeable future.

9. Interested Parties

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2. Geoffrey Barnard
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3. Eric G. Dornfeld
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III. INFORMATION SOURCES

10. Sources of Information

A. Publications

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B. Museum collections

1. Herbaria searched:
University of Minnesota, St. Paul
University of Minnesota, Duluth
University of Wisconsin, Madison
University of North Dakota, Fargo
St. Cloud State University, St. Cloud, MN
Winona State University, Winona, MN
Iowa State University, Iowa City

C. Field work

Field investigation was conducted at various times in 1980 and 1981 by Heritage staff botanist Welby Smith. All specimens collected during the course of this investigation are on deposit in the herbarium of the University of Minnesota, St. Paul. All data were recorded on standardized survey forms and are on file in the office of Minnesota Natural Heritage Program.

D. Knowledgeable individuals

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Harvard University
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IV. AUTHORSHIP

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STATUS REPORT

Taxon Name: Eyrthronium propullans Gray

Common Name: Minnesota trout lily

Family: Liliaceae

States Where Taxon Occurs: Minnesota

Author of This Report: Welby R. Smith

Date of This Report: July 1, 1981

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14a. Goodhue County. T111N R17W; NW1/4 SW1/4 SW1/4 Section 6. About 15 miles east of site 1a.
14b. U.S. Geological Survey 7.5 minute quadrangle map; Sogn, 1968.
14c. Observed in 1978 by Dr. T. Morley.
14d. Four native colonies consisting of about 20 individuals each, occurring in level floodplain woods on north side of Little Cannon River.
14e. This site is privately owned.
14f. This site may be threatened by conversion of the habitat to agricultural uses.

15a. Elouise Butler Wildlfower Garden, Minneapolis, Hennepin County. T117N R24W; NW1/4 section 29.
15b. U.S. Geological Survey 7.5 minute quadrangle map Series V872, Minneapolis South, 1972.
15c. Observed in 1978 by Dr. T. Morley.
15d. Size of population unknown, but believed to be small. The plants occurring at this site are not a naturally occurring population. They were transplanted to this site from an unknown location.
15e. Ownership is unknown.
15f. There are no known threats to this population.

16a. University of Minnesota Landscape, Arboretum, 4 miles west of Chanhassen on Highway 5.
16b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Shakopee, 1972.
16c. Observed by Dr. T. Morley in the 1970s.
16d. The size of the population is small but apparently viable. The plants occurring at this site are not a naturally occurring population. They were illegally obtained from the Grace Nature Preserve (site 13a) in the early 1970s
16e. This site is owned by the University of Minnesota.
16f. There are no known threats to this population.

2. Populations known or assummed extirpated

1a. Goodhue County. The only reference to this location is a herbarium label which reads "Zumbrota MN". The town of Zumbrota occurs in parts of T110N R16W and T110N R15W.
1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Zumbrota, 1968.
1c. Know only by a specimen on file at the University of Minnesota herbarium in St. Paul. The label reads "Zumbrota Mn. A.C. Ballard #4, May 1892". Potential habitat in the vacinity of Zumbrota has been intensively searched with no success by Dr. T. Morley. Morley has concluded that the site of Ballard's collection was destroyed by expansion of the city of Zumbrota (Morley, personal communication).
1d. The size and circumstance of the original collection site is unknown.
1e. Ownership cannot be determined without additional locational information.

2a. Rice County. T110N R20W; S1/2 NE1/4 SW1/4 Section 16. About 1/8 mile southwest of site 1a.
2b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Cannon City, 1960.

2c. This population was destroyed sometime prior to 1978 by a truck hauling firewood from the floodplain to the top of the bluff (Morley personal communication)
2d. Approximately one colony consisting of about 20 individuals was destroyed.
2e. This site is privately owned.

3a. Rice County. T110N R20W; SE1/4 SW1/4 SE1/4 Section 33.
3b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Cannon City 1960.
3c. This population was destroyed sometime prior to 1978 by the construction of a road (Morley, personal communication).
3d. The size of the population is not known.
3e. This site is privately owned.

3. Historically known populations where current status is not known

Since the description of this species in 1871, numerous specimens have been collected and deposited in the University of Minnesota herbarium. All are from Rice and Goodhue Counties, but several have insufficient locational data to relocate the exact site. It is uncertain if they were collected from the same sites we know about today, or if they were collected from currently unknown sites.

Dr. Morley (1979) believes that all the surviving populations have been rediscovered, and that few is any currently unknown populations will ever be found.

4. General Environment and Habitat Description

The habitat of E. propullans is most commonly a wooded north-facing slope 15-27 m high rising above or near a stream bed, the latter either of a present stream or an old abandoned channel. The plants ususally occupy the lower part of the slope and may extend out onto the floodplain if one is present, even crossing to the far side of the stream sometimes. Less often they climb nearly to the top of the slope. At one location the slope is only about 4 m high. Sometimes the exposure is northeast or northwest or even, rarely, east or west. At two sites, Kenyon and Cannon Falls, the plants are scattered on the floodplain only and are so far north of the slope that there may be no relation to it, and a third place now destroyed was similar. The Cannon Falls location is on the north side of the river, and although apparently suitable habitats occurs on the south side, nearer the foot of the slope, no plants are found there. Therefore one has to conclude that the plants can succeed in the absence of a north-facing slope under the right conditions.

The plants occur most often in moderate to heavy shade. The shading trees are deciduous, of many kinds. Occasionally plants will be found in the open, apparently after tree removal, yet they appear to survive well enough. Elms were common cover trees and are now mostly dead or dying; the effect of their loss is yet to be seen. Cattle are often pastured in the habitats of these trout lilies, but the plants appear to stand up well under light to moderate grazing. They may persist in the open and in the presence of grazing after many other herbs have disappeared. (Morley, 1979).

5. Population Biology of Species

A. General summary of population biology

Self-pollination does not yield fruit nor does Erythronium propullans demonstrate apomixis (Sohmer and Banks 1979). Experimental evidence indicates that sexual reproduction does not occur (Sohmer and Banks 1979) even though the majority of plants in the colony usually flower (Morley 1979). E. propullans produces only one vegetative offshoot while the sympatric E. albidum may produce several (Sohmer and Banks 1979)

The plants tend to form clones in the form of irregular clumps or colonies. The colonies are ususally 2-5 dm or more in diameter, although they may be smaller or the plants may be scattered individually. The average number of individuals per colony is about 20 (Morley 1979).

B. Demography

Morley (1979) considered there to be 25 naturally occurring sites in existence. However, many of these sites are separated by only a few hundred feet of what is apparently suitable habitat. This author has combined some of Morley's sites to produce a total of 14 naturally occurring sites. A site by site description has already been presented, but a rough estimate of the total number of colonies currently known to exist is a little over 400. A conservative estimate of the average number of individuals per colony is about 20 (Morley 1979). However, since these colonies are clones, and all individuals of the clones are genetically identical, it may be more useful to consider the 400 count as the total number of surviving plants.

6. Current Land Ownership Summary

All known populations are privately owned. Two of the sites which have 20 and 110 colonies are owned by the Minnesota Chapter of The Nature Conservancy, and are managed by them for the preservation of E. propullans.

7. Evidence of Threats to Survival - Summary

A. Present or threatened destruction, modification or curtailment of habitat or range.

1. Several of the known populations occur within the city limits of Faribault. Many of these are known to face an immediate threat from residential and commercial development.

2. Many of the urban populations are threatened by the recreational use of dirt bikes. This destroys sites directly by wearing trails, and indirectly by causing erosion. At least one colony has been destroyed as a result of dirt bike usage.

3. Populations occurring outside the city are threatened by conversion of the land to agricultural uses and herbicide drift from adjacent agricultural land. One population is known to have been destroyed when the site was cleared of timber and plowed.

B. Overutilization for commercial, sporting, scientific, or educational purposes.

1. Because of the unique status of this species (the only state endemic), its attractive appearance and its proximity to populated areas, it is seriously threatened by horticultural collecting. The site near Kenyon was severly damaged in the early 1970s when a large number of the plants occurring there were illegally removed and replanted in the University of Minnesota landscape arboretum.

II. ASSESSMENT AND RECOMMENDATIONS

8. Recommended Status

All known populations of Erythronum propullans are described in this report. Because of the intensive research this species has attracted, it seems unlikely that few if any new populations will be discovered in the future. Therefore, because of the limited occurrence and vulnerability of this species, a status of threatened is recommended.

Because of the publicity-sensitive nature of Erythronum propullans, critical habitat cannot be recommended. Past events have shown that public knowledge of the precise location of populations of E. propullans may lead to the damage or destruction of such populations. One such event resulted in the illegal removal of a significant portion of the population occurring near Kenyon. It is therefore believed that recommending critical habitat would pose an unnecessary risk to surviving populations.

9. Interested parties

1. Dr. Tom Morley, Department of Botany, University of Minnesota, St. Paul, MN.

2. The Nature Conservancy, Minnesota Chapter. 328 East Hennepin, Minneapolis MN.

3. Barbara Coffin, Coordinator Minnesota Natural Heritage Program. Department of Natural Resources, Box 7, Centennial Office Building, St. Paul, MN 55155.

III. INFORMATION SOURCES

10. Sources of Information

A. Publications

Blodgett, F.H. 1910. The origin and development of bulbs in the genus Erythronium. Bot. Gaz., 50:340-373.

Gray, A. 1871. A new species of Erythronium. Amer. Naturalist, 5:298-300.

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Johnson, A.G. and M.K. Smithberg. 1968. A wildflower unique to Minnesota. Minn. Horticulturalist, 96:38-39.

Meads, M.E. 1893. The range of variation in species of Erythronium. Bot. Gaz., 18:134-138.

Morley, T. 1978. Distribution and rarity of Erythronium propullans. Phytologia, 40:5,381-389.

Rosendahl, C.O. 1919. Variations in the flowers of Erythronium propullans Gray. Torreya, 19:43-47.

Sommers, S.H. and J.A. Banks. 1979. The reproductive biology of Erythronium propullans. MS Thesis, Univ. Wisc. La Crosse.

Utech, F.H. and S. Kawano. 1975. Biosystematic studies in Erythronium. I. Floral biology of E. japonicum Decne. Bot. Mag. Tokyo, 88:163-176.

B. Museum collections

1. Herbaria searched: University of Minnesota, St. Paul.
North Dakota State University, Fargo
University of Minnesota, Duluth
University of Wisconsin, Madison
St. Cloud State College, St. Cloud

C. Field work

The field work which forms the basis for this report was done by Dr. Thomas Morley prior to and during 1978. Because of the exhaustive nature of Morley's field work, it was believed unneccessary for Heritage staff to do additional field work.

D. Knowledgeable individuals

1. Dr. Tom Morley, University of Minnesota, St. Paul

2. Geoff Barnard, The Nature Conservancy, 328 East Hennepin, Minneapolis, Mn.

IV. AUTHORSHIP

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Minnesota Natural Heritage Progrm
Department of Natural Resources
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STATUS REPORT

Taxon Name: *Hydrastis canadensis* L.

Common Name: Golden seal

Family: Ranunculaceae

States Where Taxon Occurs: Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Kentucky, Maryland, Michigan, Minnesota, Missouri, Nebraska, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, Mississippi.

Author of This Report: Welby Smith

Date of This Report: November 16, 1981

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4. General Environment and Habitat Description

There is only one population in Minnesota for which we have a detailed habitat description. That population occurs in a forest dominated by Acer saccharum (Sugar maple) and Tilia americana (Basswood), with some Quercus borealis (Red oak), Populus grandidentata (Big-tooth aspen) and a few seedlings of Carya cordiformis (Hickory). Herbaceous species include: Podophyllum peltatum, Osmorhiza claytoni, Thalictrum dioicum, Smilacina racemosa, Uvularia grandiflora, Aralia racemosa, Sanguinaria canadensis, Anemone quinquefolia, and Laportea canadensis. The population occurs on level ground in silty loam. It is associated with occasional karsts in Galena limestone.

5. Population Biology of Species

A. General summary of population biology

Essentially nothing is known about the population biology of Minnesota populations. However, a rather extensive study of population in Indiana has been conducted by Eichenberger and Parker (1976) and is the basis of the following summary. Hydrastis canadensis will send up a single or double stem from a tuber. The stems will flower in April and May before the leaves have expanded. The above ground biomass reaches a peak by mid-July and them declines with the senescence of the individual plants until the first killing frost. Reproduction is accomplished by both seed and rhizhoms. The typical clumped distribution of plants is probably the result of dispersal of seeds by animals, but may also be caused by the death of interior plants of a large clump or the lack of sufficient time for the species to completely colonize the suitable habitat.

B. Demography

The only extant population of Hydrastis canadensis known in Minnesota consists of about 75 plants scattered in a two acre portion of a 40 acre woods.

6. Current Land Ownership Summary

The only extant population of Hydrastis canadensis known in Minnesota is owned and managed by Olmsted County.

7. Evidence of Threats to Survival - Summary

A. Overutilization for commercial, sporting, scientific, or educational purposes

1. Because of the commercial value of its roots, Hydrastis canadensis must be considered potentially threatened by commercial exploitation. At this time, however, there is no indication that Hydrastis is experiencing harvest pressure in Minnesota.

II. ASSESSMENT AND RECOMMENDATIONS

8. Recommended Status

Because of the extreme rarity of this species, I recommend a status of endangered for Hydrastis canadensis in Minnesota. Because of the commercial value of the roots of this species, I cannot recommend critical habitat. To allow the location of this species to become public knowledge would be to encourage commercial exploitation. Such exploitation would severely endanger the survival of this species in Minnesota.

9. Interested Parties

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2. Barbara Coffin
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St. Paul, MN 55155

III. INFORMATION SOURCES

10. Sources of Information

A. Publications

Charette, L.A. 1964. Hydrastis canadensis in New England. Rhodora, 66:94-96.

Eichenberger, M.D., and G.R. Parker. 1976. Golden seal (Hydrastis canadensis L.) distribution, phenology and biomass in an oak-hickory forest. Ohio J. Sci. 76(5):204-210.

Fassett, L.C. 1946. Preliminary reports on the flora of Wisconsin; #33 Ranunculaceae. Wisc. Acad. Sci. Arts & Letters, 38:195.

Rosendahl, C.O., and J.W. Moore. 1947. A new variety of Sedum rosea from southeastern Minnesota and additional notes on the flora of the region. Rhodora 49:197-202.

Thorne, R.F. 1953. Rare Iowa plants. Iowa Acad. Sci., 60:266.

B. Museum collections

1. Herbaria searched: University of Minnesota, St. Paul
University of Minnesota, Duluth
University of Wisconsin, Madison
North Dakota State Univerity, Fargo
St. Cloud State University, St. Cloud, MN
Winona State University, Winona, MN

C. Field work

Field verification was conducted by Heritage staff botanist Welby Smith on May 27, 1980. Also by Heritage staff Henry Woolsey and George-Ann Maxson on June 19, 1980. Specimens of Hydrastis canadensis and associated plant species were collected and later deposited in the herbarium of the University of Minnesota, St. Paul.

All field data collected during the course of this investigation were recorded on standardized survey forms and are on file in the office of the Minnesota Natural Heritage Program.

D. Knowledgeable individuals

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2. George-Ann Maxson
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IV. AUTHORSHIP

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STATUS REPORT

Taxon name: *Lespedeza leptostachya* Engelm.

Common name: Prairie Bush Clover

Family: Fabaceae

States Where Taxon Occurs: Minnesota, Iowa, Wisconsin, Illinois

Author of This Report: Welby R. Smith

Date of This Report: October 16, 1981

STATUS REPORT

Taxon name: *Lespedeza leptostachya* Engelm.

Common name: Prairie Bush Clover

Family: Fabaceae

States Where Taxon Occurs: Minnesota, Iowa, Wisconsin, Illinois

Author of This Report: Welby R. Smith

Date of This Report: October 16, 1981

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I. SPECIES INFORMATION

1. Classification and Nomenclature

   A. Species
      1. Lespedeza leptostachya Engelm.
      2. There are no currently used synonyms
      3. Common name is Prairie Bush Clover

   B. Family Classification
      1. Fabaceae

   C. Major group
      1. Angiospermae

   D. Current alternative taxonomic treatment
      1. None

2. Present State Status

   A. Legal. None
   B Advisory. Proposed by the Minnesota Natural Heritage Program as being threatened in Minnesota.

3. Geographic Distribution and Site Descriptions

   A. Geographic range. This species is limited to portions of southern Minnesota, northern Iowa, southern Wisconsin and northern Illinois. In Minnesota, this species is known by herbarium specimens to occur in Jackson, Goodhue, Cass, Cottonwood and Renville counties. There is an unreliable literature report of this species occurring in Rock County (Upham, 1884). Because of the undocumented nature of this report, it is not included under precise occurrences.

   B. Precise occurrences
      1. Populations currently or recently known extant
         1a. Jackson County. T102N R35W; SW1/4 SW1/4 NE1/4 Section 10
         1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Lakefield NE, 1970.
         1c. The site was visited by Welby Smith on August 21, 1980.
         1d. About 40 specimens were counted on a north-facing 15 degree slope in an area occupying about 2 acres. The soil is well drained, brown clayey loam producing a dry to mesic habitat. The population of L. leptostachya occurs with native prairie vegetation and is presumed to be naturally occurring.
         1e. This site is in the private ownership of Johnny David Chihak, who lives in the vicinity.
         1f. This site is potentially threatened by herbicide run-off from the agricultural field located directly up-slope. It is also threatened by natural vegetation changes; specifically the invasion of ash and elm trees into the prairie. Interviews with the owner also indicate that developers have attempted to purchase the site.

2a. Jackson County. T103N R35W; SE1/4 SE1/4 NW1/4 section 17. About 5 miles north-northwest of site 1a.
2b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Lakefield NE, 1970.
2c. The site was visited by Welby Smith on August 21, 1980.
2d. An estimated population of 1400 specimens occur on a northwest-facing 15 degree slope. The plants occupy about one acre in a native prairie habitat. The soil is somewhat gravelly overlying black clayey loam, and the habitat is best described as mesic. This population of L. leptostachya is presumed to be native.
2e. The site is within Kilen Woods State Park, and is owned and managed by the Division of Parks and Recreation, DNR.
2f. The site was previously threatened by a foot path that has since been re-routed. There is a potential threat from the encroachment of wild plum trees that currently form dense thickets directly south of the site.

3a. Jackson County. T103N R35W; SW1/4 SW1/4 NE1/4 section 17. About 150 meters notheast of site 2a.
3b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Lakefield NE, 1970.
3c. The site was visited by Welby Smith on August 20, 1980. A specimen was collected (Smith #3417) and deposited in the herbarium of the University of Minnesota, St. Paul.
3d. An estimated population of 2500 specimens occur on a west-facing 15 degree slope. The plants occupy less than one acre in a native prairie habitat. The soil is well drained black loam, producing a mesic to dry habitat. This population of L. leptostachya is believed to be native. It is presumed that this population was at one time continuous with the population described in 2a, but became separated when agricultural activities made the intervening area uninhabitable.
3e. The site is within Kilen Woods State Park, and is owned and managed by the Division of Parks and Recreation, DNR.
3f. The site was previously subjected to the application of herbicides, but no existing threats are known.

4a. Cottonwood County. T107N R35W; NW1/4 NE1/4 NW1/4 section 9.
4b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Sanborn SE, 1967.
4c. The site was visited by Welby Smith on August 22, 1980.
4d. Somewhere between 25 and 65 plants were observed on a flat, native prairie habitat, in an area of about 300 square feet. More specimens may be scattered on this 2 acre portion of the prairie, but a recent fire made the plants difficult to locate. The soil is well drained brown loam, and is somewhat gravelly. The habitat is best described as dry prairie with some elements of a mesic prairie. This population of

L. leptostachya is believed to be native.

4e. The site occurs within the Jeffers Petroglyph Historic Site, and is owned and managed by the Minnesota Historical Society.

4f. The entire population of L. leptostachya at this site occurs within a large circular driveway that serves an information booth at the entrance to the Historic Site. Because of the location, the site receives considerable foot traffic from visitors. The site is also threatened by poor management practices. Such practices include an ill-timed prescribed burn on June 30, 1980. The burn destroyed the aerial portions of the L. leptostachya just at the beginning of their floral development. When observed on August 22, 1980, the population was seen as small vegetative sprouts rising from the bases of charred stems. The population may be potentially threatened by hybridization with L. capitata. The hybrid has been recorded from this site, but the population dynamics controlling the hybridization are unknown.

5a. Goodhue County. T112N R18W; SE1/4 SW1/4 SE1/4 section 18.

5b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Randolph, 1974.

5c. The site was visited by Welby Smith on August 22, 1980.

5d. Approximately 23 plants were observed in an area 50 by 25 feet, but reports indicate that there may be more plants scattered over the entire 20 acre prairie area. The soil is sandy and gravelly loam, producing a dry prairie habitat. The observed plants were on a ten degree north-facing slope. This popuation of L. leptostachya is believed to be native.

5e. The site is owned and managed by Carlton College in Northfield, MN.

5f. The site was heavily grazed until it was acquired by Carlton College in 1970. Since that time it has been managed for the perpetuation of the native plant community.

6a. Renville County. T113N R35W; W1/2 NW1/4 section 31.

6b. U.S. Geological Survey 15 minute quadrangle map; Series V772, Morton, 1952.

6c. The site was last visited by Dr. Tom Morley in 1981.

6d. The exact size and physical circumstances of this population are unknown. When Heritage staff botanist Welby Smith searched this site on August 23, 1980, no plants were located. The same site was visited by Dr. Tom Morley in 1981. Morley reported seeing a few plants on a north-facing slope at the location given above. It is believed that the extant population may number between 20 and 200 individuals and may be scattered over 40 acres of dry prairie amongst scattered granite outcrops. This population is presumed to be native.

6e. The site is owned by the Cold Spring Granite Company, Cold Spring, MN.
6f. The site is currently threatened with destruction from the quarrying activities of the land owner. The population may face a potential threat from hybridization with L. capitata. Such a hybrid has been collected at the site (Dana, MN). However, the destructive potential of hybridization on phenotypically pure L. leptostachya is not known.

2. Populations known or assumed extirpated

1a. None

3. Historically known populations where current status is not known

1a. Goodhue County. T112N R18W; NE1/4 NW1/4 section 19. About 1/4 mile south of site 1.5a.
1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Dennison, 1960.
1c. This site was discovered by Dr. Tom Morley in 1972 (Morley #1273 MN). He counted 30-35 plants in an area 100 x 50 feet on a gentle north-facing slope in a dry prairie habitat. The site was re-visited by Welby Smith on August 20, 1980. At that time, the site was being intensely grazed by cattle, and no native plant species could be identified. It is possible that L. leptostachya still exists at the site in a much reduced vegetative state, or as dormant seeds.
1d. The current size and physical circumstances of the population cannot be determined.
1e. This site is privately owned.
1f. If this population is extant, it faces a current and future threat from grazing by dairy cattle.

2a. Cass County. In the vicinity of Gull Lake.
2b. U.S. Geological Survey 7.5 minute quadrangle maps; Series V872, Gull Lake, 1973 and Wilson Bay, 1973.
2c. This population is known only by an herbarium specimen (MIN) labeled: "Brainerd, MN, MacMillan and Sheldon #87, August 1890)." A more detailed description is later given in a published account by Sheldon (1890): "on dry, sandy hillside near Gull Lake, Cass County". It was decided that this description was too vague to initiate a search by Heritage staff.
2d. The size and nature of the population cannot be determined from the information available.
2e. Ownership of the site cannot be determined without more specific locational data.

2f. Threats to this population of L. leptostachya (if extant) cannot be evaluated without more information.

4. General Environment and Habitat Description

In Minnesota, L. leptostachya most frequently inhabits dry to mesic prairies, but occasionally is found in typical dry prairie habitat. In the drier situations it is often associated with such species as Andropogon scoparius, Bouteloua curtipendula, Sporobolus heterolepis, Stipa spartea, Cyperus schweinitzii and Euphorbia corollata. In the more mesic habitats it is known to associate with Andropogon gerardi, Sorghastrum nutans, Solidago missouriensis, Pycnanthemum virginianum and Astragalus canadensis. Some species have been found at all sites and include: Solidago rigida, Petalostemum purpureum, Lespedeza capitata, Heuchera richardsonii var. hispidior and Oenothera serrulata.

The aspect of local topography also appears to be relevant. Five of the six confirmed occurrences were found on north or northwest-facing slopes of 10 to 15 degrees. The sixth occurs on level terrain. All sites occurred on well drained prairie soil that had never been plowed, but four of the six sites are known or suspected to have been grazed in the past.

All of the Minnesota occurrences are within the glaciated portions of the state, which is consistent with reports from other portions of its range (Alverson 1981).

5. Population Biology of the Species

A. General summary of population biology. Although much has been written about the biology of the genus Lespedeza, very little work has been directed towards L. leptostachya. It is known that the species produces cleistogamous flowers as well as chasmogamous flowers. It has been suggested by Clewell (1966) that this may explain the lack of variation between individuals of a given population.

B. Demography

Reliable estimates, or actual stem counts, have been made at all confirmed sites of Lespedeza leptostachya in Minnesota. The results show the following population sizes: 2500, 1400, 50, 50, 40, 23. It should be remembered that the 2500 and 1400 count populations are separated by only 150 meters, and are probably remnants of a much larger population that was once continuous.

The total area occupied by all the confirmed populations in Minnesota is probably less than 10 acres. The populations tend to occupy less than 2 acres each, regardless of the amount of habitat available or the number of individuals in the population.

6. Current Land Ownership Summary

Of the six confirmed populations, three occur on public land; two of which are in Kilen Woods State Park (DNR, Parks), and one is in the Petroglyph Historic Site (Minnesota Historical Society). One of the remaining sites is owned by a resident farmer, another by a mining company, and the last one by a private college (Carlton, Northfield, MN).

7. Evidence of Threats to Survival - Summary

A. Present or threatened destruction, modification or curtailment of habitat or range

1. The popualtion in Renville County is threatened with destruction of its habitat by rock quarrying activities.

2. One of the three sites in Jackson County (1.1a) is potentially threatened by agricultural activity and housing development.

3. Another site in Jackson County (1.3a) may be threatened by vegetational changes.

4. The site in Cottonwood County is threatened by trampling from site visitors, and by ill-advised management techniques.

II. ASSESSMENT AND RECOMMENDATIONS

8. Recommended Status

Because of the generally small populations of this species and the remnant nature of its habitat, I recommend a status of threatened for L. leptostachya in Minnesota.

9. Interested Parties

1. Dr. Tom Morley
Department of Botany
University of Minnesota
St. Paul, MN 55108

2. Lowell Jaeger
Park Manager
Kilen Woods State Park
Lakefield, MN 56150

3. Geoff Barnard
Chapter Director
The Nature Conservancy
328 E Hennepin Ave
Minneapolis, MN 55414

4. Barbara Coffin
Coordinator, Minnesota Natural Heritage Program
Department of Natural Resources
Box 7, Centennial Office Bldg
St Paul, MN 55155

III. INFORMATION SOURCES

10. Sources of Information

A. Publications

Alverson, William. 1981. Wisconsin's critical plant species. Bulletin Bot. Club of Wisc. 13(3) 1-10.

Clewell, A.F. 1966. Native North American species of Lespedeza. Rhodora 68:359-405.

Fassett, N.C. 1939. The leguminous plants of Wisconsin. University of Wisconsin Press. 157pp.

Fox, W.B. 1945. Leguminosae of Iowa. Am. Midl. Nat. 34(1):207-230.

Gambill, W.G. 1953. The Leguminosae of Illinois Ill. Biol. Monographs, 22.

Isely, D. 1955. North-central Hedysareae. Iowa State College Jour. of Sci. 30(1)

Sheldon, E.P. 1890. Some extensions of plant ranges. Mn. Bot. Stud. vol. I, Bulletin #9 of the Geological and Natural History Survey of Minnesota p 14-18.

Tans, W.E. 1975. Recent Wisconsin records for some interesting vascular plants in the Western Great Lakes Region. The Michigan Botanist 14:131-143.

Upham, W. 1884. Catalogue of the flora of Minnesota. The Geological and Natural History Survey of Minnesota. Minneapolis.

B. Museum collections

1. Herbaria searched: University of Minnesota, St. Paul
University of Minnesota, Duluth
North Dakota State University, Fargo
St. Cloud State University, St. Cloud, MN
Winona State University, Winona, MN
University of Wisconsin, Madison

C. Fieldwork

Field verification was conducted by Heritage staff botanist Welby Smith on August 20-22, 1980. During this time two of the five historically known populations were rediscovered and three previously undocumented popuations were located. Two of the remaining historical sites were searched with no success, and the fifth historical site was not investigated because of insufficient locational information.

Specimens of L. leptostochya and associated plant species were collected and later deposited in the herbarium of the University of Minnesota, St Paul.

All field data collected during the course of this investigation were recorded on standardized survey forms and are on file in the office of the Minnesota Natural Heritage Program.

C. Knowledgeable individuals

1. Dr. Tom Morley
   Department of Botany
   University of Minnesota
   St Paul, MN 55108

2. Dr. G. B. Ownbey
   Department of Botany
   University of Minnesota
   St Paul, MN 55108

IV. AUTHORISHIP

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612-296-9779

STATUS REPORT

Taxon Name: *Listera auriculata* Wiegand

Common Name: Auricled twayblade

Family: Orchidaceae

States Where Taxon Occurs: Minnesota, Wisconsin, Michigan, Vermont, New Hampshire, Maine, New York and Canada.

Author of This Report: Welby R. Smith

Date of This Report: November 13, 1981

TABLE OF CONTENTS

I. SPECIES INFORMATION

1. Classification and Nomenclature

   A. Species

      1. *Listera auriculata* Wiegand
      2. Synonyms include: *Ophrys auriculata* (Wiegand) House
         Bifolium auriculatum (Wiegand)Nieuwland
      3. Common name: Auricled twayblade

   B. Family Classification

      1. Orchidaceae

   C. Major group

      1. Angiospermae

   D. Current alternative taxonomic treatment

      1. None

2. Present State Status

   A. Legal. None

   B. Advisory. Proposed by the Minnesota Natural Heritage Program as threatened in Minnesota.

3. Geographic Distribution and Site Descriptions

   A. Geographic range. This species is known to occur in Minnesota, Wisconsin, Michigan, New York, Vermont, New Hampshire & Maine. It also occurs in the Canadian Provinces of Manitoba, Ontario, Quebec, Newfoundland & Labrador. In Minnesota, it is known by herbarium specimens to have occurred in St Louis and Cook counties.

   B. Precise occurrences

      1. Populations currently or recently known extant

         1a. None.

      2. Populations known or assumed extirpated

         1a. None

      3. Historically known populations where current status is not known.

         1a. This population is known only by a herbarium specimen (MIN), labeled: "A small colony growing in mossy bank of Tischer Creek, below the dam at the Birches, between Hunters Hill and

Woodland Avenue, Duluth, Minn. July 4, 1945. Olga Lakela #6010." Although many of the descriptive terms used by Lakela are local terms that do not appear on maps, it appears that the collection site is located at: St Louis County, T150N R14W; SW1/4 NE1/4 section 11.

1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Duluth, 1953.

1c. This population has not been located since the date of the original collection (1945). The site was visited by Heritage staff members Welby Smith and Barbara Coffin on June 19, 1980, but no plants were found.

1d. The size of the population was described by Lakela as "small", and her description of the habitat was, "growing in mossy bank of Tischer Creek".

1e. Ownership of the site has not been positively determined, but it is believed to be owned by the city of Duluth.

1f. Because the site is located in an urban area, potential threats may include development, pollution and vandalism.

2a. This population is known only by a herbarium specimen (MIN), labeled, "Grand Marais, L.S. Cheney, July 23, 1891." Grand Marais is located at: Cook County, T61N R1E; sections 20 and 21. The relation of the town to the original collection site is unknown. It is known, however, that L. auriculata prefers habitats associated with small streams entering Lake Superior. There are four such streams (all unnamed) that enter Lake Superior within 2 miles of Grand Marais.

2b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Grand Marais, 1960.

2c. This population has not been located since the date of the original collection (1891). There has been no attempt by Heritage staff to relocate the population.

2d. The size and physical circumstances of the population represented by the Cheney specimen are not known.

2e. Ownership of the site cannot be determined without more accurate locational data.

2f. Threats to this population (if extant) cannot be assessed without further data.

3a. This population is known only by a herbarium specimen (MIN), labeled, "In very shady places, alder-Cornus swamp: west of post office at Grand Portage. C.O. Rosendahl #6026b, Aug 13, 1929." Grand Portage is located at: Cook County, T63N R6E; S1/2 section 4.

3b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Grand Portage, 1959.

3c. This population has not been located since the date of the original collection (1929). The site was visited by Heritage staff members Welby Smith and Barbara Coffin on June 20, 1980. At that time it was learned that the present post office was less than twenty years old. The precise location

of the old post office and, therefore, the location of the original collection site could not be determined. There are, however, several alder thickets in town, but most appear to be of recent origin. No specimens of L. auriculata were found.

3d. The size of the population represented by Rosendahl's collection is not known. The habitat was described on the specimen label as "In very shady places, alder-Cornus swamp."

3e. The most probable owner of the site is the Grand Portage Band (Indian), but this cannot be certain until the population is relocated.

3f. Threats to this population (if extant) cannot be assessed without further data.

4. General Environment and Habitat Description

Two of the three Minnesota collections have brief habitat descriptions on the labels. One is from a shady Alnus-Cornus swamp, and the other is from a mossy creek bank. All three of the collections are from moist sites very near the shore of Lake Superior. Although these descriptions are superficial, they do agree with observations in Wisconsin (Alverson 1981), where the species has been collected from alder thickets on wet sand beaches of Lake Superior. Similar observations on the preferred habitat of L. auriculata have been reported by Case (1964), Luer (1975), and Whiting and Catling (1977). Several of these descriptions include reference to acidic alluvium on the banks of streams or open "flats" associated with the streams. Further field work will be needed to accurately characterize the preferred habitat of this species in Minnesota.

5. Population Biology of Species

A. General summary of population biology

A general search of the literature has failed to locate any substantive data on the population biology of this species.

B. Demography

Nothing is known about the demography of this species in Minnesota.

6. Current Land Ownership Summary

Ownership is not known for any of the sites in Minnesota.

7. Evidence of Threats to Survival - Summary

Current or potential threats to any of the populations in Minnesota (if extant) cannot be assessed without additional occurrence information.

II. ASSESSMENT AND RECOMMENDATIONS

8. Recommended Status

Because of the extreme rarity of this species, and its apparently specific habitat requirements, I recommend a status of threatened for Listera auriculata in Minnesota.

9. Interested Parties

1. Barbara Coffin
Coordinator, Minnesota Natural Heritage Program
Box 7, Centennial Office Building
St Paul, MN 55155

III. INFORMATION SOURCES

10. Sources of Information

A. Publications

Alverson, W.S. 1981. Wisconsin's critical plant species. Bulletin of the Botanical Club of Wisconsin, 13(3):1-10.

Ayensu, E.S. 1975. Endangered and threatened orchids of the United States. American Orchid Society Bulletin, 44:384-399.

Case, F.W. 1964. Orchids of the western Great Lakes Region. Cranbrook Institute of Science, Bulletin No. 48. Bloomfield Hills, Mich. 147 pp.

Correll, D.S. 1950. Native orchids of North America north of Mexico. Cronica Botanica Company, Waltham, Mass. 399 pp.

Luer, C.A. 1975. The native orchids of the United States and Canada, New York Botanical Garden. 361 pp.

MacKenzie, H.N. and E.W. Greenwood. 1969. Range extensions of Listera auriculata Wiegand in Ontario and Quebec. Canadian Field-Naturalist, 83(1):55-56.

Whiting, R.E. and P.M. Catling. 1977. Distribution of the Auricled Twayblade orchid (Listera auriculata) in Canada and descriptions of new stations in southern Ontario. Canadian Field naturalist, 91:403-406.

B. Museum collections

1. Herbaria searched: University of Minnesota, St Paul
University of Minnesota, Duluth
University of Wisconsin, Madison
North Dakota State University, Fargo
St Cloud State University, St Cloud, MN
Winona State University, Winona, MN

C. Field Work

Field investigation was conducted on June 19-20, 1980 by Heritage staff members Welby Smith and Barbara Coffin. The Duluth site and the Grand Portage site were visited and data were recorded. All data collected during the course of this investigation were recorded on standardized survey forms and are on file in the office of Minnesota Natural Heritage Program.

D. Knowledgeable Individuals

1. Barbara Coffin
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   St Paul, MN 55155

IV. AUTHORSHIP

Welby R. Smith
Botanist, Minnesota Natural Heritage Program
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St Paul, MN 55155

STATUS REPORT

Taxon Name: *Platanthera flava* (L.) R.Br. var *herbiola* (Lindl.) Ames and Correll

Common Name: Tubercled rein-orchid

Family: Orchidaceae

Status Where Taxon Occurs: Minnesota, Wisconsin, Iowa, Missouri, Illinois, Indiana, Michigan, Ohio, Virginia, West Virginia, Tennessee, Kentucky, North Carolina, Pennsylvania, Maryland, Delaware, New York, Massachusetts, Connecticut, New Hampshire, Maine, New Jersey, Georgia, Vermont.

Author of This Report: Welby R. Smith

Date of This Report: December 1, 1981

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I. SPECIES INFORMATION

1. Classification and Nomenclature

   A. Species

      1. Platanthera flava (L.) R.Br. var herbiola (Lindl.) Ames and Correll.
      The typical variety of P. flava occurs in the southern United States and has never been recorded in Minnesota.

      2. Synonyms include:

      Habenaria herbiola R. Br.
      Orchis herbiola (R.Br.) Pursh
      Habenaria fuscescens (Wildenow) Torr.
      Orchis glareosa Rafin.
      Orchis fuscata Rafin.
      Platanthera herbiola (R.Br.) Lindl.
      Tulotis fuscescens (R.Br.) Rafin.
      Perularia virescens (Muhl.) A. Gray
      Platanthera fuscescens (Willdenow) Kranzlin
      Perularia flava Farwell
      Habenaria flava (L.) R.Br. var. virescens (Muhl.) Fern.
      Platanthera flava (L.) Lindl. var. herbiola (R.Br.) Luer.

      3. Common name is Tubercled rein-orchid.

   B. Family classification

      1. Orchidaceae

   C. Major group

      1. Angiospermae

   D. Current alternative taxonomic treatment

      1. None

2. Present State Status

   A. Legal. Under the jurisdiction of the Minnesota Wildflower Protection Law.

      Advisory. Proposed by the Minnesota Natural Heritage Program as being endangered in Minnesota.

3. Geographic Distribution and Site Descriptions

   A. Geographic range. Minnesota, Wisconsin, Iowa, Missouri, Illinois, Indiana, Michigan, Ohio, Virginia, West Virginia, Tennessee, Kentucky, North Carolina, Pennsylvania, Maryland, Delaware, New York,

Vermont, Massachusetts, Connecticut, New Hampshire, Maine, New Jersey, Georgia, Ontario, Quebec and Nova Scotia.

B. Precise occurrences

1. Populations currently or recently known extant

1a. None.

2. Populations known or assumed extirpated

1a. None.

3. Historically known populations where current status is not known

1a. This population is known only by a herbarium specimen (MIN) labeled, "Crow Wing County, Brainerd, Mn. July, 1892, Sheldon, E.P. #2682." Brainerd is located in portions of T133N, R28W. The exact location of this population has never been determined.
1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Merrifield, 1973; Series V872, Brainerd, 1973.
1c. This population has not been located since the date of the original collection (1892).
1d. The size and physical circumstances of the population are unknown.
1e. Ownership of the site cannot be determined without additional locational information.
1f. Threats to this population (if extant) cannot be assessed without additional information.

2a. This popultion is known only by a herbarium specimen (MIN) labeled, "Goodhue County, Zumbrota, Mn. July 13, 1892, A.L. Ballard. Zumbrota is located in portions of T110N, R16W and T110N, R15W. The exact location of this population has never been determined.
2b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Zumbrota, 1968.
2c. This population has not been located since the date of the original collection (1892).
2d. The size and physical circumstances of the population are unknown.
2e. Ownership of the site cannot be determined without additional locational information.
2f. Threats to this population (if extant) cannot be assessed without additional information.

3a. This population is known only by a herbarium specimen (MIN) labeled, "Washington County, Echo Lake, Mahtomedi, Mn. June

24, 1904, H.L. Lyon #852." Echo Lake is located at T30N R21W sections 17 and 18. The exact location of this population has never been determined.

3b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, White Bear Lake East, 1967.

3c. This population has not been located since the date of the original collection (1904).

3d. The size and physical circumstances of the population are unknown.

3e. Ownership of the site cannot be determined without additional locational information.

3f. Threats to this population (if extant) cannot be assessed without additional information.

4a. This population is known only by a herbarium specimen (MIN) labeled, "Fort Snelling Reservation, infrequent. Prairie, in moist depressions with Carex, Dryopteris, Onochea sensibilis. July 3, 1909. C.O. Rosendahl #2206." Fort Snelling was located in portions of Dakota, Hennepin and Ramsey counties. The exact location of this population has never been determined.

4b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, St. Paul West, 1972; Series V872, St. Paul SW, 1967.

4c. This population has not been located since the date of the original collection (1909).

4d. The size of the population is not known, but the label describes the species as "infrequent". The habitat is described as "moist depressions with Carex, Dryopteris, Onoclea sensibilis."

4e. The site was apparently owned by the federal government at the time of the original collection (1909). Current ownership cannot be determined because the reservation boundaries have changed (receded) and the exact location of the population is not known.

4f. Threats to this population (if extant) cannot be assessed without additional information.

5a. This population is known only by a herbarium specimen (MIN) labeled, "Hennepin County, Minneapolis, MN. July 1, 1884, Thos. S. Roberts." The city of Minneapolis (in 1884) was located at T117N, R24W. The exact location of this popultion has never been determined.

5b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Minneapolis South, 1967.

5c. This population has not been located since the date of the original collection (1884).

5d. The size and physical circumstances of the population are not known.

5e. Ownership of the site cannot be determined without additional locational information.
5f. Threats to this population (if extant) cannot be assessed without additional information.

6a. This population is known only by a herbarium specimen (MIN) labeled, "Wet places, near Minneapolis. June 1892, F.H. Burglehaus." Depending on the interpretation of the label data, the site could be anywhere in Hennepin, Ramsey, or Dakota counties. The exact location has never been determined.
6b. It is not known which U.S. Geological Survey quadrangle map the site occurs on.
6c. This population has not been located since the date of the original collection (1892).
6d. The size and physical circumstances of the population are unknown.
6e. Ownership of the site cannot be determined without additional locational information.
6f. Threats to this population (if extant) cannot be assessed without additional information.

7a. This population is known only by a herbarium specimen (MIN) labeled, "Chisago County, Center City. June 1892, B.G. Taylor #1342." Center City is located at T34N, R20W; sections 35 and 34. The exact location of this population has never been determined.
7b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Lindstrom, 1974.
7c. This population has not been located since the date of the original collection (1892).
7d. The size and physical circumstances of the population are unknown.
7e. Ownership of the site cannot be determined without additional locational information.
7f. Threats to the survival of this population (if extant) cannot be assessed without additional information.

8a. This population is known only by a herbarium specimen (MIN) labeled, "Wabasha County, near Lake City. June 26, 1884, Sara M. Manning." Lake City is located at T111N, R12W; sections 4 and 5. The exact location of this popultion has never been determined.
8b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Lake City, 1974.
8c. This population has not been located since the date of the original collection (1884).
8d. The size and physical circumstances of the population are unknown.

8e. Ownership of the site cannot be determined without additional locational information.
8f. Threats to this population (if extant) cannot be assessed without additional information.

4. General Environment and Habitat Description

Essentially nothing is known about the habitat of this species in Minnesota. Only one of the eight historically known populations has any description of the habitat. This description comes from a herbarium label (MIN; Rosendahl #2206) and reads, "Prairie, in moist depressions with Carex, Dryopteris, Onoclea sensibilis." This description is similar to that given for this species in Iowa (Lammers and Van Der Valk 1978). Most sources, however, indicate that P. flava var. herbiola prefers moist, sandy, acidic habitats (Roosa and Eilers 1978; Hartley 1966; Alverson 1981).

5. Population Biology of Species

A. General summary of population biology

A general search of the literature has failed to locate any substantive data on the population biology of this species.

B. Demography

Nothing is known about the demography of this species in Minnesota.

6. Current Land Ownership Summary

Ownership is not known for any of the sites in Minnesota.

7. Evidence of Threats to Survival - Summary

Current or potential threats to any of the populations in Minnesota (if extant) cannot be assessed without additional occurrence information.

II. ASSESSMENT AND RECOMMENDATIONS

8. Recommended Status

Because of its extreme rarity, and the apparent decline in its populations, I recommend a status of threatened for Platanthera flava var. herbiola in Minnesota.

9. Interested Parties

1. Barbara Coffin
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St. Paul, MN 55155

III. INFORMATION SOURCES

10. Sources of Information

A. Publications

Alverson, W.S. 1981. Wisconsin's critical plant species. Bulletin of the Botanical Club of Wisconsin, 13(3):1-10.

Ayensu, E.S. 1975. Endangered and threatened orchids of the United States. American Orchid Society Bulletin, 44:384-399.

Case, F.W. 1964. Orchids of the western Great Lakes Region. Cranbrook Institute of Science, Bulletin No. 48. Bloomfield Hills, Mich. 147 pp.

Correll, D.S. 1950. Native orchids of North America north of Mexico. Cronica Botanica Company, Waltham, Mass. 399 pp.

Fuller, A.M. 1933. Studies on the flora of Wisconsin, Part 1: The orchids; Orchidaceae. Bulletin of the Public Museum of the City of Milwaukee 14(1):1-284.

Hartley, T.G. 1966. The flora of the "Driftless Area". University of Iowa Press, Iowa City.

Lammers, T.C. and A.G. Van Der Valk. 1978. A checklist of the aquatic and wetland vascular plants of Iowa. Proc. Iowa Acad. Sci. 85; 121-143.

Luer, C.A. 1975. The native orchids of the United States and Canada, New York Botanical Garden. 361pp.

Roosa, D.M. and L.J. Eilers. 1978. Endangered and threatened Iowa vascular plants. Special Report No. 5. State Preserves Advisory Board.

B. Museum collections

1. Herbaria searched: University of Minnesota, St. Paul
University of Minnesota, Duluth
University of Wisconsin, Madison
North Dakota State University, Fargo
St. Cloud State University, St. Cloud, MN
Winona State University, Winona, MN

C. Field work

None of the historically known populations have locational information precise enough to direct a search effort. For this reason, the Minnesota Natural Heritage Program did not conduct any field work in connection with this species.

D. Knowledgeable individuals

1. None

IV. AUTHORSHIP

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Department of Natural Resources
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STATUS REPORT

Taxon Name: Platanthera leucophaea (Nutt.) Lindl.

Common Name: Prairie white fringed orchis

Family: Orchidaceae

State Where Taxon Occurs: Minnesota, North Dakota, South Dakota, Nebraska, Iowa, Kansas, Oklahoma, Missouri, Arkansas, Louisiana, Wisconsin, Illinois, Indiana, Illinois, Michigan, Ohio, New York, Maine.

Author of This Report: Welby R. Smith

Date of This Report: November 4, 1981

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3f. Threats to the survival of this population (if extant) cannot be assessed without further data.

4a. Freeborn County. This population is known only by a herbarium specimen (MIN), labeled, "Fairly abundant. Meadow between U.S. 16 and Milwaukee RR right-of-way. 10 miles east of Albert Lea. C.O. Rosendahl, F.K. Butters, R.A. Phillips #7277. July 21, 1939." This description would locate the site in Freeborn County at T102N R19W section 6.

4b. U.S. Geological Survey 15 minute quadrangle map; Series V772, Hayward, 1954.

4c. This population has not been located since the date of the original collection (1939). This site was visited by Welby Smith on July 18, 1980 but no plants were found. Approximately 3 miles of right-of-way was searched, much of which appeared to be suitable habitat. It is possible that the population persists but was overlooked.

4d. The plants were described on the specimen label as, "fairly abundant" and the habitat was described as a "meadow". This population is believed to be native.

4e. This site is believed to be owned by the Milwaukee Road Railroad Company.

4f. Threats to the survival of this population (if extant) cannot be assessed without further data.

5a. Dakota County. This population is known only by a herbarium specimen (MIN), labeled, "In swale, Snelling Reservation, rare, Koellaria, Zizia, Poa. Prairie. C.O. Rosendahl #2308. July 19, 1909." The Fort Snelling Reservation is currently limited to a small area in Hennepin County. It formerly covered a larger area of Hennepin County as well as portions of Ramsey and Dakota counties. Most of the native vegetation which persists within the old reservation boundaries is in what is now Fort Snelling State Park (outside the current boundaries of the reservation). The park is located in Dakota County at T27N R23W, sections 4,5 and 8; T28N R23W sections 33 and 28.

5b. U.S. Geological Survey 7.5 minute quadrangle maps; Series V872, St. Paul West, 1967 and Series V872, St. Paul SW, 1967.

5c. This population has not been located since the date of the original collection (1909).

5d. According to the information on the specimen label, this species was rare at this site, and the habitat was prairie (swale).

5e. If this population occurs in the state park (this has not been determined) the owner would be the DNR, Division of Parks and Recreation. With the information available, however, current ownership cannot be positively determined.

5f. Threats to the survival of this population (if extant) cannot be determined without further data.

6a. Houston County. This population is known only by a herbarium specimen (MIN), labeled, "Houston County, Crooked Creek, W.A. Wheeler #299, July 7, 1899". The entry in Wheeler's collection book for #299 contains the following notation, "Hay meadow infrequent. along railroad tracks sections 15 and 16 of Crooked Creek." Thee are currently no railroad tracks in sections 15 or 16 of Crooked Creek Township.

6b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Brownsville, 1980.

6c. This population has not been located since the date of the original collection (1899).

6d. Based on the description in Wheeler's collection book, this species was infrequent at this site and occurred in a hay meadow.

6e. Current ownership of this site cannot be determined without additional locational information.

6f. Threats to the survival of this population (if extant) cannot be assessed without further data.

7a. Goodhue County. This population is known only by a herbarium specimen (MIN), labeled, "Cannon Falls, J.H. Sandberg, August 1881." The town of Cannon Falls is located in Goodhue County at T112N R17W, sections 7 and 8. The exact relation of Cannon Falls to the original collection site is not known.

7b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Cannon Falls, 1974.

7c. This population has not been located since the date of the original collection (1881).

7d. The size and physical circumstances of this population are not known. This population is believed to be native.

7e. Ownership of this site cannot be determined without additional locational information.

7f. Threats to the survival of this population (if extant) cannot be assessed without further data.

8a. Nicollet County. There are three herbarium specimens (MIN) of this species from Nicollet County, but none have any locational information. The specimen labels read as follows, "Nicollet County. C.A. Ballard #1067, July 1893"; "Nicollet County. Moist prairie, July 1878" (collector unknown); "Nicollet County. John Leiberg, July 1883." The locations of these collection sites are unknown.

8b. It is not known which U.S. Geological Survey quadrangle maps these sites occur on.
8c. These populations have not been located since the dates of the original collections (1878, 1893, 1883).
8d. The size and physical circumstances of these populations are not known.
8e. The current ownership of these sites cannot be determined without additional locational information.
8f. Threats to the survival of these populations (if extant) cannot be assessed without further data.

9a. Douglas County. This population is known only by a herbarium specimen (MIN), labeled, "Alexandria, C.L. Herrick, July 1878." The city of Alexandria is located in Douglas County at T128N R37W, sections 19, 20 and 30. The exact relation of Alexandria to the original collection site is not known.
9b. U.S. Gelogical Survey 7.5 minute quadrangle maps; Series V872, Forada, 1966; Series V872, Lake Mary, 1966; Series V872, Alexandria West, 1966; Series V872, Alexandria East, 1966.
9c. This population has not been located since the date of the original collection (1878).
9d. The size and physical circumstances of this population are not known.
9e. Ownership of this site cannot be determined without additional locational information.
9f. Threats to the survival of this population (if extant) cannot be assessed without further data.

4. General Environment and Habitat Description

Of the six populations known to be extant in Minnesota, we have specific observations of three of them. Two of the three are located in Polk County in the northwest, and are mesic prairies with low meandering swales. P. leucophaea occurs in these swales in association with such species as Spartina pectinata, Triglochin maritima, Asclepias incarnata and Cicuta maculata. The third population is in Mower County in the southeast, and is a wet prairie habitat in a roadside area. The origin of this habitat is uncertain. It may be a remnant of the original prairie or it may be a recent revegetation of native flora on previously disturbed soil. Associated species include Spartina pectinata, Gentiana flavida, Spiranthes cernua, Carex conoidea and Carex annectins.

There is sufficient evidence to say that all 15 popultions (extant, extinct and unknown) inhabit similar prairie environments. There is no indication that P. leucophaea has ever been collected from a bog, swamp or marsh in Minnesota.

5f. Threats to the survival of this population (if extant) cannot be determined without further data.

6a. Houston County. This population is known only by a herbarium specimen (MIN), labeled, "Houston County, Crooked Creek, W.A. Wheeler #299, July 7, 1899". The entry in Wheeler's collection book for #299 contains the following notation, "Hay meadow infrequent. along railroad tracks sections 15 and 16 of Crooked Creek." Thee are currently no railroad tracks in sections 15 or 16 of Crooked Creek Township.
6b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Brownsville, 1980.
6c. This population has not been located since the date of the original collection (1899).
6d. Based on the description in Wheeler's collection book, this species was infrequent at this site and occurred in a hay meadow.
6e. Current ownership of this site cannot be determined without additional locational information.
6f. Threats to the survival of this population (if extant) cannot be assessed without further data.

7a. Goodhue County. This population is known only by a herbarium specimen (MIN), labeled, "Cannon Falls, J.H. Sandberg, August 1881." The town of Cannon Falls is located in Goodhue County at T112N R17W, sections 7 and 8. The exact relation of Cannon Falls to the original collection site is not known.
7b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Cannon Falls, 1974.
7c. This population has not been located since the date of the original collection (1881).
7d. The size and physical circumstances of this population are not known. This population is believed to be native.
7e. Ownership of this site cannot be determined without additional locational information.
7f. Threats to the survival of this population (if extant) cannot be assessed without further data.

8a. Nicollet County. There are three herbarium specimens (MIN) of this species from Nicollet County, but none have any locational information. The specimen labels read as follows, "Nicollet County. C.A. Ballard #1067, July 1893"; "Nicollet County. Moist prairie, July 1878" (collector unknown); "Nicollet County. John Leiberg, July 1883." The locations of these collection sites are unknown.

8b. It is not known which U.S. Geological Survey quadrangle maps these sites occur on.
8c. These populations have not been located since the dates of the original collections (1878, 1893, 1883).
8d. The size and physical circumstances of these populations are not known.
8e. The current ownership of these sites cannot be determined without additional locational information.
8f. Threats to the survival of these populations (if extant) cannot be assessed without further data.

9a. Douglas County. This population is known only by a herbarium specimen (MIN), labeled, "Alexandria, C.L. Herrick, July 1878." The city of Alexandria is located in Douglas County at T128N R37W, sections 19, 20 and 30. The exact relation of Alexandria to the original collection site is not known.
9b. U.S. Gelogical Survey 7.5 minute quadrangle maps; Series V872, Forada, 1966; Series V872, Lake Mary, 1966; Series V872, Alexandria West, 1966; Series V872, Alexandria East, 1966.
9c. This population has not been located since the date of the original collection (1878).
9d. The size and physical circumstances of this population are not known.
9e. Ownership of this site cannot be determined without additional locational information.
9f. Threats to the survival of this population (if extant) cannot be assessed without further data.

4. General Environment and Habitat Description

Of the six populations known to be extant in Minnesota, we have specific observations of three of them. Two of the three are located in Polk County in the northwest, and are mesic prairies with low meandering swales. P. leucophaea occurs in these swales in association with such species as Spartina pectinata, Triglochin maritima, Asclepias incarnata and Cicuta maculata. The third population is in Mower County in the southeast, and is a wet prairie habitat in a roadside area. The origin of this habitat is uncertain. It may be a remnant of the original prairie or it may be a recent revegetation of native flora on previously disturbed soil. Associated species include Spartina pectinata, Gentiana flavida, Spiranthes cernua, Carex conoidea and Carex annectins.

There is sufficient evidence to say that all 15 popultions (extant, extinct and unknown) inhabit similar prairie environments. There is no indication that P. leucophaea has ever been collected from a bog, swamp or marsh in Minnesota.

5. Population Biology of Species

A. General summary of population biology

Flowering plants release a fragrance at twilight which attracts species of sphinx moths which act as pollinators (Cass 1964). Individuals of this species are long lived and reproduce primarily by vegetative means. Vegetative growth may be stimulated by fire, and the long-term absence of fire may have deleterious effects on populations.

B. Demography

Very little is known about the demography of this species in Minnesota. In a remnant population in Polk County, 370 plants were counted in an 80 acre prairie. It is not known, however, how these plants were distributed. It is believed that some of the extant popultions number several hundred individuals and perhaps more than a thousand. Unfortunately, there is no statistical census to confirm this.

6. Current Land Ownership Summary

Of the six extant popultions known in Minnesota, one is privately owned by a resident farmer; two are owned by the Minnesota Chapter of The Nature Conservancy; one is leased by TNC; one is owned separately by the Minnesota Department of Transportation and the Milwaukee Road Company; and ownership of one is not known.

7. Evidence of Threats to Survival - Summary

A. Present or threatened destruction, modification, or curtailment of habitat or range

1. The population in Clay County is potentially threatened with mining of gravel deposits on which the population occurs.

2. The population in Polk County that is owned by Vernon Floan is immediately threatened with habitat destruction. The land owner has expressed his desire to convert the site to agricultural uses.

3. The site in Mower County is currently threatened because of its proximity to the adjacent highway. Normal road maintenance work such as salting the road surface as well as spraying and mowing the ditches presents an immediate threat to its survival.

B. Overutilization for commercial, sporting, scientific, or educational purposes

1. The population in Mower County has been severely depleted by illegal removal of plants, presumably for personal or commercial use, by unknown persons. This threat to its survival is expected to continue.

II. ASSESSMENT AND RECOMMENDATIONS

8. Recommended Status

Because of its extreme rarity and the increasing destruction of its habitat, I recommend a status of threatened for Platanthera leucophaea in Minnesota, and throughout its range.

9. Recommended Critical Habitat

Because of the publicity-sensitive nature of this species, critical habitat cannot be recommended. Past events have proven that public knowledge of the precise location of populations of P. leucophaea may lead to damage or destruction of such populations.

10. Interested Parties

1. Geoffrey Barnard
The Nature Conservancy
328 E. Hennepin Ave.
Minneapolis, MN 55414

2. Lawrence Foote
Department of Transportation
Office of Environmental Affairs
John Ireland Blvd.
St. Paul, MN 55155

3. Kathryn E. Bolin
Region V Resource Coordinator
Department of Natural Resources
Rochester, MN

4. Barbara Coffin
Coordinator, Minnesota Natural Heritage Program
Department of Natural Resources
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St. Paul, MN 55155

III. INFORMATION SOURCES

11. Sources of Information

A. Publications

Ayensu, E.S. 1975. Endangered and threatened orchids of the United States. American Orchid Society Bulletin, 44:384-399.

Case, F.W. 1964. Orchids of the Western Great Lakes Region. Cranbrook Institute of Science Bulletin Number 48. Bloomfield Hills, Mich. 147pp.

Correll, D.S. 1950. Native orchids of North America north of Mexico. Cronica Botanica Company, Waltham, Mass. 399pp.

Luer, Carlyle, A. 1975. The native orchids of the United States and Canada. The New York Botanical Garden, New York, NY. 361 pp.

B. Museum collections

1. Herbaria searched:
   University of Minnesota, St. Paul
   University of Minnesota, Duluth
   University of North Dakota, Fargo
   University of Wisconsin, Madison
   St. Cloud State University, St. Cloud, MN
   Winona State University, Winona, MN

C. Field work

Field investigation was conducted by Heritage staff botanist Welby Smith between July 18 and July 23, 1980. All field data collected during the course of this investigation were recorded on standardized survey forms and are on file in the office of the Minnesota Natural Heritage Program.

D. Knowledgeable individuals

1. Dr. Dan Svedarsky
   Agriculture Division
   University of Minnesota
   Crookston, MN 56716

2. Dr. Thomas Morley
   Department of Botany
   University of Minnesota
   St. Paul, MN 55108

3. Dr. G.B. Ownbey
   Department of Botany
   University of Minnesota
   St. Paul, MN 55108

IV. AUTHORSHIP

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STATUS REPORT

Taxon Name: *Sullivantia renifolia* Rosendahl

Common Name: None

Family: Saxifragaceae

States Where Taxon Occurs: Minnesota, Wisconsin, Illinois, Iowa, Missouri.

Author of This Report: Welby R. Smith

Date of This Report: October 15, 1981.

TABLE OF CONTENTS

I. SPECIES INFORMATION

1. Classification and Nomenclature

   A. Species
      1. Sullivantia renifolia Rosendahl
      2. There are no currently used synonyms for the taxon
      3. No common names are known for this taxon.

   B. Family Classification
      1. Saxifragaceae

   C. Major group
      1. Angiospermae

   D. Current alternative taxonomic treatment
      1. Preliminary reports from unpublished research indicates that this species may be combined with Sullivantia sullivantii (T. & G.) Britton. The future of this taxonomic treatment will depend on the acceptance of revisionary work being done by D.E. Soltis of Indiana University.

2. Present State Status

   A. Legal
      1. None

   B. Advisory
      1. Proposed by the Minnesota Natural Heritage Program as threatened in Minnesota.

3. Geographic Distribution and Site Descriptions

   A. Geographic range. This taxon is known to occur in NE Iowa, SW Wisconsin, SE Minnesota, NW Illinois and NE Missouri. In Minnesota it is known to occur in Houston, Fillmore and Winona counties. There is no historical evidence to indicate that its range in Minnesota may have been larger in recent times.

   B. Precise Occurrences

      1. Populations currently or recently known extant

         1a. Houston County. T101N R6W; N1/2 SE1/4 section 32. About 1/4 mile northwest of Bee, along the southwest bend of Bee Creek.
         1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Wilmington, 1965.
         1c. Specimen was collected by Heritage staff members Henry Woolsey and George-Ann Maxson on June 19, 1980.

1d. Approximately 60 plants were counted on a northeast-facing dolomite cliff overlooking Bee Creek. The plants occupied an area on the cliff face about 10 feet high by 13 feet wide. This is believed to be a naturally occurring population.
1e. This site is privately owned.
1f. There are no known threats to this population.

2a. Winona County. T106N R5W; S1/2 SW1/4 section 22. On the north face of King's Bluff.
2b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Pickwick, 1973.
2c. Specimen was collected by Heritage staff members Henry Woolsey and George-Ann Maxson on June 19, 1980.
2d. More than 150 plants were counted on a northeast-facing calcareous sandstone cliff face. The plants were scattered along 75 feet of overhanging ledge. This is believed to be a naturally occurring population.
2e. This site is a private inholding within O.L. Kipp State Park. The landowner's name is Mr. Cone, but his address is unknown.
2f. There are no known threats to this population

3a. Winona County. T106N R5W; SE1/4 NE1/4 NE1/4 section 27. On the north face of Queen's Bluff.
3b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Pickwick, 1973.
3c. A specimen was collected by Dr. G.B. Ownbey #6250 in 1979. The site was revisited on June 18, 1980 by Heritage staff members Henry Woolsey and George-Ann Maxson.
3d. About 35 plants were counted on a northeast-facing, non-calcareous sandstone cliff face, in an area 10 feet high and 30 feet wide. The plants occurred in the shade of an overhanging ledge. This is believed to be a naturally occurring population.
3e. This site is in O.L. Kipp State Park, and is owned and managed by the Division of Parks and Recreation, Minnesota DNR.
3f. There is a potential threat to this population from the overuse of the recreational potential of this portion of the park.

2. Populations known or assumed extirpated

1a. None

3. Historically known populations where current status is not known

1a. Fillmore County - The only record of S. renifolia occurring in this county is a herbarium specimen (MIN) collected by Mrs. Jessie McIntire, dated June 1920 and labeled "Root River Valley, near Amherst". The town of Amherst (pop. 40) is located in T102N R9W section 27. The exact location of the original collection has not been determined.

1b. U.S. Geological Survey 7.5 minute quadrangle map; Series V872, Canton, 1965.
1c. The collection by Mrs. McIntire is the only report on the occurrence of this population.
1d. The size and physical circumstance of this population are unknown.
1e. Ownership of the site is unknown.
1f. Threats to this population cannot be assessed.

4. General Environment and Habitat Description

All three verified populations of Sullivantia renifolia in Minnesota occur on northeast-facing cliffs of calcareous or neutral sedimentary rock. In every case, the plants are protected by an overhanging ledge, and kept cool by seeping water. This micro-habitat is usually shared with mosses, liverworts and vascular plants such as Cyptopteris bulbifera, Dodecatheon radicatum, Cryptogramma stelleri, Pellaea glabella and Mitella diphylla. The populations in Minnesota are entirely limited to the non-glaciated portion of the state.

5. Population Biology of the Species

A. General summary of population biology. A general literature search has failed to locate any significant published material pertaining to the population biology of this species.

B. Demography

The exact number of plants occurring at each verified site and the physical descriptions of the sites are detailed in the section of precise occurrences. To summarize those data, there are approximately 245 plants occurring in three distinct populations, occupying a total area of about 1200 square feet of cliff face. The plants occur as individuals separated by 6 to 12 inches, or occasionally appear to grow in clumps of a few to several individuals. There is, in addition, a fourth un-verified populations of unknown size.

6. Current Land Ownership Summary

Two of the three verified populations occur within O.L. Kipp State Park. One of these populations is on land owned and managed by the Division of Parks and Recreation, Minnesota DNR. The other is on land privately owned, but within the statutory boundaries of the park. The third verified population is on private land, and land ownerhsip of the only un-verified population is not know.

7. Evidence of Threats to Survival - Summary

A. Overutilization for commerical, sporting, scientific or educational purposes.

1. The population occurring on public land in O.L. Kipp State Park may potentially be affected by normal park activities. Although its location on a cliff face protects it from most direct impact, the eventual construction of a road or path above the cliff may cause erosion and run-off problems that could effect the population.

II. ASSESSMENT AND RECOMMENDATIONS

8. Recommended Status

Because this species is largely restricted to the "driftless area", its range of potential occurrence is very limited. Furthermore, this area has been intensely botanized and it seems unlikely that many new locations will be found (in Minnesota at least). For these reasons I recommend that Sullivantia renifolia be given the status of threatened in Minnesota.

9. Interested Parties

1. Dr. Gastony
   Department of Biology
   Indiana University
   Bloomington, Indiana 47401

2. Mr. Douglas Soltis
   Department of Biology
   Indiana University
   Bloomington, Indiana 47401

3. Dr. G. B. Ownbey
   Department of Botany
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4. Dr. Tom Morley
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5. Barbara Coffin
   Coordinator, Minnesota Natural Heritage Program
   Section of Wildlife, Department of Natural Resources
   Box 7, Centennial Office Building
   St. Paul, MN 55155

III. INFORMATION SOURCES

10. Sources of Information

A. Publications

Fernald, M.L. 1950. Grays Manual of Botany. eighth edition. D. Van Nostrand Company.

Morley, T. 1969. Spring Flora of Minnesota. The University of Minnesota Press, Minneapolis.

Read, Robert H. 1976. Endangered and threatened vascular plants in Wisconsin. Technical Bulletin No. 92. Scientific Areas Preservation Council. DNR, Madison, Wisconsin.

Roosa, D. M. and L.J. Eilers. 1978. Endangered and threatened Iowa vascular plants. Special Report No. 5. State Preserves Advisory Board. Des Moines, Iowa

Rosendahl, C. O. 1927. A revision of the genus Sullivantia. Minnesota Studies in Biological Sciences, #6.

B. Museum Collections

1. Herbaria searched: University of Minnesota, St. Paul
University of Minnesota, Duluth
University of Wisconsin, Madison
St. Cloud State University, St. Cloud, MN
North Dakota State University, Fargo
Winona State University, Winona, MN

2. Hebaria where Minnesota specimens of Sullivantia renifolia are known to be on deposit:

University of California
Berkley, California

Oregon State University
Corvallis, Oregon 97331

Oberlin College
Oberlin, Ohio 44074

University of Illinois
Bloomington, Indiana 47401

U.S. National Herbarium
Smithsonian Institution
Washington, D.C.

University of Minnesota
St. Paul, MN 55108

C. Field Work

Field verification was conducted by Heritage staff members Henry Woolsey and George-Ann Maxson on June 18 & 19, 1981. Three of the four historically known populations were rediscovered during this time. The fourth population was not included in the search because the locational information was insufficient to insure a reasonable chance of rediscovery.

Specimens were collected at King's Bluff and Bee Creek, and later deposited in the herbarium of the University of Minnesota, St. Paul. A specimen from Queen's Bluff had been vouchered the previous year by Dr. G. B. Ownbey and is also in the herbarium of the University of Minnesota.

All field data collected by Heritage staff were recorded on standardized survey forms and are on file in the office of the Minnesota Natural Heritage Program.

D. Knowledgeable individuals

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