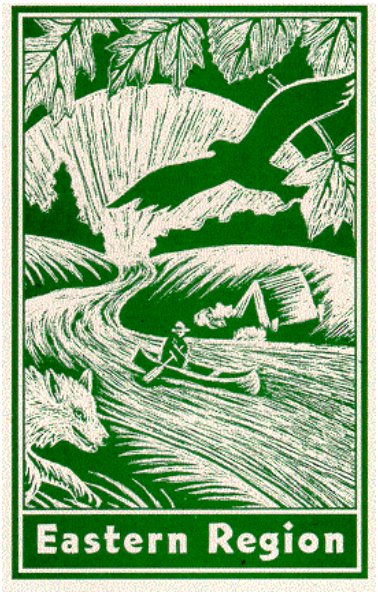
Conservation Assessment
For
Pitcher's Stitchwort (Minuartia patula) *(Michx.) Mattf.*



USDA Forest Service, Eastern Region
2003

This Conservation Assessment was prepared to compile the published and unpublished information and serves as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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NOMENCLATURE AND TAXONOMY

Scientific Name: Minuartia patula (Michx.) Mattf.

Common Name: Pitcher's stitchwort

Family: Caryophyllaceae

Synonyms: Arenaria patula Michx., Sabulina patula (Michx.) Small

USFS Region 9 Status: Sensitive Species

USFW Status: None

Illinois Status: Threatened Species

Global And State Rank: G4

RANGE

This species can be found in east Kansas, south and east Oklahoma, Virginia to Indiana and Minnesota, and south to Alabama and Texas (Gleason and Cronquist, 1991; Larson, 1986) (figure 1). In Illinois, this species can be found in seven counties: Cook, DuPage, Grundy, Kankakee, Kendall, St. Clair, and Will (figure 2).

PHYSIOGRAPHIC DISTRIBUTION

Minuartia patula can be found in the Southwestern Great Lakes Moraines Section and Ozark Highlands Section of the Eastern Broadleaf Forest Continental Province and Central Till Plains Section of the Prairie Parkland Temperate Province (Key et al., 1995). Based upon the Natural Divisions of Illinois (Schwegman et al., 1973), Minuartia patula can be found at the Northeastern Morainal Division, Grand Prairie Division, and Ozark Division (Eric Ulaszek per. comm.).

HABITAT

This species can be found in barrens, limestone glades, and bluffs (limestone cliff) in very shallow soils (i.e. beds or pavements of limestone near the surface of the ground). In the eastern portions of its range (KY-TN), it is restricted to limestone soils, but in the it Ozarks can be found on several substrates (e.g. limestone, sandstone, and granite soils) (Ware, 1990). Plants associated with Minuartia patula are: Androsace occidentalis, Asclepias verticillata, Dalea foliosa, Deschampsia caespitosa, Draba reptans, Eleocharis compressa, Geranium carolinianum, Isanthus brachiatus, Lithospermum incisum, Malvastrum hispidum, Opuntia humifusa, Penstemon hirsutus, Satureja arkansana, Scutellaria parvula, and Verbena simplex (Swink and Wilhelm, 1994).

SPECIES DESCRIPTION

Delicate taprooted annual (5-20 cm tall) with few to many branches from the base and slender stem. Opposite leaves, mostly cauline, linear with entire margin, and pinnate venation. Numerous white flowers in a bracteate cyme. Fruit a 3-valved capsule with very small dark brown seeds (Gleason and Cronquist, 1991; Larson, 1986). This species can be confused with Minuartia stricta (e.g. inflorescence).

LIFE HISTORY

The seedlings of this annual species produce rosettes in the fall and bolt the following spring forming bushy plants (less than 30 cm height) which bloom from spring to early summer (April to July) (Caiazza and Quinn, 1980; Larson, 1986; Swink and Wilhelm, 1994). No information regarding the reproductive biology of Minuartia patula, including breeding system or pollinators is available. However, based upon other members of the genus Minuartia, this species may have the following reproductive characteristics: 1) self-compatible with protandry (Fishman and Wyatt, 1999); 2) plants at a giving site may flower synchronously because in granite outcrops or dolomite prairies the growing season is limited to a few months by low water availability; and 3) pollinators are generalists (small bees, and flies) (Fishman and Wyatt, 1999). Steven R. Hill (per. comm.) also suggests that ants can be potential pollinators for the species.

The population size of this species appears to fluctuate depending upon location, vegetation encroachment, and age of the cedar glade. In a study by Picklesimer (see Baskin and Baskin, 1996) on the vegetation of cedar glades in the Central Basin of Tennessee, an abundance of 13,122 plants in open glades and 497 plants in glade woods was found. Reviews by Baskin and Baskin (1996) of other studies, suggest that as the cedar glade woods get older the frequency and cover of Minuartia patula will be less than 30%. Also, in a study on the Weches outcrops in eastern Texas, it was found that Minuartia patula had a frequency of 42.2% (relative frequency 4.20%), density of 26.42 (inv/m^2) (relative density 9.70), and an importance value of 13.90 (George and Nixon, 1990). This suggests that sometimes the species may be very abundant.

In a study by Caudle and Baskin (1968), freshly harvested seed germinated at low temperatures (10 and 15 °C). However, they were dormant at high temperature (20-30 °C). This high temperature dormancy can be broken as time of storage increases (five months). Also, maximum seed germination occurred at these high temperatures.

Minuartia patula has capsules for fruit. It is possible that as the capsules split the minute seeds will be dispersed away by wind, possibly a few cm from the maternal plant. Steven R. Hill (per. comm.) suggested that ants may be a potential seed dispersal vector.

NATURAL AND HUMAN LAND USE THREATS

Because Minuartia patula is considered a conservative species (Swink and Wilhelm, 1994) highly associated with limestone and dolomite prairies, concern regarding the decline of this species in the region is evident. The main threat to this species is the loss of habitat as a consequence of development, agriculture, and grazing. These activities can increase nutrient levels (e.g. fertilizers or cow/horse manure) in the soil increasing the potential for invasive species to out compete Minuartia patula or create a siltation problem. Also, changes in the hydrology of the site and vegetation encroachment may affect the species.

VIABILITY

To maintain minimum viable populations of Minuartia patula throughout its habitat range, protection, management, and restoration of habitat should be provided as much as possible. A minimum viable population is defined as a population size likely to give a population a 95% probability of surviving over a 100 year period (Menges, 1992). To insure viability:

1. It is vital that the size of the existing populations of Minuartia patula be maintained or increased to insure the persistence of this species in the region. Also, it is necessary that local seed sources are available for future reintroductions of the species to other areas. The only way to accomplish such a task is by protecting the already existing seed sources (i.e. populations) available in the region.

2. The creation and maintenance of a metapopulation for Minuartia patula is crucial for the persistence of the species in the region. A metapopulation is as an assemblage of populations existing in a balance between extinction and colonization, the boundaries of which can be a site or a geographical region (Husband and Barrett, 1996; Levins 1969, 1970). The populations that will form this metapopulation should be large because they can have a better opportunity of persistence than small populations (Hanski et al., 1996). Hanski et al. (1996) have suggested, based upon models, that a metapopulation should consist of a minimum of 15-20 well connected populations. However, Hanski et al. (1996) point out that if this cannot be achieved, the few remaining populations and habitats should be protected and other management techniques should be used to allow the persistence of these populations. Also, based upon models, populations should be >200 individuals to avoid demographical and environmental stochasticity (Menges, 1992). This number can be higher or lower depending upon the species.

The existing population of Minuartia patula in the region potentially can go extinct as a consequence of low recruitment in several drought years, low seed production, or depletion of the seed bank. By developing several populations (i.e. metapopulation) this situation may be prevented. Also, by having a metapopulation, other interactions that will impact the overall viability of Minuartia patula in the region, such as pollinator interactions, genetic structure, gene flow within and between populations, and seed dispersal, can be maintained.

3. Protection of existing and newly discovered populations in the region should be attempted. Protection of these populations also implies protection of their habitat.

MANAGEMENT

To maintain minimum viable populations of Minuartia patula throughout its habitat range, specific management practices will be needed to insure the persistence of the species.

To maintain and increase the existing populations of Minuartia patula, specific practices should be followed:

a. **Management practices such as prescribed burns, minimum grazing, mowing, and removal of vegetation** (e.g. woody, noxious weeds, etc.) should be used to avoid encroachment in existing habitat. These management practices should be conducted during the early spring or fall to avoid any impact on the reproduction of the species. The use of an Integrated Pest Management Plan such as the one developed by Carroll and White (1997) can be used to control exotic species in these areas.

b. **Tiles should not be broken** to prevent changes in the hydrology of the site (existing habitat) that may impair reproduction, recruitment, and establishment of individuals.

c. **Activities that increase** the likelihood of noxious weed introduction or cause trampling (e.g. humans or animals) of the plants should be avoided or minimized.

d. **Development of trails** in areas where Minuartia patula is found should be avoided or minimized to prevent negative impacts to the populations.

e. **Collection of Minuartia patula** should only be allowed for scientific reasons and only by permit.

To develop and maintain a metapopulation of Minuartia patula, attempts should be made to restore or reintroduce this species in areas that were historically dolomite. This includes the improvement of areas that have dolomite prairie and the reconstruction of areas that have lost the dolomite prairie plant matrix. Part of this restoration and reconstruction should include the reintroduction of Minuartia patula in the appropriate habitat. Potential habitat that can be used are sites that have soils found in dolomite prairies. The following is a list of soils found in dolomite prairies (Laatsch and Loebach, 1997; Eric Ulaszek per. comm.). Priority should be given to Romeo silt loam (soil depth ~2-10" over bedrock) because Minuartia patula can be found in shallow soils or pavements (i.e. shallow depressions with exposed dolomite bedrock). This should be followed by Channohon silt loam (soil depth 10-25" over bedrock), Joliet silty clay loam (soil depth 10-25" over bedrock), and Millsdale silty clay (soil depth 25-42" over bedrock). Other potential soil types are Lorenzo silt loam and Rodman gravelly loam.

To maintain and increase these populations of Minuartia patula, the following practices should be considered in addition to those measures outlined under 1 of this section:

a. To **enhance the genetic diversity** of the populations, seeds should be collected from nearby populations (e.g. 50-100 miles from the site).

b. **Seed sowing** should be used to develop populations in the proper areas.

c. **Pavements** (i.e. shallow depressions with exposed dolomite bedrock) that are exposed to early spring flooding can provide suitable habitat for new populations (e.g. colonization and free of competitors).

d. To **create habitat** for new populations, depressions resembling pavements should be created by removing soil to expose dolomite bedrock. The depression should be of approximately 2-3 meters in diameter and have very shallow soil (i.e. soil depth ~2). These depressions should be created in such a way that they will not fill with silt from scraped-off soil. In addition, depressions should be kept free of competition (e.g. noxious weeds, vegetation encroachment) (Steven R. Hill per. comm.).

e. **Monitoring and evaluation** should be conducted for any restored or reintroduced populations. In the event that a restored or reintroduced population is unsuccessful, a site's potential for a second reintroduction or restoration attempt should be reevaluated. This may require additional research.

In the case that additional populations of Minuartia patula are found in the region, they should be marked and protected from any potential damage and the above practices for maintenance and enhancement of these populations should be followed. Their habitat should also be protected.

MONITORING

In natural populations, annual counts of individuals should be done to determine population status. Transects and quadrats should be used to determine the size of a population in a large area. Hand counts can be done if a population is small (less than 100 individuals). In restorations, sampling should be done as above to detect increases or decreases in the population. If no significant changes are detected, reevaluation of seeding techniques and management practices should be done to enhance the population.

RESEARCH NEEDS

Immediate research needs that will help in the establishment and management of Minuartia patula are:

1. Collect information on several aspects of natural history such as specific habitat requirements (e.g. soils) of the species. This will allow a better understanding of how and where the species can be reintroduced.

2. Determine several aspects of the reproductive biology and dispersal of the species. Knowledge of the breeding system, presence/absence of pollinators or how pollen or seeds

move can help us understand some of the limiting factors in the persistence of populations in an area or in the reintroduction of the species to an area.

3. Collect demographic and population size information. This information is needed to determine the population structure and population changes (i.e. increases or decreases) of the species. With this information, specific recommendations can be made if the population is declining or only seedlings are found.

4. Determine the impact of stochastic events (e.g. flooding) on the species. This information can be used to determine or incorporate new management practices that may benefic the species.

5. Develop a Population Viability Analysis (PVA). A PVA identifies the threats faced by a species and can evaluate the likelihood that the species will persist for a given time into the future. To develop a PVA, field studies, data analysis, modeling, assessment of extinction risks, sensitivity analysis, and monitoring, among other things, are needed.

6. Determine the impact of different management (e.g. grazing, fire) and recreational activities. It is important to determine the best management practice(s) to improve the habitat for the species. Also, it is important to determine which recreational activities are compatible with the species. This will prevent any risks to the species and its habitat.

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