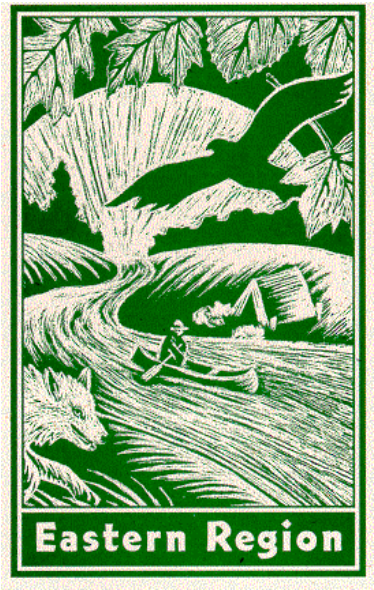
Conservation Assessment
For
Globe Mallow (Sphaeralcea angusta) (Gray) Fern.



USDA Forest Service, Eastern Region
2003

Prepared by:

This Conservation Assessment was prepared to compile the published and unpublished information and serves as a Conservation Assessment for the Eastern Region of the Forest Service.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.

Table of Contents

NOMENCLATURE AND TAXONOMY

Scientific Name: Sphaeralcea angusta (Gray) Fern.

Common Name: Globe mallow, false mallow, hispid false mallow, yellow false mallow

Family: Malvaceae

Synonyms: Malvastrum hispidum (Pursh) Hochr., Malvastrum angustum Gray, Sidopsis hispida (Pursh) Rydb., Sida hispida Pursh

USFS Region 9 Status: Sensitive Species

USFW Status: None

Illinois Status: Endangered Species

Global And State Rank: G?Q

RANGE:

Temperate North America, central US from Illinois and Iowa in the north, to Arkansas and Oklahoma in the south, east to Kentucky and Tennessee, and west to Kansas with the highest frequency in Missouri. Also, it has been reported in Nebraska (Hill, 1982) and historically in Alabama (Steven R. Hill per. comm.) (figure 1). In Illinois, this species can be found in six counties: Grundy, LaSalle, Randolph, Rock Island, St. Clair, and Will (figure 2).

PHYSIOGRAPHIC DISTRIBUTION:

Sphaeralcea angusta can be found in the Ozark Highlands Section of the Eastern Broadleaf Forest Continental Province and the 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), Sphaeralcea angusta can be found in Grand Prairie Division, Upper Mississippi River and Illinois Division (Mississippi River Section), Middle Mississippi Border Division, and Ozark Division (Eric Ulaszek per. comm.).

HABITAT:

This species can be found in dolomite (i.e. pavements, shallow depressions with exposed dolomite bedrock), glades (i.e. limestone outcrops), limestone hills, and rocky prairies in very shallow organic soils. Plants associated with Sphaeralcea angusta are: Aster oblongifolius, Bouteloua curtipendula, Calamintha arkansana, Isanthus brachiatus, Lithospermum incisum, Dalea purpurea, Onosmodium hispidissimum, Sporobolus asper, and Verbena stricta (Steven R. Hill per. comm.; Swink and Wilhelm, 1994).

SPECIES DESCRIPTION:

Annual species with simple or branched stems. Alternate leaves, linear to lanceolate, serrate to dentate, and pinnate venation. Flowers solitary in the axils of upper main stem and branch leaves. Corolla yellow to pale yellow-orange with 8-13(16) stamens and 5-6 carpels (Hill, 1982). Calyx conspicuously enlarged and enclosing fruit, at maturity becomes papery. Fruit star-like schizocarp with broad, deep sinuses between the adjacent carpels. Carpels, each dehiscent releasing a single seed. Seeds 2.1-2.5 mm in height x 2.0-2.5 mm in length x 1.3-1.5 mm width (Hill, 1982).

LIFE HISTORY:

This annual species flowers from July to September. Flowers will open during the late morning and early afternoon or not at all (Hill, 1982). This suggests that the species has both cleistogamous and chasmogamous flowers (Brenda Molano-Flores per. comm.; Hill, 1982). However, Hill (1982) calls the chasmogamous flowers functionally cleistogamous flowers. In general, Sphaeralcea angusta can be considered an autogamous species (Hill, 1982). No pollinators are known for the species.

No studies have been conducted to determine the conditions for the germination of this species. However, because this species is found in open spaces it may have a light requirement to germinate. Steven R. Hill (per. comm.) points out that partial mechanical opening of the hard seed coat will result in successful germination of the species. Seeds in the seed bank potentially can be viable for over 50 years (Steven R. Hill per. comm.). Based upon fruit structure (i.e. lack of dispersal mechanism) and a relative heavy seed, minimal seed dispersal can be expected for this species (Steven R. Hill per. comm.). Seeds are likely to fall and stay near the parent plant.

Minimal information is available regarding the size of Sphaeralcea angusta populations. From Steven R. Hill's records, populations can fluctuate between <100 to 1,000 individuals. This fluctuation can be associated with environmental factors such as drought or by competition or grazing. Sphaeralcea angusta has a short period of time to complete its life cycle. In drought years or drought spells, the plants will die without completing reproduction which may influence the structure of the population (Steven R. Hill per. comm.). Additional information regarding site locations and population sizes will be collected by Steven R. Hill (funded proposal by IDNR-Natural Heritage "Status assessment of Illinois Endangered false mallow (Malvastrum hispidum)").

NATURAL AND HUMAN LAND USE THREATS:

Because of land use practices and the association of this species with dolomite prairie, concern regarding the decline of Sphaeralcea angusta 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 Sphaeralcea angusta or create a siltation problem. Changes in the hydrology of the site, vegetation encroachment by

native/non-native species, and herbivory by rabbits may affect the species by impairing several aspects of reproduction (i.e. fruit formation) and recruitment. In addition to these threats, trampling by humans during monitoring of the species is a concern.

VIABILITY:

To maintain minimum viable populations of Sphaeralcea angusta 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 Sphaeralcea angusta 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 Sphaeralcea angusta 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 Sphaeralcea angusta 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 Sphaeralcea angusta 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 Sphaeralcea angusta throughout its habitat range,

specific management practices will be needed to insure the persistence of the species.

1. To maintain and increase the existing populations of Sphaeralcea angusta, 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 only during the winter or early spring to avoid any impact to the species (Steven R. Hill per. comm.). 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. Micro-management (i.e. hand pulling) is required to remove vegetation near the species (Steven R. Hill per. comm.).

c. 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.

d. 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.

e. Development of trails in areas where Sphaeralcea angusta is found should be avoided or minimized to prevent negative impacts to the populations.

f. Collection of Sphaeralcea angusta should only be allowed for scientific reasons and only by permit.

2. To develop and maintain a metapopulation of Sphaeralcea angusta, 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 Sphaeralcea angusta 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 this species can be found in shallow soils, and Channohon silt loam (soil depth 10-25" over bedrock). This should be followed by Joliet silty clay loam (soil depth 10-25" over bedrock) and Millsdale silty clay (soil depth 25-42" over bedrock). Other potential soil types where Sphaeralcea angusta can be found are Lorenzo silt loam and Rodman gravelly loam. However, Steven R. Hill (per. comm.) points out that the soil type is not as important as soil depth.

To maintain and increase these populations of Sphaeralcea angusta, 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 to propagate 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. 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.).

d. 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.

3. In the case that additional populations of Sphaeralcea angusta 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 restored areas, sampling should be done as above to detect increases or decreases in the population. If no significant changes are detected, reevaluation of restoration 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 Sphaeralcea angusta are:

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

2. Collect information regarding the reproductive biology of the species, in particular if the species is cleistogamous and/or chasmogamous and potential pollinators. This information may help us understand factors that may limit 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. Develop a Population Viability Analysis. 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.

5. 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.

REFERENCE LIST

Literature cited

Carroll, C. J. and J. White. 1997. Integrated Pest Management Methods for Control of Invasive Exotic Plant Species at Midewin National Tallgrass Prairie. Unpublished report by Ecological Services for the Illinois Department of Natural Resources, Springfield, IL.

Hanski, I., A. Moilanen, and M. Gyllenbergl. 1996. Minimum viable metapopulation size. The American Naturalist 147: 527-541.

Hill, S. R. 1982. Amonograph of the genus Malvastrum A. Gray (Malvaceae: Malveae). Rhodora 84: 1-83, 159-264, 317-409.

Husband, B. C. and S. C. H. Barrett. 1996. A metapopulation perspective in plant population biology. Journal of Ecology 84: 461-469.

Key, J. Jr., C. Carpenter, S. Hooks, F. Koenig, W. H. McNab, W. Russell, and M. L. Smith. 1995. Ecological Units of the Eastern United States-First Approximation (map and booklet of map unit tables). U.S. Department of Agriculture-Forest Service, Atlanta, GA.

Laatsch, J. and B. Loebach. 1997. Midewin Ecological Unit Map and Summaries. Unpublished report by Division of Natural Heritage-Illinois Department of Natural Resources, Springfield, IL.

Levins, R. 1969. Some demographical and genetic consequences of environmental heterogeneity for biological control. Bulletin of the Entomological Society of America 15: 237-240.

Levins, R. 1970. Extinction. In Lectures on Mathematics in the Life Sciences, 2. ed. M.

Gerstenhaber. Pp. 77-107. American Mathematical Society, Providence, RI.

Menges, E. S. 1992. Stochastic modeling of extinction in plant populations. In Conservation Biology: The Theory and Practice of Nature Conservation, Preservation, and Management. eds. P. L. Fiedler and S. Jain. Pp. 253-275. Chapman and Hall, New York, NY.

Mohlenbrock, R. H. and D. M. Ladd. 1978. Distribution of Illinois Vascular Plants. Southern Illinois University Press, Carbondale, IL.

Schwegman, J. E., G. D. Fell, J. Hutchinson, G. Paulson, W. M. Shepard, and J. White. 1973. Comprehensive Plan for the Illinois Nature Preserve Commission. Part II - The Natural Divisions of Illinois. Illinois Nature Preserve Commission, Springfield, IL.

Swink, F. and G. Wilhelm. 1994. Plants of the Chicago Region. 4th ed. Indiana Academy of Science, Indianapolis, IN.

Web pages cited

www.fs.fed.us/ne/delaware/ilpin/S.htm

www.itis.usda.gov/plantproj/plants/cgi_bin/fr_enter.cgi?earl=fr_qurymenu

Personal communications

Steven R. Hill. Illinois Natural History Survey-Center for Biodiversity. 607 East Peabody Drive. Champaign, Illinois 61820. Phone number: 217-244-8452.

Brenda Molano-Flores. Illinois Natural History Survey-Center for Biodiversity. 607 East Peabody Drive. Champaign, Illinois 61820. Phone number: 217-265-8167.

Eric Ulaszek. U.S. Forest Service. Midewin National Tallgrass Prairie. 30071 South State Route 53. Wilmington, Illinois 60481. Phone number: 815-432-6370.