

New England Plant Conservation Program  
Conservation and Research Plan

*Ludwigia polycarpa* Short & Peter.  
Many-Fruited False-Loosestrife

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## SUMMARY

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*Ludwigia polycarpa* Short & Peter. (Onagraceae), a perennial plant species of various floodplain and pond shore habitats, is a regionally rare Division 2 species in New England (Brumback and Mehrhoff *et al.* 1996). The species is documented from two current occurrences in Vermont and eight current occurrences in Massachusetts; it is considered to be historic in Connecticut. One of the eight current occurrences in Massachusetts is a new record discovered in 1999. Vermont lists *L. polycarpa* as an S1 species and protects it under its Endangered Species Law as an endangered species. Massachusetts designates the taxon as an S2 species and protects it under its Endangered Species Act as a threatened species. Outside of New England, the plant is an S1 or S2 species in four states and in Ontario. Although ten populations are considered to be extant in Vermont and Massachusetts, recent field visits (1994-1999) failed to locate plants at six of these sites. While this is cause for concern, it is possible that the populations still exist; factors such as not searching in the precise location of the populations, natural fluctuations in population size, or high water levels obscuring the plants may prevent consistent observations of the species.

In the absence of confirmed occurrences, it is difficult to propose specific conservation actions for *Ludwigia polycarpa*. Another problematic element in developing conservation actions is the paucity of information in the scientific literature on *L. polycarpa*; little is reported on the biology of the species. It is likely, however, that hydrological regimes play an important role in the occurrence and persistence of the species. Threats due to invasive wetland plant species, competition from other plant species, recreational activities, and agricultural activities may be important as well.

Several of the occurrences are on protected property, and there may be additional opportunities to pursue protection of the habitats in which *L. polycarpa* occurs. However, protected designations for sites will be effective in the conservation of the species only if they can accommodate the plant's biological needs. Conservation objectives include ensuring the existence of any of the known populations that still exist and maintaining these populations at a minimum of 100 individuals per population. Development of specific protection and management procedures must await confirmation of the occurrences. Major steps in support of achieving the conservation objectives include confirming occurrences, identifying threats and land use patterns, investigating pertinent aspects of the biology of the species (e.g., methods of reproduction, response to water levels and light levels), and re-introduction.

## PREFACE

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This document is an excerpt of a New England Plant Conservation Program (NEPCoP) Conservation and Research Plan. Full plans with complete and sensitive information are made available to conservation organizations, government agencies and individuals with responsibility for rare plant conservation. This excerpt contains general information on the species biology, ecology, and distribution of rare plant species in New England.

NEPCoP is a voluntary association of private organizations and government agencies in each of the six states of New England, interested in working together to protect from extirpation, and promote the recovery of the endangered flora of the region.

In 1996, NEPCoP published *Flora Conservanda: New England*, which listed the plants in need of conservation in the region. NEPCoP regional plant Conservation Plans recommend actions that should lead to the conservation of *Flora Conservanda* species. These recommendations derive from a voluntary collaboration of planning partners, and their implementation is contingent on the commitment of federal, state, local, and private conservation organizations.

NEPCoP Conservation Plans do not necessarily represent the official position or approval of all state task forces or NEPCoP member organizations; they do, however, represent a consensus of NEPCoP's Regional Advisory Council. NEPCoP Conservation Plans are subject to modification as dictated by new findings, changes in species status, and the accomplishment of conservation actions.

Completion of the NEPCoP Conservation and Research Plans was made possible by generous funding from an anonymous source, and data were provided by state Natural Heritage Programs. NEPCoP gratefully acknowledges the permission and cooperation of many private and public landowners who granted access to their land for plant monitoring and data collection. If you require additional information on the distribution of this rare plant species in your town, please contact your state's Natural Heritage Program.

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# I. BACKGROUND

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## INTRODUCTION

*Ludwigia polycarpa* Short & Peter. (Onagraceae) is an herbaceous wetland plant species that is regionally rare in New England (Brumback and Mehrhoff *et al.* 1996). The taxon's current distribution in New England is limited to Massachusetts and Vermont, and it is protected under state endangered species acts in both of these states. Outside of New England, the plant is relatively widely distributed (14 states and one Canadian province). While *L. polycarpa* is common in portions of the mid-western United States, it is rare in New England and in several states throughout its range. Species such as *L. polycarpa* that are not yet globally endangered are promising candidates for the development of effective conservation plans. Efforts to prevent endangerment are likely to be more successful than attempts to rescue species once they are critically imperiled.

The need for a conservation plan for *Ludwigia polycarpa* in New England stems primarily from four factors that will be detailed in this work:

1. the number of current occurrences reported for the species in New England is low (ten)
2. population sizes are typically modest
3. the wetland habitats in which *L. polycarpa* occurs are subject to a variety of threats including invasive plant species and alterations in hydrology that may adversely affect the species
4. there is evidence of decline of the species in New England and elsewhere in the U.S.

While the New England occurrences of *L. polycarpa* are peripheral to the central range of the species, these occurrences are still important in conservation efforts for the taxon. Lesica and Allendorf (1995) and Huenneke (1991) argue that species conservation depends on the protection of genetic variation occurring throughout the natural range of a species. Brumback and Mehrhoff *et al.* (1996) emphasize the importance of edge-of-range occurrences both as a part of New England's natural heritage and in preventing the erosion of species' entire ranges.

The intent of this conservation plan is to provide information and recommendations leading to the protection and recovery of *Ludwigia polycarpa* in New England. The plan consists of two sections: a synthesis of information on the status and biology of the taxon, and a conservation strategy for the taxon in New England. Species status and biology information are compiled from Natural Heritage program data, the scientific literature, persons knowledgeable about the species, and field visits to several New England occurrences. The conservation strategy utilizes the status and biology information to review potential conservation actions for

the taxon and to develop conservation objectives for the taxon in New England during the next 20 years, conservation actions for the taxon in general, and conservation actions for each New England occurrence. During such a time period, a focus on demographic rather than genetic factors may be most productive as suggested by Schemske *et al.* (1994) and Holsinger and Gottlieb (1991). Ultimately, however, genetic considerations will be important as well. The plan emphasizes the need for the collection of standardized and thorough data as suggested by Schemske *et al.* (1994) and Bevill and Louda (1999). The plan also attempts to create a document that will be useful to conservation managers and programs as advocated by Schemske *et al.* (1994).

## **DESCRIPTION**

The following description of the species is based on information from Gleason and Cronquist (1991) except where noted. *Ludwigia polycarpa* is a semi-aquatic herbaceous perennial ranging in height from two to ten decimeters. The plant is erect, and the upper stem is usually much-branched. The plant originates from a stoloniferous base. The stolons are up to 15 centimeters in length. Peng (1989) notes that the apex of the stolons is covered by densely congested and overlapping leaves. This protection of the stolon meristem may be an adaptation to severe winter conditions experienced by *L. polycarpa* in northern states. Leaves are lanceolate or lance-linear in shape and range from about four to ten centimeters in length; they are alternate on the stem and sessile or obscurely petiolar. The leaves are glabrous except on the margin and may turn a dark red-purplish color in autumn. Flowers are perfect and solitary with minute, greenish petals; they are four-merous with four short stamens and a short style. However, Peng (1989) states that petals are absent. There is a hypanthium on which narrow bracteoles occur extending nearly to or beyond the sinuses between the calyx lobes (Fernald 1950). The bracteoles range in length from three and a half to seven and a half millimeters. The plant flowers from approximately July to September. Fruits are present in September and remain on the plant and dehisce as it senesces in October to November (J. Ramstetter, *personal observation*). Fruits range in size from about 4 to 7 millimeters in length and from about 3 to 5 millimeters in width; they are sessile and occur both on the main stem and branches. Fruits are glabrous and may have a slightly four-sided appearance; fruit color is green to purplish. Seeds are minute with a length typically less than 0.4 millimeter (Peng 1989).

Experience with herbarium specimens and live plants in the genus *Ludwigia* suggests that useful characters in the identification of *Ludwigia polycarpa* include the:

1. erect, branching growth form of the plant
2. sessile, alternate, and lanceolate leaves
3. sessile, rounded fruits (see size described above) at the base of leaves.

Using this combination of characters, the species is distinguishable from other similar species in

the genus such as *L. palustris* and *L. alternifolia*. However, definitive identification of immature plants or of plants early in the growing season prior to flowering and fruiting may be difficult.

### **TAXONOMIC RELATIONSHIPS, HISTORY, AND SYNONYMY**

Peng (1989) provides a thorough taxonomic treatment of the section of the genus *Ludwigia* to which *L. polycarpa* belongs, and the following description comes from his treatment. The genus *Ludwigia* has existed at least 50 million years and is considered one of the least specialized genera of the Onagraceae. Species in the genus *Ludwigia* probably originated in wet habitats of the tropics of South America; this area is the center of diversity for *Ludwigia* and contains the most primitive species (Ramamoorthy and Zardini 1987, Peng 1989). *Ludwigia polycarpa* is one of approximately 82 species of *Ludwigia* that occurs worldwide and one of 23 species of *Ludwigia* that is native to North America. The North American species are divided into three sections: sect. *Ludwigia* (4 species), sect. *Dantia* (DC.) Munz (5 species), and sect. *Microcarpium* Munz (14 species). *Ludwigia polycarpa* is a member of the section *Microcarpium*. While most species within this section are found along the Coastal Plain of the southeastern United States, *L. polycarpa* is distributed mainly in the north-central United States. *L. polycarpa* was first described in 1836 by Charles Wilkins Short and Robert Peter in Kentucky.

The species is a tetraploid with a chromosome number of  $n = 16$ . Within section *Microcarpium*, there are seven other tetraploid taxa that are  $n = 16$ ; four diploid species that are  $n = 8$ ; two hexaploid species that are  $n = 24$ ; and an octoploid species that is  $n = 32$ . All eight tetraploid taxa (*L. glandulosa* subsp. *glandulosa*, *L. glandulosa* subsp. *brachycarpa*, *L. lanceolata*, *L. pilosa*, *L. polycarpa*, *L. ravenii*, *L. sphaerocarpa*, and *L. suffruticosa*) are interfertile; chromosome pairing at meiosis, pollen stainability, and seed set in hybrids between two tetraploid taxa are high even if the two taxa differ significantly morphologically.

Within section *Microcarpium*, only *L. polycarpa* and *L. sphaerocarpa* occur together in New England (Gleason and Cronquist 1991). Geographical isolation and self-pollination are likely important in limiting hybridization among species within *Ludwigia* sect. *Microcarpium*. For example, where *L. polycarpa* occurs in the central Midwest, it is geographically isolated from all other sect. *Microcarpium* species except *L. sphaerocarpa*, and where the species co-occur, hybridization occurs. *L. polycarpa* has also been reported to hybridize with the diploid *L. palustris* in Kentucky, but hybrids are sterile.

### **SPECIES BIOLOGY**

Reproduction in *Ludwigia polycarpa* includes both sexual and asexual reproduction, as it does in all 14 species of *Ludwigia* sect. *Microcarpium* (Peng 1989). All of the species

are genetically self-compatible. During sexual reproduction, flowers open in the morning, and the stigma becomes sticky and receptive and the stamens dehisce, exposing yellowish pollen entangled by viscin threads. Initially the stamens are spread apart and not in contact with the stigma. Gradually, however, the filaments arch toward the center, and the anthers become firmly appressed to the sides of the sticky stigma within one to several hours of anthesis causing self-pollination (Peng 1989). The extent to which insect pollination may occur in *L. polycarpa* is unclear. All species of *Ludwigia* sect. *Microcarpium* have nectary discs that are variable in size and nectar production. Wasps, moths, and ants (Peng 1989), bumblebees and honeybees (Peng 1989; Ott 1991), specialized bees (Ott 1991, Gimenes 1997), and adult bruchid beetles (Ott 1991) have been observed as visitors and potential pollinators of various other *Ludwigia* species. The presence of abundant natural hybrid populations suggests that insect pollination may be somewhat common (Peng 1989). No specific information on nectar production or other indications of insect pollination in *L. polycarpa* was found in Peng (1989) or in any other source. The plant was seen in fruit rather than in flower during 1999 field visits.

Asexual reproduction occurs in nearly all species of *Ludwigia* sect. *Microcarpium* via sprawling stolons at the base of the erect flowering stems late in the flowering season. This vegetative reproduction enables plants to overwinter when the erect stems die back. In the spring, they can produce a large colony before other species invade (Peng 1989). However, (Peng 1989) did not indicate whether or not *L. polycarpa* exhibits this vegetative reproduction. During field visits, a thick growth of leaves was observed at the bases of stems suggesting the presence of stolons. Although species of *Ludwigia* sect. *Microcarpium* are usually stoloniferous, none of the species exhibit the aggressive characteristic of weedy species. *Ludwigia polycarpa* was not one of the four *Ludwigia* sect. *Microcarpium* species that has rarely been observed occupying disturbed habitats according to Peng (1989). However, several occurrences in New England are in disturbed habitats (e.g., W. Springfield, MA, new record and Orwell, VT, .001). In Idaho, the state botanist observed *L. polycarpa* along a very disturbed shoreline.

Seeds are released in *L. polycarpa* as a result of the dehiscence of the fruit. *L. polycarpa* exhibits peeled dehiscence in which the capsule dehisces by irregular rupture of the outer capsule wall (Peng 1989). Even after the capsule dehisces, many seeds may remain in the capsule into the winter (J. Ramstetter, *personal observation*). Seeds have a spongy mesocarp and an endocarp with a conspicuous inner hypodermis. When the seeds are dispersed, they often carry along hypodermal cells; the usefulness of these cells for floatation awaits confirmation (Peng 1989).

Additional studies concerning other species of *Ludwigia* or the genus in general include an examination of: beaver pond seed banks revealing *L. palustris* seeds (Le Page and Keddy 1998); growth strategies of *L. peploides* (Rejmankova 1992); role of fruit size and shape in entrapment of a bruchid beetle in fruits of *L. alternifolia* (Ott 1991, Ott and Lampo 1991); effects of the herbicide isoproturon on *L. natans* (Grollier *et al.* 1997 and Feurtet-Mazel *et al.* 1996); occurrence of *L. peruviana* in the Botany wetlands near Sydney, Australia (Jacobs *et*

al. 1994); the systematics and evolution of *Ludwigia* (Peng 1988 and 1989, Tobe *et al.* 1988, Averett *et al.* 1990, Zardini and Raven 1992); the occurrence of *L. uruguayensis* in Tennessee and Kentucky (Chester and Holt 1990); and the pollinators and visitors of *L. elegans* flowers in Brazil (Gimenes 1997).

## **HABITAT/ECOLOGY**

All species of *Ludwigia* sect. *Microcarpium* grow in wet habitats such as alluvial ground or in shallow water of ponds, lakes, rivers, streams, lagoons, sloughs, backwaters, swales, wet meadows or prairies, open swamp forests, drainages, and irrigation ditches (Peng 1989). The habitat of *Ludwigia polycarpa* includes swamps, marshes and wet prairies (Gleason and Cronquist 1991) and pond-shores and wet places (Fernald 1950). More specific habitat information on the species in New England comes from the Massachusetts Natural Heritage and Endangered Species Program and the Vermont Nongame and Natural Heritage Program unless otherwise noted. While the habitat varies from site to site, there are several characteristics that the majority of sites have in common. All sites are likely subject to annual inundation; reports suggest that the plant occurs both on the edges of the bodies of water described and in standing water. In New England, sites are typically located in former oxbows and river channels in floodplain forested swamps or floodplain shrub swamps (Sorrie 1986). The plant also grows along pondshores in Massachusetts and in a protected backwaters of a river and along the shore of Lake Champlain in Vermont. Bruce Sorrie (Botanist, *personal communication*) believes that the hydrology of a site is important in the occurrence and persistence of the species; the particular relationship that exists between water levels and the species is unclear. Reports indicate that the plant grows in open light conditions on essentially level terrain. Elevations for the Massachusetts sites and for one Vermont site range from approximately 50-140 feet; the other Vermont site is at approximately 300 feet. Existing information on soils is not comprehensive. Peng (1989) states that species of *Ludwigia* sect. *Microcarpium* grow in sandy or occasionally peaty soils. In Vermont, soils are described as saturated, alkaline-rich, mucky sand at one site and as peat and muck at the other site. In Massachusetts, soils are described as: silty, probably alluvium; sandy; exposed mud; muddy shore; peaty; and gravelly shore. Associated natural communities in Vermont are a shallow rush-grass marsh and calcareous pond shore; in Massachusetts, they are a seasonal pond in floodplain forest, floodplain swamp, and coastal plain-type pond. Reported associated plant species at some specific sites where *L. polycarpa* occurs include:

VT .001 (Orwell): *Potentilla anserina*, *Bidens frondosa*, *Setaria lutescens*, *Butomus umbellatus*, *Alisma gramineum*, and *Heteranthera dubia*

VT .002 (Rockingham): *Scirpus* sp., *Typha latifolia*, and other tall herbs

MA .002 (Deerfield): *Typha latifolia*, *Cephalanthus*, *Leersia oryzoides*, *Phalaris*, *Lindernia dubia*, *Dulichium* sp., *Lythrum salicaria*; *Polygonum cuspidatum*, *Impatiens pallida*, and



*Polygonum* sp.

MA .003 (Northampton): Canopy--*Acer saccharinum*, *Populus* sp.; Shrub layer--*Cornus* sp., *Alnus* sp.; Herbaceous layer--*Boehmeria cylindrica*, *Urtica dioica*, *Onoclea sensibilis*, *Matteuccia struthiopteris*, *Celastrus* sp., and *Lythrum salicaria*

MA .007 (Montague): *Alisma* sp., *Penthorum* sp., *Polygonum* sp., and *Lycopus* sp.

MA .009 (Longmeadow): *Acer saccharinum*, *Acer rubrum*, *Fraxinus* sp., *Populus*, *Salix nigra*, *Quercus palustris*, *Rumex verticillatus*, *Polygonum hydropiperoides*, *Onoclea sensibilis*, *Ludwigia palustris*, *Viburnum recognitum*, *Alisma* sp. *Lysimachia terrestris*, *Bidens discoidea*, *Boehmeria cylindrica*, *Leersia virginica*, *Cinna arundinacea*, *Cicuta bulbifera*, *C. maculata*, and *Sparganium androcladum*

MA (new record, West Springfield): *Cyperus erythrorhizos*, *Bidens cernua*, *Leersia oryzoides*, *Penthorum sedoides*, *Ludwigia palustris*, *Polygonum hydropiperoides*, and *Polygonum* sp. Forest at edge of backwater: *Salix* sp., *Populus*, *Acer saccharinum*, *Acer rubrum*, *Fraxinus* seedlings, *Toxicodendron radicans*, *Onoclea sensibilis*

Sorrie (1986) noted significant overlap in species composition at sites in which he worked. From four Massachusetts sites sampled, herbaceous species associated with *L. polycarpa* in at least three of the sites are: *Alisma plantago-aquatica*, *Boehmeria cylindrica*, *Polygonum hydropiperoides*, *Penthorum sedoides*, *Acer saccharinum* seedlings, *Ludwigia palustris*, *Lysimachia terrestris*, and *Cephalanthus occidentalis*. Canopy species include *Acer saccharinum*, *Fraxinus pennsylvanica*, and *Quercus palustris*.

Little additional information exists on the life history and ecology of *Ludwigia polycarpa*. Searches of data bases including Biosis, Infotrac, CarlUncover, and Biological and Agricultural Index revealed no articles from the scientific literature written exclusively on *Ludwigia polycarpa*. As previously discussed, however, Sorrie (1986) reviewed information on distribution and habitat. Brumfield *et al.* (1982) reported the recent discovery of *L. polycarpa* among other rare wetland taxa that have a limited or disjunct distribution in West Virginia. Munro (1998) reports the establishment of *L. polycarpa* after moving a small portion of a buttonbush swamp/mixed marsh in a mass plant salvage operation as a part of a wetland mitigation effort in central Pennsylvania. No other references to studies exclusively on *L. polycarpa* were found.

## **THREATS TO TAXON**

Based on field visits by the authors and information from the Vermont and Massachusetts Natural Heritage Programs, potential threats to *Ludwigia polycarpa* include: disturbances due to alterations of hydrological regimes, invasion of exotic wetland plant species,

competition from other species, agricultural activities, and recreational activities. Most of the sites are subject to the above threats. It is difficult to be more specific about the exact nature and severity of the threats because the precise locations of many of the occurrences are not known.

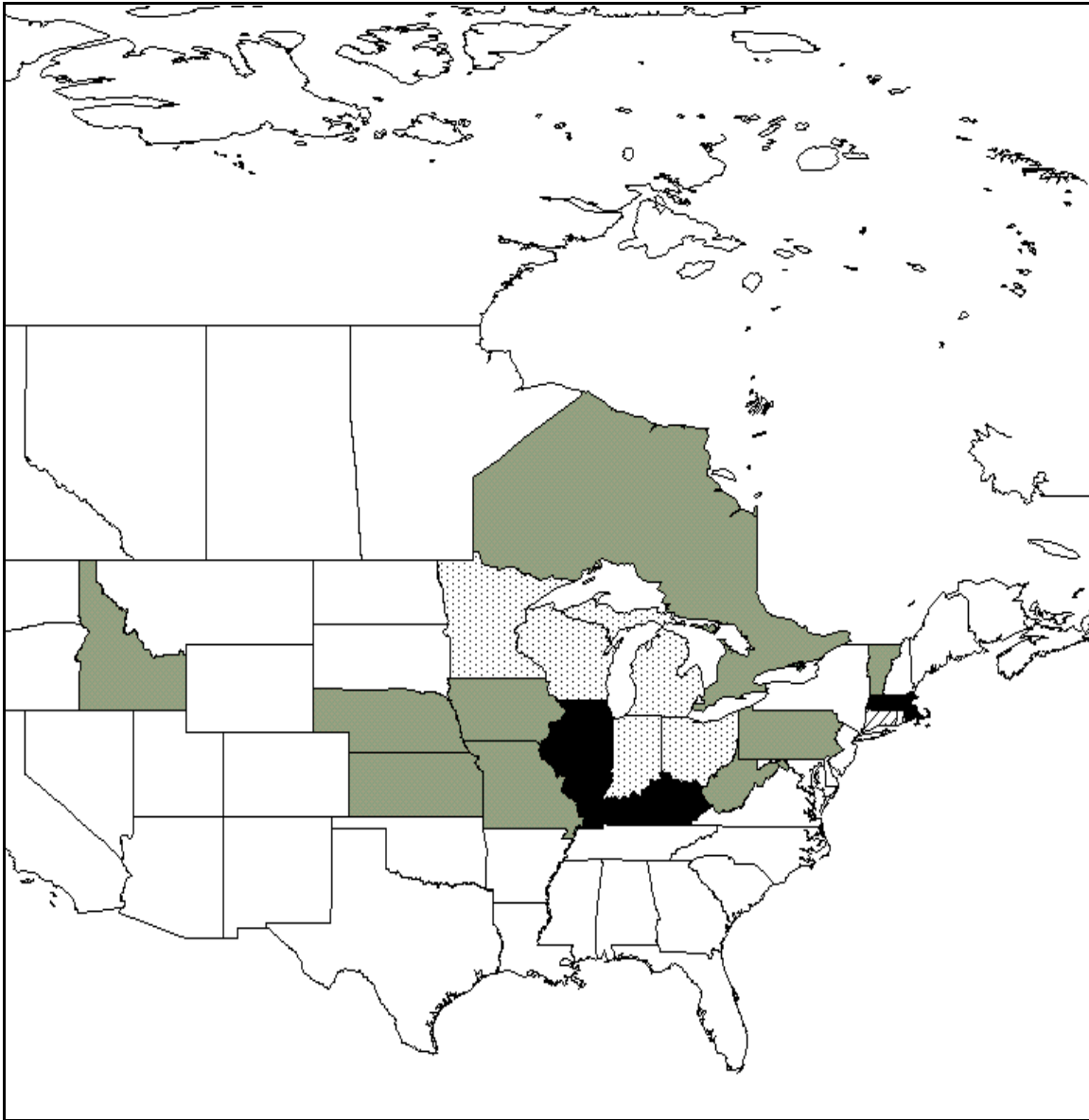
## **DISTRIBUTION AND STATUS**

### ***General status***

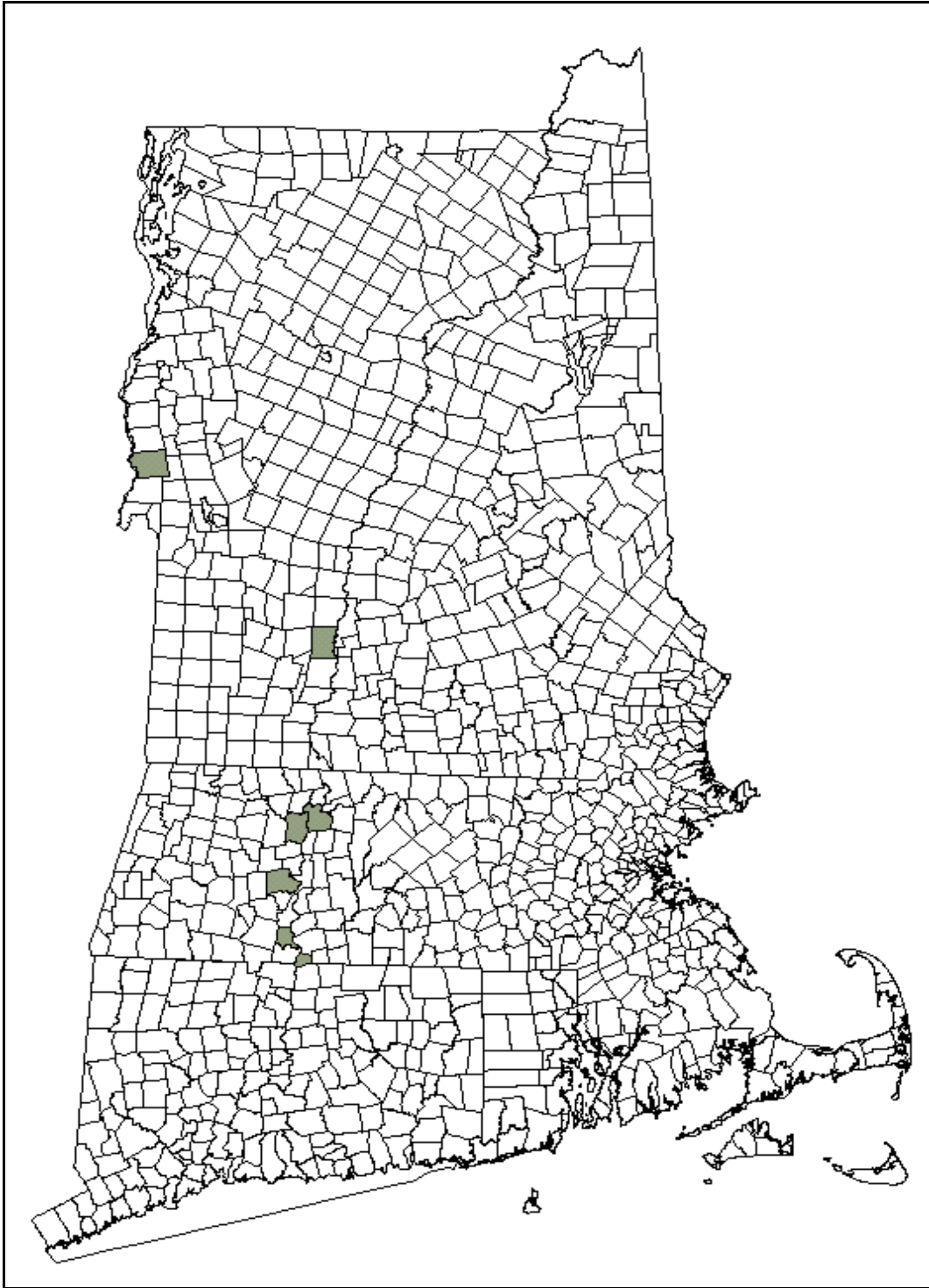
*Ludwigia polycarpa* currently occurs in Massachusetts and Vermont in New England, southern Ontario, several mid-western states, a few southern states, and in Kansas, Nebraska, and Idaho (Figure 1). Sorrie (1986) describes the plant as a Midwestern species that is a rare disjunct east of the Appalachians. Gleason and Cronquist (1991) describe the range as Massachusetts and Connecticut, southern Ontario to Minnesota, south to Tennessee and Kansas. Fernald (1950) reports the occurrence of the species from Maine to Connecticut; southwestern Ontario and Ohio to Minnesota, south to Tennessee, Missouri, and Kansas. The species occurs in New England (Maine, Vermont, Massachusetts, and Connecticut), in Pennsylvania, West Virginia, Virginia, Ohio, Kentucky, Tennessee, Alabama, Michigan, Indiana, Wisconsin, Illinois, Minnesota, Iowa, Missouri, Arkansas, Nebraska, Kansas, and Idaho (The Nature Conservancy and Association for Biodiversity Information 1999). In addition, Kartesz (1994) indicates that the species occurs in New Jersey. Peng (1989) provides a distribution map of the species based on the examination of hundreds of herbarium specimens throughout its range. Natural Heritage programs were contacted to confirm the occurrence of *L. polycarpa* in each of these states and in Ontario and to obtain the most recent information on the species' status. The distribution of the species in Figure 1 is based on information from Peng (1989) and information from the Natural Heritage Programs of all states from which the taxon has been reported. See Table 1 for species ranks across its range, and Appendix for an explanation of ranks.

Outside of New England, the species has an S1 or S2 rank in four states (Pennsylvania, West Virginia, Kansas, and Idaho) and in Ontario (Table 1). Of the remaining states from which the species is verified, *L. polycarpa* is considered to be common or relatively common in six states. There are four states in which the taxon is considered rare or somewhat rare but is not listed as an S1 or S2 species. Although *L. polycarpa* has a relatively broad distribution, the species consists of a limited number of populations throughout much of its range. In addition, many of these populations are relatively small and occur in habitats that are threatened (e.g., Hochman *et al.* 1996). According to Heritage Program representatives, there is no official documentation of the species occurring in five states from which it was reported previously (New York, Virginia, Alabama, Arkansas, Maine, and Tennessee).

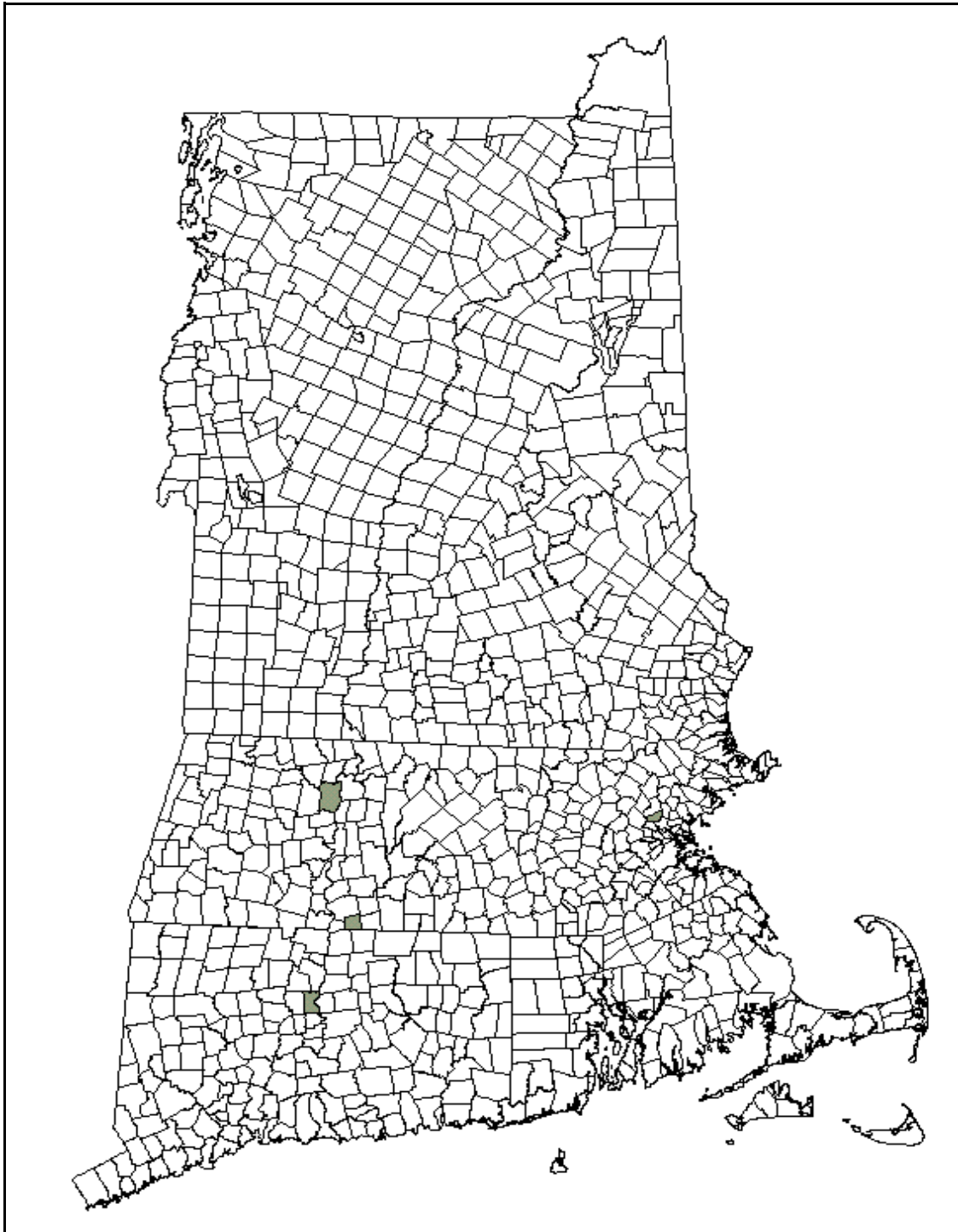
<b>Table 1. Occurrence and status of <i>Ludwigia polycarpa</i> in the United States and Canada based on information from Natural Heritage Programs.</b>			
<b>OCCURS &amp; LISTED (AS S1, S2, OR T &amp;E)</b>	<b>OCCURS &amp; NOT LISTED (AS S1, S2, OR T &amp; E)</b>	<b>OCCURRENCE UNVERIFIED</b>	<b>HISTORIC (LIKELY EXTIRPATED)</b>
Massachusetts (S2/T): 7 current and 2 historic occurrences	Michigan (S?): 'somewhat common'	Ohio (SR): northwest and southern parts of state	Connecticut (SH): 3 to 8 suggested in Hartford area
Vermont (S1): 2 current occurrences	Kentucky (S?): somewhat rare, occurs in 8 counties	Indiana (SR): reported as 'relatively common' in northern and southern parts of state	
Pennsylvania (S1): 2 current occurrences	Illinois (S?): occurs in 76 of 106 counties	Wisconsin (SR): reported as 'relatively common'	
Ontario (S2): only in southwest of province	Iowa (S3)	Minnesota (SR): reported as 'somewhat rare' and under consideration for listing	
West Virginia (S1): known from 1 record only	Nebraska (S4): at least 4 extant sites	Missouri (SR): 'fairly common' in northern and north-eastern parts of state	
Kansas (S2)		New York: one unconfirmed specimen	
Idaho (S1): 3 current occurrences, possibly introduced (Peng 1989)		Arkansas (SR)	
		Virginia (SU): doubtful single specimen	
		Alabama (SR): reported occurrence is F1 hybrid of <i>L. pilosa</i> and <i>L. glandulosa</i> (Peng 1989)	
		Tennessee (SR)	
		Maine (SR)	
		New Jersey (SR)	



**Figure 1. Occurrences of *Ludwigia polycarpa* in North America.** Shaded states and provinces have 1-5 extant occurrences or are noted simply as occurring, while those shaded in black have more than 5 known extant occurrences. States with the taxon reported as “SR” (see Table 1 and Appendix for explanation of ranks) are shaded on the map with stippling where additional confirmation exists. States with diagonal hatching are designated “historic” or “presumed extirpated” (see Table 1), where *Ludwigia polycarpa* no longer occurs.



**Figure 2. Extant occurrences of *Ludwigia polycarpa* in New England.** Town boundaries for New England are shown. Shaded towns have 1-5 extant occurrences.



**Figure 3. Historic occurrences of *Ludwigia polycarpa* in New England.** Town boundaries for New England are shown. Shaded towns have 1-5 historic occurrences.

*Ludwigia* is an S2 species (generally 6-20 current occurrences in the state) and is protected as a threatened species in Massachusetts (Massachusetts Endangered Species Act M.G.L.c.131A and regulations 321 CMR 10.00). It is an S1 species (generally 1-5 current occurrences in the state) and is protected as an endangered species in Vermont (Vermont Endangered Species Law 10 V.S.A.). The species, thought to be extirpated in Connecticut, is listed as SH in that state (Brumback and Mehrhoff *et al.* 1996). As a result of the taxon's rarity in New England, *Ludwigia polycarpa* is a Division 2 (regionally rare) plant species according to *Flora Conservanda: New England* (Brumback and Mehrhoff *et al.* 1996). Division 2 taxa include those species with fewer than 20 current occurrences verified since 1970. The species is considered extant (populations verified since 1970) at eight sites in Massachusetts and at two sites in Vermont.

**Table 2. New England Occurrence Records for *Ludwigia polycarpa* based on data from State Natural Heritage Programs. Shaded occurrences are considered extant.**

State	EO #	County	Town
VT	<b>.001</b>	<b>Addison</b>	<b>Orwell</b>
VT	<b>.002</b>	<b>Windham</b>	<b>Rockingham</b>
MA	.001	Franklin	Deerfield
MA	<b>.002</b>	<b>Franklin</b>	<b>Deerfield</b>
MA	<b>.003</b>	<b>Hampshire</b>	<b>Northampton</b>
MA	<b>.005</b>	<b>Hampshire</b>	<b>Northampton</b>
MA	<b>.006</b>	<b>Hampshire</b>	<b>Northampton</b>
MA	<b>.007</b>	<b>Franklin</b>	<b>Montague</b>
MA	.008	Hampden	East Longmeadow
MA	<b>.009</b>	<b>Hampden</b>	<b>Longmeadow</b>
MA	<b>.010</b>	<b>Middlesex</b>	<b>Winchester</b>
MA	<b>New</b>	<b>Hampden</b>	<b>West Springfield</b>
CT	.001	Hartford	Hartford
CT	None		Unknown



## II. CONSERVATION

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### CONSERVATION OBJECTIVES FOR THE TAXON IN NEW ENGLAND

As discussed in the previous section on the status and biology of *Ludwigia polycarpa*, the taxon is rare in New England and in several other locations throughout its distribution. The wetland habitats in which it occurs are often subject to a variety of threats, and aside from state-listing, there are no known conservation measures in place in New England to specifically promote the conservation of the taxon. Additionally, important aspects of the biology of *L. polycarpa* are not well-studied, including seed dispersal, seedling establishment, asexual reproduction, response of plants to fluctuations in water levels, competition from co-occurring species, and to threats such as invasive plant species. The goal of this conservation plan is to present research and conservation objectives and actions that will contribute to the development of a comprehensive conservation strategy for *L. polycarpa* in New England during the next 20 years.

There are a number of potential conservation actions that may be important in ensuring the existence of rare plant species. These include: land protection; regular surveys of known occurrences; *de novo* searches for new populations; species biology research; management recommendations; *ex situ* activities such as seed banking; re-introduction (augmentation, re-introduction, and introduction); and education of landowners and the public. Each of these actions is appropriate in developing a conservation strategy for *L. polycarpa* in New England. However, a productive strategy may be to focus on some of the actions initially (e.g., determination of the existence and extent of previously reported populations; species biology research; collection of seed; land acquisition and protection when occurrences and/or appropriate habitat are identified; and education of landowners and the public) and then proceed to others (e.g., management recommendations; re-introduction) as information becomes available.

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## **Appendix 1. An explanation of conservation ranks used by The Nature Conservancy and the Association for Biodiversity Information**

The conservation rank of an element known or assumed to exist within a jurisdiction is designated by a whole number from 1 to 5, preceded by a G (Global), N (National), or S (Subnational) as appropriate. The numbers have the following meaning:

- 1 = critically imperiled
- 2 = imperiled
- 3 = vulnerable to extirpation or extinction
- 4 = apparently secure
- 5 = demonstrably widespread, abundant, and secure.

G1, for example, indicates critical imperilment on a range-wide basis—that is, a great risk of extinction. S1 indicates critical imperilment within a particular state, province, or other subnational jurisdiction—i.e., a great risk of extirpation of the element from that subnation, regardless of its status elsewhere. Species known in an area only from historical records are ranked as either H (possibly extirpated/possibly extinct) or X (presumed extirpated/presumed extinct). Certain other codes, rank variants, and qualifiers are also allowed in order to add information about the element or indicate uncertainty.

Elements that are imperiled or vulnerable everywhere they occur will have a global rank of G1, G2, or G3 and equally high or higher national and subnational ranks. (The lower the number, the "higher" the rank, and therefore the conservation priority.) On the other hand, it is possible for an element to be rarer or more vulnerable in a given nation or subnation than it is range-wide. In that case, it might be ranked N1, N2, or N3, or S1, S2, or S3 even though its global rank is G4 or G5. The three levels of the ranking system give a more complete picture of the conservation status of a species or community than either a range-wide or local rank by itself. They also make it easier to set appropriate conservation priorities in different places and at different geographic levels. In an effort to balance global and local conservation concerns, global as well as national and subnational (provincial or state) ranks are used to select the elements that should receive priority for research and conservation in a jurisdiction.

Use of standard ranking criteria and definitions makes Natural Heritage ranks comparable across element groups—thus G1 has the same basic meaning whether applied to a salamander, a moss, or a forest community. Standardization also makes ranks comparable across jurisdictions, which in turn allows scientists to use the national and subnational ranks assigned by local data centers to determine and refine or reaffirm global ranks.

Ranking is a qualitative process: it takes into account several factors, including total number, range, and condition of element occurrences, population size, range extent and area of occupancy, short- and long-term trends in the foregoing factors, threats, environmental specificity, and fragility. These factors function as guidelines rather than arithmetic rules, and the relative weight given to the factors may differ among taxa. In some states, the taxon may receive a rank of SR (where the element is reported but has not yet been reviewed locally) or SRF (where a false, erroneous report exists and persists in the literature). A rank of S? denotes an uncertain or inexact numeric rank for the taxon at the state level.

Within states, individual occurrences of a taxon are sometimes assigned element occurrence ranks. Element occurrence (EO) ranks, which are an average of four separate evaluations of quality (size and productivity), condition, viability, and defensibility, are included in site descriptions to provide a general indication of site quality. Ranks range from: A (excellent) to D (poor); a rank of E is provided for element occurrences that are extant, but for which information is inadequate to provide a qualitative score. An EO rank of H is provided for sites for which no observations have been made for more than 20 years. An X rank is utilized for sites that known to be extirpated. Not all EO's have received such ranks in all states, and ranks are not necessarily consistent among states as yet.