

New England Plant Conservation Program

Agastache nepetoides (L.) Kuntze
Yellow Giant Hyssop

Conservation and Research Plan
for New England

Prepared by:
Bill Toomey
and
Barbara H. Toomey, Ph D.
220 Day Road
Pomfret Center, Connecticut 06259

For:

New England Wild Flower Society
180 Hemenway Road
Framingham, MA 01701
508/877-7630
e-mail: conserve@newfs.org • website: www.newfs.org

Approved, Regional Advisory Council, 2002

SUMMARY

Agastache nepetoides (L.) Kuntze is a fast-growing, woody-stemmed, perennial member of the Lamiaceae family. Its range includes much of the eastern and central United States from Vermont and Connecticut south to Virginia and North Carolina, west to southeastern Nebraska, eastern Kansas, and eastern Oklahoma. *Agastache nepetoides* also occurs in Ontario and Quebec in Canada. *Agastache nepetoides* is relatively common in some mid-western states and is not considered rare on a global scale (G5). However, it is rare in some eastern and southern states. In New England, *A. nepetoides* is currently extant at one site in Connecticut and one site in Vermont. *Agastache nepetoides* was known historically from seven other sites in Connecticut and one site in Vermont (herbarium specimen data are not precise enough to determine the exact number or sites of historic locations). *Agastache nepetoides* populations in New England appear to be disappearing or declining due to habitat loss, habitat modification, exotic species invasion, and ecological succession.

Agastache nepetoides occurs in moist, open woodland areas on rich soils and calcareous bedrock, thickets, woodland borders, and disturbed areas such as along railroad tracks, fencerows, floodplains, and disturbed woodlands. As a member of the mint family, it has also been cultivated for commercial and research purposes and as forage for bees.

The conservation objectives for *A. nepetoides* in New England include: protection and maintenance of the two extant populations in Connecticut and Vermont; collection of seed from both populations for possible establishment of new populations; and discovery of new populations. Since the extant populations both are located on privately owned land, continued landowner contact will be essential. In order to maintain viable populations, some active management should include: the control of woody and invasive species in and around the populations; proper timing of roadside mowing; and possible thinning of the canopy to ensure adequate sunlight penetration.

PREFACE

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.

The New England Plant Conservation Program (NEPCoP) of the New England Wild Flower Society 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.

This document should be cited as follows:

Toomey, B. and B. H Toomey. 2002. *Agastache nepetoides* (L.) Kuntze (Yellow Giant Hyssop) New England Plant Conservation Program Conservation and Research Plan for New England. New England Wild Flower Society, Framingham, Massachusetts, USA.
<http://www.newfs.org>.

© 2002 New England Wild Flower Society

I. BACKGROUND

INTRODUCTION

Agastache nepetoides is a fast-growing perennial member of the Lamiaceae. Its range includes much of the eastern and central United States from Vermont and Connecticut south to Virginia and North Carolina, west to southeastern Nebraska, eastern Kansas, and eastern Oklahoma. *Agastache nepetoides* also occurs in Ontario and Quebec in Canada.

Agastache nepetoides occurs in moist, rich open woodland areas, thickets, woodland borders, and disturbed areas such as along railroad tracks, fencerows, floodplains, and disturbed woodlands. Although it is not considered rare on a global scale and is common in some mid-western states, it is rare in New England and other eastern states. *Agastache nepetoides* populations in New England appear to be disappearing or declining due to habitat loss, habitat modification, exotic species invasion and ecological succession.

A conservation plan is needed to determine actions required to maintain viable populations in New England. This plan summarizes existing knowledge of the species biology and habitat requirements of *A. nepetoides*, identifies knowledge gaps, and proposes conservation actions necessary to maintain New England populations. These actions include active management at the extant sites and surveys for the species in new locations.

DESCRIPTION

Agastache nepetoides is a fast-growing perennial with an upright growth habit and woody, square stems that usually grow from one to two meters tall and are sometimes branched in the upper parts. The stems of *A. nepetoides* are slightly winged at the corners, green in color, and mostly glabrous but with slight pubescence near the top. The roots of most *Agastache* species including *A. nepetoides* are fibrous and branched.

Leaves are opposite and coarsely toothed. The stalkless flowers are pale greenish-yellow and occur in dense spikes (Newcomb 1977). Leaf blade morphology can be variable and may be partly under environmental control (Vogelmann 1983). Leaf blades are thin and ovate or ovate-lanceolate with a median length of 5-15 cm and width of 3-7 cm; leaves are much smaller toward the summit of the stem. Leaves are acuminate at the apex, rounded or subcordate at the base and moderately serrate with the serrations mucronate (Lint 1942, Gleason 1952). The upper leaf surface is glabrate, and the lower surface is sparsely pubescent with fine curved hairs. The petioles of the median leaves are mostly 2-5 cm long (with the upper ones reduced), and generally glabrous. Calyces range in length from 3-6 mm with five teeth

about 1 mm long and are ovate and obtuse or subacute. Calyces are green and more opaque than the tubes, with prominent veins (Lint 1942).

The flowers of *A. nepetoides* are small, numerous and in dense verticils on a terminal, nearly cylindrical spike up to 20 cm long and 1-1.5 cm in diameter (Lint 1942, Gleason and Cronquist 1991). Flowers are subtended by inconspicuous bracts (Gleason and Cronquist 1991). Corollas are yellowish or greenish yellow and small, from 5-6.5 mm long and 1.5 cm in diameter or less (Lint 1942). The upper lip of the corolla is nearly erect and 2-lobed; the lower lip is 3-cleft with the middle lobe crenate (Fernald 1950). Stamens are whitish to yellowish; the two lower stamens are curved upward under the upper corolla lip. The two upper stamens are longer and curved downward (Gleason 1952, Gleason and Cronquist 1991). Styles are 8.8-13.7 mm long; nutlets about 1.5 mm long with dense pubescence at the apices (Vogelmann 1983).

One other species of *Agastache* occurs in the eastern United States: *A. scrophulariifolia*, which is similar to *A. nepetoides* in habit, size and foliage (Gleason 1952). However, *A. nepetoides* and *A. scrophulariifolia* can be easily distinguished by stem morphology and corolla size and color. As mentioned above, the stems of *A. nepetoides* are slightly winged at the corners, whereas stems of other *Agastache* species are square in cross section. The corolla spikes of *A. scrophulariifolia* are 1.5-2.0 cm in diameter and rose or purplish in color. *Agastache foeniculum* is found in the Midwestern United States and Canada (Gleason 1952, Vogelmann 1983, Gleason and Cronquist 1991) and may overlap slightly at the very northern and western edges of *A. nepetoides*' range. *Agastache foeniculum* is approximately 1 M tall, usually not branching in the upper parts, and the flowers are purple in color (Gleason 1952, Gleason and Cronquist 1991).

TAXONOMIC RELATIONSHIPS, HISTORY, AND SYNONYMY

Agastache nepetoides is a tall, perennial member of the mint family with the common names of yellow or catnip giant hyssop or horse mint. *Agastache nepetoides* (L.) was named by Kuntze (Revis. Gen. 511. 1891), with previous genus names of:

Hyssopus nepetoides L. (*Sp.Pl.* 569. 1753)

Vleckia nepetoides (L.) Raf. (*Med. Repos. N. York* 5: 352, 1808)

Lophanthus nepetoides (L.) Benth. (*Bot. Reg.* sub t. 1282, 1829) (Vogelmann 1983).

The history of *A. nepetoides* appears to indicate that about half of the population survived the most recent glaciation and populations migrated north to reach the current extent of its range when the glacier retreated. The present range is most likely determined by several interrelated limiting factors including temperature (possibly limiting the range in the north and south) and precipitation (possibly limiting the western range) (Craig Anderson, Wisconsin

Department of Natural Resources, and Jerry Budy, University of Wisconsin, personal communication).

There are 22 species in the genus *Agastache*. Within this genus, two sections -- *Agastache* and *Brittonastrum* -- have been delineated based on differences in stamen orientation and geographical distribution (Lint and Epling 1945), although it is not clear if these delineations are reflective of the species biological distinctions (Vogelmann 1985). *Agastache nepetoides* is in section *Agastache*, as are six other North American species and *A. rugosa* from Eastern Asia. Species in section *Brittonastrum* are found in the arid regions of southwestern United States and Mexico. There are no varieties or subspecies of *A. nepetoides* known.

SPECIES BIOLOGY

Agastache nepetoides is reported to be weakly protandrous (Vogelmann 1983). The stigmas are usually receptive to pollen early, while still in the corolla tubes. *Agastache* species that show early stigma receptivity (including *A. nepetoides*) readily self-pollinate under greenhouse conditions and probably do in the wild as well (Vogelmann 1983). This may be one explanation for the relatively low level of heterozygosity of *A. nepetoides* compared with other *Agastache* species (Vogelmann and Gastony 1987). *Agastache nepetoides* is reported to flower from July through September through much of its range (Fernald 1950, Gleason 1952, Gleason and Cronquist 1991).

Agastache nepetoides grows from seed, woody rootstocks, or short creeping rhizomes. The seeds of *Agastache* are very small, and are difficult to grow when seeded directly in the field (Fuentes-Granados 1997). Moist chilling treatment of seeds may aid in germination success, as does planting the seeds shallowly and controlling for weeds (Fuentes-Granados 1997). A population of approximately 20 individuals of *A. nepetoides* has been successfully established in the edges of an open woodland at the Norcross Wildlife Sanctuary in Monson, Massachusetts. According to the records of Leslie Duthie of the Norcross Wildlife Sanctuary, the seed was obtained from the North American Rock Garden Society seed exchange in late January of 1997. The seed was not collected from the wild, and it came from Casper Ultee of the Connecticut Botanical Society. The seeds were sown in their greenhouse in a seed starter mix (metro mix 360) with a fine screened sand cover over the seed. The seeds were sown on February 11, 1997 and germinated on February 20, 1997. Fifty seedlings were transplanted into a soil mix of 2 parts loam, 2 parts perlite, 1 part peat with about 3 parts of metro mix added to keep it a light soil mix. The plants were transplanted into a flat on March 4, 1997 and continued to grow in the green house. Approximately 40 plants were planted into the garden on June 14, 1997. There are currently approximately 20 plants growing in an upland woodland garden. The soil is on the dry side, but has been enriched with decomposing leaf compost and cow manure. Plants seem to do best under a canopy of *Acer saccharum*, *Fraxinus americana* and some *Populus alba* and where most plants get at least a half a day of

sun. Plants that were planted under a large maple tree receive significant shading, and most of the seedlings in this area have been lost. It appears that plants that receive too much shade do not do well (L. Duthie, personal communication).

Another population of *A. nepetoides* is growing at the NEWFS Rare Plant Garden in the Woods (seeds were obtained from Shaw Arboretum), and according to Chris Matrick (personal communication), it was easy to germinate and grow. On March 4, 1997 a large number of seeds were sown on flats in straight nursery starter mix and grown in a warm greenhouse resulting in 132 seedlings in two flats by March 24, 1997. The seedlings were transplanted into pots (10 plants per pot) and moved outdoors in May 1997. The seedlings were planted in the garden in June 1997 at the edge of a woodland trail on the north side of a hill. Plants received direct sun for about one hour per day and ambient light for the rest of the day. Soils were amended with lime to be slightly calcareous. Plants grew to over 8 feet in height and seeded themselves within the garden. In 2000, the adult plants originally planted in 1997 did not appear, but the younger seedlings became well established (Chris Matrick, New England Wildflower Society, personal communication). Between the germination and planting work done by NEWFS and Norcross, there is a well-established germination protocol for growing *A. nepetoides* in New England.

Susceptibility to diseases and pests is yet another factor affecting the establishment and maintenance of *Agastache* species. In this regard, *A. nepetoides* is reported to have a low susceptibility to verticillium wilt (Fuentes-Granados and Widrechner 1995). In one study in Illinois, scarce endotrophic mycorrhizal fungi were found associated with two individual plants of *A. nepetoides*; presumably the fungus was parasitic and not symbiotic to the plant (McDougall and Liebttag 1928).

Some work has been done on the usefulness of *Agastache* species (especially *A. foeniculum*) as bee forage (Ayers and Widrechner 1994). There are several potential pollinators of *Agastache* flowers, including members of the orders Hymenoptera, Diptera, and Lepidoptera (Vogelmann 1983). *Agastache* species produce volatile oils that are being investigated for commercial and agricultural uses as well (Wilson et al. 1992, Fuentes-Granados 1997).

HABITAT/ECOLOGY

According to information from a number of state Natural Heritage programs, herbarium specimens, and from the literature, *A. nepetoides* can be found in a variety of habitats but typically inhabits rich open woods and woodland edges, edges of calcareous woods, thickets, low moist open woods, and floodplains (Fernald 1950, Gleason 1952, Gleason and Cronquist 1991). It is also found along railroad tracks, fencerows, and roadsides (Vogelmann 1983).

Agastache nepetoides is common in the Piedmont of Delaware but rare on the Coastal Plain, where it is only found on rich loamy soils. *Agastache nepetoides* can be found in the following rich-woods community types: yellow poplar woodlands, mesic hardwood forests and tulip poplar dominated forests. *Agastache nepetoides* is not found in dense shading habitats or in full sun, but it prefers open woodlands with filtered sunlight (William McAvoy, Delaware Natural Heritage Program, personal communication).

In North Carolina, *A. nepetoides* occurs primarily in the Piedmont but can be found in the coastal plain and mountains. It is generally is found in woodlands and forests growing in soils derived from calcareous or mafic bedrock (Jame Amoroso, North Carolina Natural Heritage Program, personal communication).

In the Midwest, *A. nepetoides* is reasonably common, although its occurrence is sporadic and difficult to predict. It is sometimes considered to be weedy and to grow in areas of disturbance. It is also found in river bottomlands and old pasturelands that are reverting to shrublands (James Vogelmann, Raytheon Corporation USGS/EROS Data Center, personal communication). In Wisconsin, *A. nepetoides* is found in open woods and woodland edges and is associated with floodplain forests, southern mesic forests and southern dry-mesic forests. (Craig Anderson, personal communication). The Wisconsin natural community descriptions for these habitats are listed in Appendix One.

In New York, *A. nepetoides* is found in or on the edges of woods with rich soils and limestone bedrock, on the edges of rivers, roads, and thickets, or in disturbed, moist woods. Associated community types and tree and understory species include: rich maple woods (maple-basswood rich mesic forest and beech-maple woods), sugar maple (*Acer saccharum*), tulip tree (*Lyriodendron tulipifera*), white ash, (*Fraxinus americana*), American basswood (*Tilia americana*), white poplar (*Populus alba*), American elm (*Ulmus americana*), hop hornbeam (*Ostrya virginiana*), tree of heaven (*Ailanthus altissima*), running strawberry bush (*Euonymus obovatus*), and nightshade (*Circaea* sp.) (Steve Young, New York State Department of Environmental Conservation, personal communication). In New York there are confirmed records of *A. nepetoides* from Washington and Renssalaer counties. These counties are close to Bennington County in Vermont, which is the site of the extant Vermont population (Robert Popp, Vermont Nongame and Natural Heritage Program, personal communication).

The two extant populations in New England occur on rich, limy soils on the lower portion of southwest facing slopes at the edges of woodlands. The extant Vermont population of *A. nepetoides* (VT .001 Pownal) is found in alluvial floodplain forest with an overstory of sugar maple (*Acer saccharum*) and silver maple (*Acer saccharinum*), white ash (*Fraxinus americana*), American basswood (*Tilia americana*), black cherry (*Prunus serotina*), and associated plant species (*Rhus glabra*, *Polygonum scandens*, *Rubus* spp., *Solidago rugosa*, *Solidago gigantea*, *Phytolacca americana*, *Solanum dulcamara*, *Vitis aestivalis*, *Echinocystis lobata*, *Apios americana*, *Rumex obtusifolius*, *Impatiens capensis*, *Impatiens pallida*, *Cirsium* sp., *Arctium lappa*, *Amphicarpa bracteata*, and *Chelone glabra*).

The Connecticut (CT.001 Canaan) population is located in northwestern Connecticut, occurs on limestone bedrock, and is found on rich soils located under a predominantly sugar maple (*Acer saccharum*) overstory with associated plant species (*Impatiens capensis*, *Smilacina racemosa*, *Alliaria officinalis*, *Arctium lappa*). These associated forest and plant species are similar to those found in other states where *A. nepetoides* is more abundant. *Agastache nepetoides* is associated with rich soils and calcareous bedrock, and the richness of the soils may be limiting the populations of *A. nepetoides* in New England. Additionally, the two extant New England populations are at the eastern edge of the range of *A. nepetoides*.

THREATS TO TAXON

Habitat Loss

The landscape of New England has changed dramatically since many of the historic specimens of *A. nepetoides* were discovered, from that of an open agricultural landscape to a much more forested landscape. Several populations of *A. nepetoides* that were documented decades ago with herbarium specimens and field surveys have been also lost to development. Additional historic populations that have been documented by herbarium specimens may have been lost, but insufficient locational information has meant that they have not been resurveyed or relocated. The extant population in Vermont appears to have been impacted directly by habitat loss due to the presence of a dirt road. According to Vermont Natural Heritage data, the population was estimated to be approximately 300 plants in 1982 and only 50 plants were observed in 2001. Direct habitat loss may in part be responsible for the reduction in this population.

Habitat Modification

Mowing and manure spreading may also be affecting the population of *A. nepetoides* in Vermont. The landowner has been stockpiling and spreading manure several inches thick in a large area adjacent to the population. This activity may have impacted the population by spreading the manure so thick that it covered or physically destroyed plants growing in that area.

While mowing may help to keep the habitat open and disturbed along the roadside thus favoring the population, the seasonal timing and frequency of the mowing must take the species biology into account. The timing of the mowing should occur in the early spring or after *A. nepetoides* sets seed in the fall. Mowing well after seed set may reduce competition from woody or other exotic plants and may assist in the dispersal of seeds. Mowing early in the season may also control competition from other species and still allow *A. nepetoides* enough time to flower and fruit. Because the population in Vermont is located on both sides of the roadway, the impacts of mowing are important. It appears that regular mowing does occur

along this dirt road to improve visibility and increase safety along the road. According to Vermont Natural Heritage data, the population was estimated to be approximately 300 plants in 1982 along both sides of the road. In 2001, only 50 plants were observed, with very few of these plants on the northeast side of the road, possibly indicating that roadside mowing may be impacting the population. Because the road is a dirt road it is most likely not heavily salted.

Competition from Invasive Species

Agastache nepetoides populations may be negatively impacted by the presence of non-native invasive plant species. The extant population in northwest Connecticut is very small, and previously it may have covered a much larger area than it does now (William Moorhead, Botanist, personal communication). Maps provided by William Moorhead to the authors indicated a large area which he believed the population to be occupying, and he noted early season sprouts in 1997 of what he thought to be *A. nepetoides*. The original population was reported in 1983 during a Connecticut Botanical Society field trip, and estimates for *A. nepetoides* in Connecticut Natural Diversity Data Base records were reported as “a number of plants.” Several invasive plant species were noted in the larger area around the extant population including *Berberis thunbergii* (Japanese barberry) and *Celastrus orbiculatus* (Asiatic bittersweet) and *Alliaria petiolata* (Garlic mustard). These invasive plant species may have impacted the larger population that W. Moorhead noted in 1997. However, they were not directly adjacent to the small population in the 2001 survey.

Ecological Succession

The extant population in northwest Connecticut is very small and found along an old logging road and very close to a residence with extensive gardens. The canopy of sugar maples is extensive and is possibly shading this population. Information from a population that was established at the Norcross Wildlife Sanctuary in Monson, Massachusetts showed that a number of seedlings did not survive under the dense shade of a large maple tree (L. Duthie, personal communication). *Agastache nepetoides* seems to prefer the edges of woodlands that have adequate light with some shading. Additionally, mint species that rely upon open woods tend to move around and rarely persist in one location for very long (R. Popp, personal communication).

DISTRIBUTION AND STATUS

General Status

Agastache nepetoides is found in the eastern and mid-western United States and south-central Canada. It is listed as a Division 2 species in *Flora Conservanda* (Brumback

and Mehrhoff et al. 1996), which is defined as a regionally rare taxon with fewer than 20 occurrences within New England. Its global rank is G5, and both its United States and Canadian national ranks are N?. It is more common in some Midwestern states and Ontario. However, it is only found in two New England States (Connecticut and Vermont). The North American distribution of *A. nepetoides* is presented in Figure 1. The distribution and current state and subnational ranks of *A. nepetoides* are presented in Table 1.

Table 1. Occurrence and status of <i>Agastache nepetoides</i> in the United States and Canada based on information from Natural Heritage Programs.			
OCCURS & LISTED (AS S1, S2, OR T &E)	OCCURS & NOT LISTED (AS S1, S2, OR T & E)	OCCURRENCE REPORTED OR UNVERIFIED	HISTORIC (LIKELY EXTIRPATED)
Alabama (S1)	District of Columbia (S?)	Arkansas (SR)	Georgia (SH)
Connecticut (S1)	Illinois (S?)	Indiana (SR)	
Delaware (S2)	Iowa (S4)	Kansas (SR)	
New Jersey (S2)	Kentucky (S?)	Maryland (SR)	
New York (S2S3)	Michigan (S?)	Massachusetts (SR)	
North Carolina (S1)	West Virginia (S?)	Minnesota (SU)	
Vermont (S1)	Pennsylvania (S?)	Missouri (SR)	
Wisconsin (S2)	Ontario (S4)	Nebraska (SR)	
Quebec (S1)		Ohio (SR)	
		Oklahoma (SR)	
		South Carolina (SU)	
		South Dakota (SR)	
		Tennessee (SR)	
		Virginia (SR)	

Status of all New England Occurrences – Current and Historical

Agastache nepetoides has been identified at two stations in Vermont and seven stations in Connecticut, and has not been found in other New England states (Table 2). Of the Vermont occurrences, one is an historical record and one is extant (confirmed during the site visit of 2001). Of the Connecticut occurrences, one is extant and seven are historical records mainly from herbarium specimens. The extant Connecticut population was field-checked and confirmed during the site visit of 2001. While the Natureserve data base lists Massachusetts as "SR," the Massachusetts Natural Heritage Program has never listed it or considered it to be historic (Melissa Dow Cullina, Massachusetts Natural Heritage and Endangered Species Program, personal communication).

Element Occurrence (EO) ranks are given in Table 2. These ranks are assigned by the state Natural Heritage programs for each population, and are developed from an assessment of population size and productivity, condition, viability, and site defensibility. Ranks range from excellent (A) to poor (D). A rank of E is given when an occurrence is known to be extant but there is not enough specific information to assign a more specific rank. A rank of H is given for sites in which individuals of the population have not been observed for more than 20 years (generic definition). A rank of EI is given to populations suspected to be introduced (Karen Zyko, Connecticut Natural Heritage Program, personal communication).

It is difficult to determine population trends for *A. nepetoides* in New England, primarily due to the small number of sites in which it is extant. Monitoring of population size and health must be done during the flowering season or early in the fruiting season. While *A. nepetoides* is a large and distinctive plant, it does not have a very showy flower, and new populations may be overlooked by field botanists (W. Moorhead, personal communication). In Connecticut and Vermont, not every population has been visited on a yearly basis, and historical records have not been checked for the possibility of extant populations.

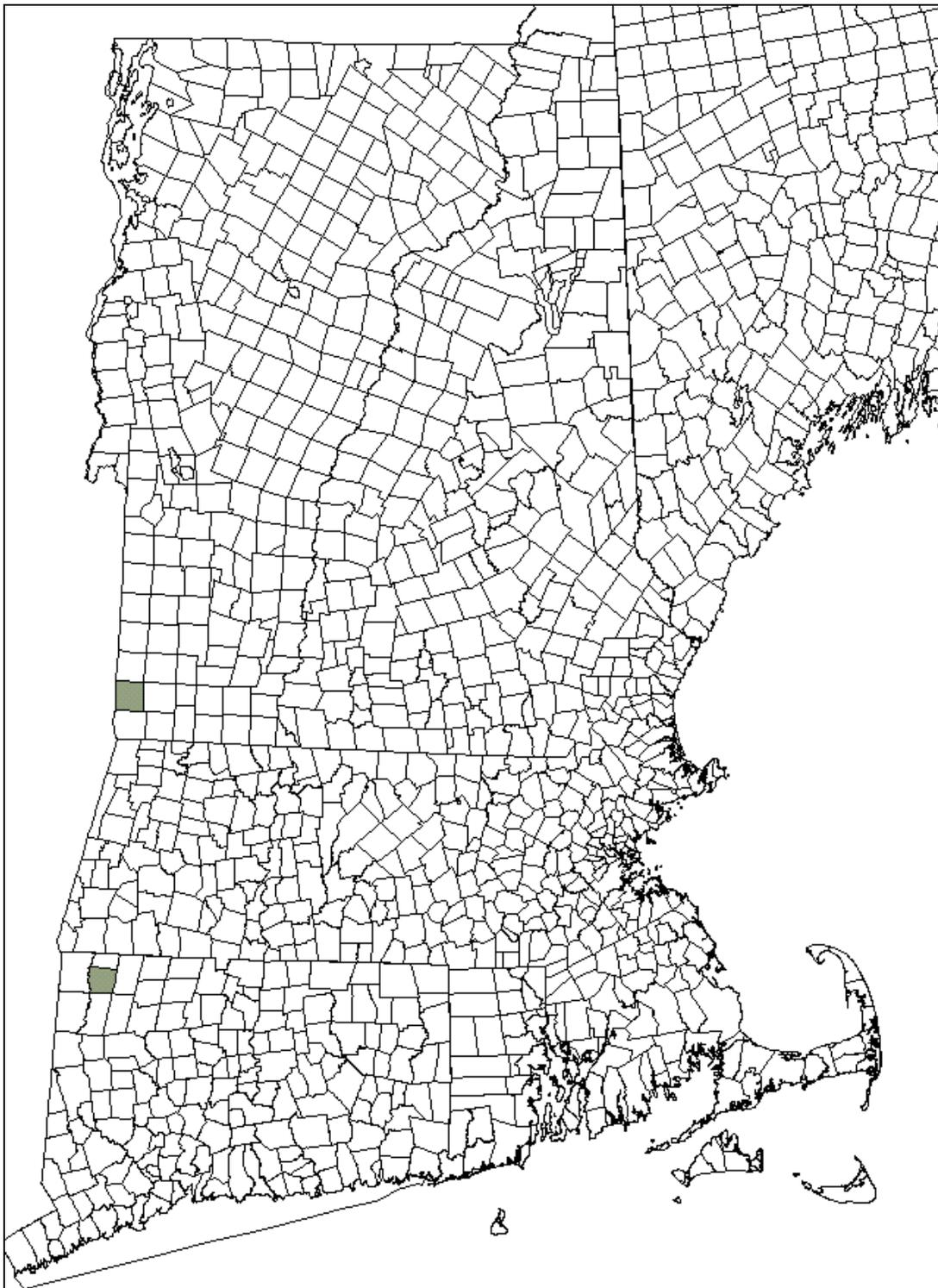


Figure 2. Extant occurrences of *Agastache nepetoides* in New England. Town boundaries for New England states are shown. Towns shaded in gray have one to five current occurrences of the taxon.

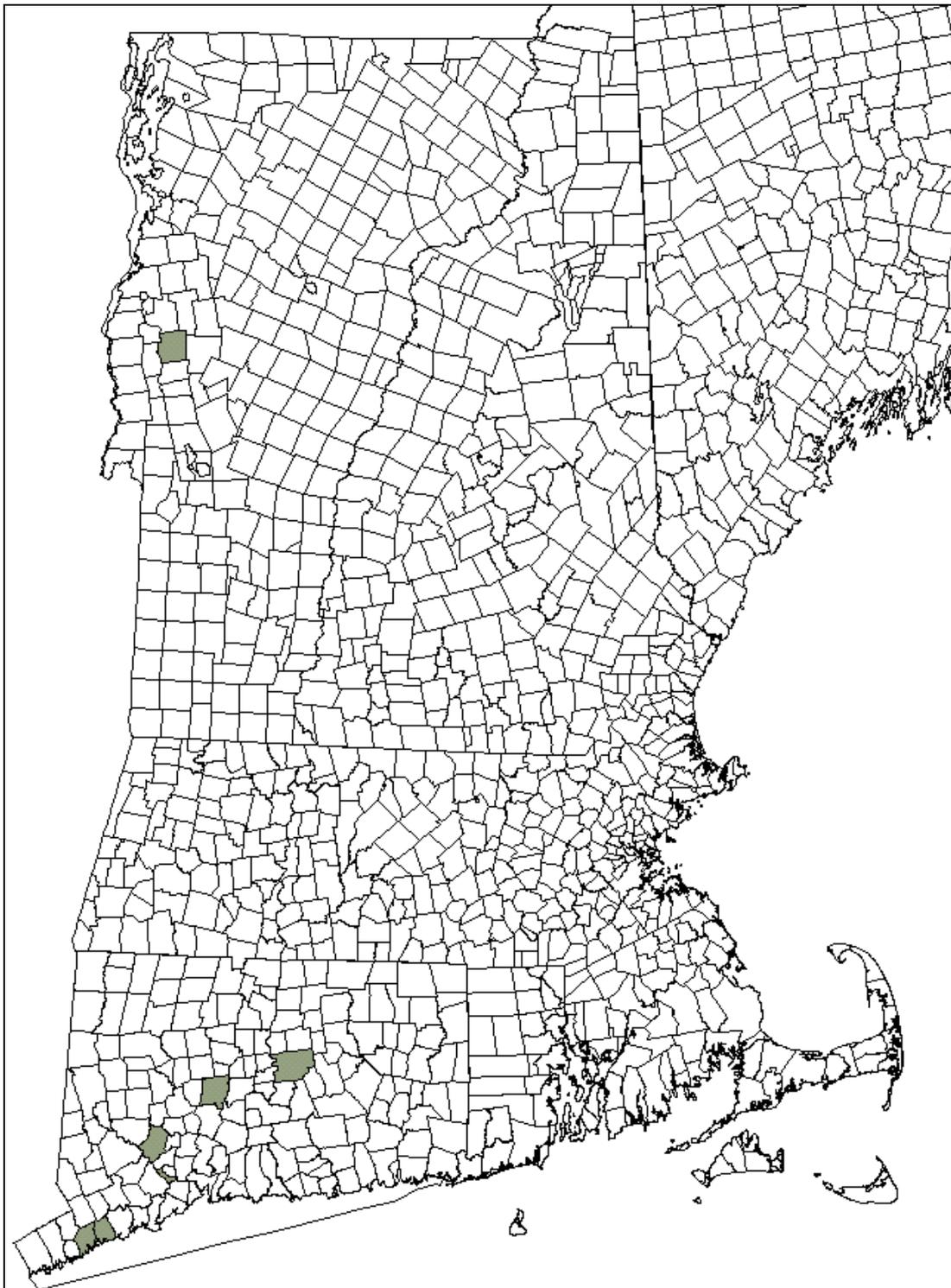


Figure 3. Historical occurrences of *Agastache nepetoides* in New England. Towns shaded in gray have one to five historic records of the taxon.

Table 2. New England Occurrence Records for <i>Agastache nepetoides</i>.			
Shaded occurrences are considered extant.			
State	EO #	County	Town
VT	.001	Bennington	Pownal
VT	.002	Addison	Middlebury
CT	.001	Litchfield	Canaan
CT	.002	New Haven	Derby
CT	.003	Fairfield	Norwalk
CT	.004	Fairfield	Westport
CT	No #	Hartford	Southington
CT	NO #	Hartford	Southington
CT	NO #	New Haven	Oxford
CT	No #	Hartford	Glastonbury

CURRENT CONSERVATION MEASURES IN NEW ENGLAND

Vermont

Agastache nepetoides is listed as Threatened in Vermont and is protected under the Vermont Endangered Species Law (10 V.S.A. Chapter 123). “Threatened Species” in Vermont are defined as having a high possibility of becoming endangered in the near future. “Endangered Species” are defined as being in immediate danger of becoming extirpated in the state. Protection of Endangered and Threatened species prohibits the taking, possessing or transport of wildlife or plants that are members of the endangered and threatened species without a permit issued by the secretary of natural resources. Persons violating the law shall be fined. There is an agricultural and silvicultural exemption to this law.

Conservation measures in Vermont by the Vermont Natural Heritage Program and the New England Wild Flower Society include monitoring of rare plant populations, contacting landowners.

Connecticut

Agastache nepetoides is listed as a Species of Special Concern in Connecticut and is protected under Connecticut law (Public Act 89-224). “Species of Special Concern” in Connecticut includes “any native plant species or any native non-harvested wildlife species documented by scientific research and inventory to have a naturally restricted range or habitat in the state, to be at a low population level, to be in such high demand by man that its unregulated taking would be detrimental to the conservation of its population or has been extirpated from the state” (Connecticut Department of Environmental Protection 2001).

State Endangered and Threatened species are protected by the Connecticut Endangered Species Act (Connecticut General Statutes Sec. 26-303 to Sec. 26-315). The purpose of the Act is to conserve, protect, restore and enhance any endangered or threatened species. The Act requires that any action authorized, funded or performed by *state agencies* cannot threaten the continued existence of any State Endangered or State Threatened species. The Act prohibits the taking of an Endangered or Threatened species for the purposed of selling, offering for sale, transporting for commercial gain or export. However, a private landowner is not prohibited from "performing any legal activities on his own land that may result in the incidental taking of endangered or threatened animal and plant species or species of special concern" (Sec.26-311 (b)). For more detailed information on the Connecticut Endangered Species Act, please refer to the Connecticut General Statutes Section 26-303.

Conservation measures in Connecticut by the Connecticut Natural Heritage Program and the New England Wild Flower Society include monitoring of rare plant populations and landowner contact.

II. CONSERVATION

CONSERVATION OBJECTIVES FOR THE TAXON IN NEW ENGLAND

Agastache nepetoides is a regionally rare, Division 2 species in New England (Brumback and Mehrhoff et al. 1996). Globally, the taxon is not considered to be rare (G5 rank), but it is considered rare in certain eastern and southern states in the United States. The New England populations are significant because they represent the northeastern limit of the species range in the United States. The population is possibly at a critical threshold, with the only known natural extant population being at one site in Vermont. According to the Connecticut Natural Heritage Program information, the extant Connecticut population is ranked EI and is suspected to be introduced (K. Zyko, personal communication).

Because of the suspect nature of the Connecticut extant population and the apparently disjunct nature of the two extant New England populations, it may make sense to do some limited genetic work to determine if the two populations are related to each other or to populations in New York in order to determine whether the Connecticut population is likely to be native or introduced. If it is introduced, seeds for reintroduction purposes should only be taken from the Vermont population if the goal is to preserve and propagate the native New England genetic material. If the New England populations and other populations of *A. nepetoides* are genetically indistinguishable, then seed for reintroduction could be taken from other populations as well.

The primary conservation goal for *A. nepetoides* in New England is to provide protection and possible restoration to existing populations in Connecticut and Vermont. In addition, it is important that historical and/or new populations are discovered and that existing populations are managed appropriately to maintain large, healthy, and stable populations. Monitoring studies should be done for this species to determine the health and long-term stability of the existing populations. Such monitoring will help determine how much management is needed to maintain *A. nepetoides* in the New England landscape.

Attempts should be made to locate other populations in appropriate habitats using historical record information. To maintain the long-term viability of *A. nepetoides* populations in New England, attempts should be made to increase the number of extant populations to near-historical levels. At least one additional population in Vermont and four to six additional populations in Connecticut would bring this species back to a safer status in New England. The populations in each state should be reproductively healthy and large enough (50-100 individuals) to provide source material for other less viable populations. Success of these objectives can be measured through the maintenance or improvement of the current state ranks of (VT S1 and CT S1) and by meeting specific conservation plan objectives.

III. LITERATURE CITED

Ayers, G. S. and M. P. Widrlechner. 1994. The genus *Agastache* as bee forage: A historical perspective. *American Bee Journal* 134: 341-348.

Brumback W. E., L. J. Mehrhoff, R. W. Enser, S. C. Gawler, R. G. Popp, P. Somers, D. D. Sperduto, W. D. Countryman, and C. B. Hellquist. 1996. *Flora Conservanda*: New England. The New England Plant Conservation Program (NEPCoP) list of plants in need of conservation. *Rhodora* 98: 233-361.

Connecticut Department of Environmental Protection. Natural Diversity Database 2001. Hartford, Connecticut, USA. Available: <http://dep.state.ct.us/cgnhs/nddb/Nddb2.htm> (Accessed: July 4, 2002).

Fernald, M. L. 1950. *Gray's Manual of Botany*. Eighth edition. American Book Company. New York, New York, USA.

Fuentes-Granados, R. G. 1997. *Genetic Studies of Agastache*. Ph.D. Dissertation, Iowa State University, Ames, Iowa, USA.

Fuentes-Granados, R. G. and M. P. Widrlechner. 1995. Evaluation of *Agastache* and other Lamiaceae species for reaction to *Verticillium dahliae*. *Journal of Herbs, Spices and Medicinal Plants* 3: 3-11.

Gleason, H. A. 1952. *The New Britton and Brown: Illustrated Flora of Northeastern United States and Adjacent Canada*. Hafner Press, New York, New York, USA.

Gleason, H. A. and A. Cronquist. 1991. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*. The New York Botanical Garden, Bronx, New York, USA.

Lint, H. 1942. *A Revision of the Genus Agastache (Labiatae)*. M. A. Thesis, University of California at Los Angeles, Los Angeles, California, USA.

Lint, H. and C. Epling. 1945. A revision of *Agastache*. *American Midland Naturalist* 33: 207-230.

McDougall, W. B. and C. Liebttag. 1928. Symbiosis in a deciduous forest. III. Mycorrhizal relations. *Botanical Gazette* 86: 226-234.

Morris, W., D. Doak, M. Groom, P. Kareiva, J. Fieberg, P. Murphy, and D. Thomson. 1999. *A Practical Handbook for Population Viability Analysis*. The Nature Conservancy, Arlington, Virginia, USA.

NatureServe: An online encyclopedia of life [web application]. 2001. Version 1.5. Arlington Virginia, USA: Association for Biodiversity Information. Available: <http://www.natureserve.org/>

Newcomb, L. 1977. *Newcomb's Wildflower Guide*. Little, Brown and Company, Boston, USA.

Vogelmann, J. E. and G. J. Gastony. 1987. Electrophoretic enzyme analysis of North American and Eastern Asian populations of *Agastache* sect. *Agastache* (Labiatae). *American Journal Botany* 74: 385-393.

Vogelmann, J. E. 1983. A biosystematic study of *Agastache* section *Agastache* (Labiatae) Ph. D. Dissertation, Indiana University, Bloomington, Indiana, USA.

Vogelmann, J. E. 1985. Crossing relationships among North American and Eastern Asian populations of *Agastache* sect. *Agastache* (Labiatae). *Systematic Botany* 10: 445-452.

Wilson, L. A., N. P. Senechal, and M. P. Widrechner. 1992. Headspace analysis of the volatile oils of *Agastache*. *Journal of Agriculture Food Chemistry* 40: 1362-1366.

Wisconsin Department of Natural Resources. 2001. Available at <http://www.dnr.state.wi.us/org/land/er/factsheets/plants/Hyssop.htm> (Accessed December 2001)

IV. APPENDICES

1. **Wisconsin natural community descriptions for habitats associated with *A. nepetoides***
2. **An Explanation of Conservation Ranks used by The Nature Conservancy and NatureServe**

1. Wisconsin Natural Community Descriptions for Habitats Associated with *A. nepetoides* (compiled from Wisconsin Department of Natural Resources 2001):

Floodplain Forest (replaces in part the **Southern Wet** and **Southern Wet-Mesic Forests** of Curtis)

This is a lowland hardwood forest community that occurs along large rivers, usually stream order 3 or higher, that flood periodically. The best-development occurs along large southern rivers in southern Wisconsin, but this community is also found in the northern Wisconsin Canopy dominants may include silver maple (*Acer saccharinum*), river birch (*Betula nigra*), green ash (*Fraxinus pensylvanica*), hackberry (*Celtis occidentalis*), swamp white oak (*Quercus bicolor*), and cottonwood (*Populus deltoides*). Northern stands are often species poor, but balsam-poplar (*Populus balsamifera*), box-elder (*Acer negundo*) and bur oak (*Quercus macrocarpa*), and box elder (*Acer negundo*) may replace some of the missing "southern" trees. Buttonbush (*Cephalanthus occidentalis*) is a locally dominant shrub and may form dense thickets on the margins of oxbow lakes, sloughs and ponds within the forest. Nettles (*Laportea canadensis* and *Urtica dioica*), sedges, ostrich fern (*Matteuccia struthiopteris*) and gray-headed coneflower (*Rudbeckia laciniata*) are important understory herbs, and lianas such as Virginia creepers (*Parthenocissus* spp.), grapes (*Vitis* spp.), Canada moonseed (*Menispermum canadense*), and poison-ivy (*Toxicodendron radicans*) are often common. Among the striking and characteristic herbs of this community are green-headed coneflower (*Rudbeckia laciniata*), cardinal flower (*Lobelia cardinalis*), green dragon (*Arisaema dracontium*), and false dragonhead (*Physostegia virginiana*).

Southern Mesic Forest

This upland forest community occurs on rich, well-drained soils. The dominant tree species is sugar maple (*Acer saccharum*), but basswood (*Tilia americana*) and (near Lake Michigan) beech (*Fagus grandifolia*) may be co-dominant. Many other trees are found in these forests, including those of the walnut family (Juglandaceae). The understory is typically open (sometimes brushy with species of gooseberry [*Ribes*]) if there is a past history of grazing) and supports fine spring ephemeral displays. Characteristic herbs are spring-beauty (*Claytonia virginica*), trout-lilies (*Erythronium* spp.), trilliums (*Trillium* spp.), violets (*Viola* spp.), bloodroot (*Sanguinaria canadensis*), blue cohosh (*Caulophyllum thalictroides*), mayapple (*Podophyllum peltatum*), and Virginia waterleaf (*Hydrophyllum virginianum*).

Southern Dry-Mesic Forest

Red oak (*Quercus rubra*) is a common dominant tree of this upland forest community type. White oak (*Q. alba*), basswood (*Tilia americana*), sugar and red maples (*Acer saccharum* and *A. rubrum*), and white ash (*Fraxinus americana*) are also important. The herbaceous understory flora is diverse and includes many species listed under Southern Dry Forest plus jack-in-the-pulpit (*Arisaema triphyllum*), enchanter's-nightshade (*Circaea lutetiana*), large-flowered bellwort (*Uvularia grandiflora*), interrupted fern (*Osmunda claytoniana*), Lady Fern (*Athyrium Filix-feomina*), tick-trefoils (*Desmodium glutinosum* and *D. nudiflorum*), and hog peanut (*Amphicarpa bracteata*). To the detriment of the oaks, mesophytic tree

species are becoming increasingly important under current management practices and fire suppression policies.

2. An Explanation of Conservation Ranks Used by The Nature Conservancy and NatureServe

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 are 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.