

New England Plant Conservation Program

Nabalus racemosus (Michx.) Hook.
Glaucous white lettuce

Conservation and Research Plan
for New England

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SUMMARY

Nabalus racemosus (Michx.) Hook., glaucous white lettuce, is a perennial member of the Asteraceae or composite family. It is considered globally secure (G5), but in New England, it is known only from northern Maine, primarily along the St. John River. There are also several occurrences along the Aroostook River. Ice scour and flooding are common annual disturbances on these rivers. Many of the *N. racemosus* populations were discovered during survey efforts for *Pedicularis furbishiae* (Furbish's lousewort), and both species, as well as many other rarities, may be found at some sites. In other parts of the country, *N. racemosus* grows in prairie communities.

There are currently 31 extant occurrences in Maine, 28 of these along the St. John River, and three on the Aroostook River. There are four historic occurrences, all on the Aroostook River, and one extirpated population on the Aroostook River. *Nabalus racemosus* is a species of Special Concern in Maine, where it is ranked S3. Other nearby areas from which it is recorded include New Brunswick (S3), Nova Scotia (S1), Newfoundland Island (S1S2), Labrador (SR), Quebec (SR), Vermont (SR), New Jersey (SH), New York (SX), and Pennsylvania (SX).

Little is known regarding the biology of *Nabalus racemosus*. It typically flowers in August and September, and dispersal by water or wind is probable. An increase in flowering has been observed following spring fires in Minnesota prairie populations. Parasitic fungi have been recorded from plants in Wisconsin. Potential threats to populations include disruption of current river disturbance regimes, river bank disturbances, and invasion of non-native plant species.

Many populations of *Nabalus racemosus* along the St. John River are under conservation ownership, easement, or some other conservation protection plan, though those along the Aroostook River are not. The ideal conservation objective for *N. racemosus* in 20 years is to have 35 or more extant occurrences, with at least six of these on the Aroostook River, and with one or two "A"-ranked populations. It is likely that with increased survey effort, more populations will be discovered on both the St. John River and the Aroostook River. Conservation actions to meet these objectives include *de novo* searches for new populations, general protection of river systems and hydrology, landowner education, regular survey and inventory, and species biology research.

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.

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I. BACKGROUND

INTRODUCTION

Nabalus racemosus (Michx.) Hook., glaucous white lettuce, is a perennial member of the Asteraceae or composite family. In New England, it is known only from northern Maine, primarily along the St. John River, with several occurrences along the Aroostook River. It grows in a calcareous-circumneutral river shore community, typically on the open cobble shore. These river systems, especially the St. John River, are high-energy systems, and ice scour and flooding are common annual disturbances. Many of the *N. racemosus* populations were discovered in survey efforts for *Pedicularis furbishiae* (Furbish's lousewort), and both species, as well as many other rarities, may be found at some sites. In other parts of the country, *N. racemosus* grows in prairie communities.

Flora Conservanda lists *Nabalus racemosus* as a Division 2 species (Brumback and Mehrhoff et al. 1996). Division 2 species are regionally rare taxa with generally fewer than 20 current occurrences within New England, or if there are more than 20 occurrences (as is the case for *N. racemosus*), this taxon is at the edge of its range in New England (Brumback and Mehrhoff et al. 1996). There are currently 31 extant occurrences in Maine, 28 of these along the St. John River, and three on the Aroostook River. There are four historic occurrences in Maine, all on the Aroostook River, and one population on the Aroostook River was extirpated as a result of inundation associated with the Tinker Dam just downriver in New Brunswick. *Nabalus racemosus* is a species of Special Concern in Maine, where it is ranked S3. The nearest populations out of state are in New Brunswick (S3), and many of these are on the Canadian side of the St. John River in areas where it occurs in Maine. There are also a few occurrences in New Brunswick further downstream from Edmonston/Madawaska on the St. John River. Other occurrences in northeastern North America are in Nova Scotia (S1), Newfoundland Island (S1S2), Labrador (SR), Quebec (SR), Vermont (SR—one or two plants, likely introduced; Blake 1914), New Jersey (SH), New York (SX), and Pennsylvania (SX). *Nabalus racemosus* is considered globally secure (G5).

Little is known regarding the biology of *Nabalus racemosus*. It typically flowers in August and September (Fernald 1950), and dispersal by wind and water is suspected. Parasitic fungi have been recorded from plants in Wisconsin (Greene 1945, 1950, 1952). An increase in flowering has been observed following spring fires in Minnesota prairie populations (Collins and Wallace 1990). Potential threats to populations include disruption of current river disturbance regimes, river bank disturbances, and invasion of non-native plant species.

Many populations of *Nabalus racemosus* along the St. John River are under conservation ownership, easement, or some other conservation protection plan. This is not the case for those on the Aroostook River. The ideal conservation objective for *N.*

racemosus in 20 years is to have 35 or more extant occurrences, with at least six of these on the Aroostook River, and with one or two “A”-ranked populations. It is likely that with increased survey effort, more populations will be discovered on both the St. John River and the Aroostook River.

This conservation plan is written in two sections. The first section summarizes the available information on the taxonomy, biology, ecology, distribution, and status of *Nabalus racemosus*. The second section presents conservation objectives and general conservation actions for *N. racemosus* in New England, specific conservation actions for each occurrence, and a prioritized implementation schedule for these conservation actions.

DESCRIPTION

The following description is from Fernald (1950), Scoggan (1979), and Gleason and Cronquist (1991), except where noted. *Nabalus racemosus* plants are 0.2-1.5 m tall, and are smooth and glaucous, except for the inflorescence, which is long-hairy. Lower leaves are oval to obovate to oblong-lanceolate, denticulate, and 7-40 x 1.5-10 cm in size. Basal leaves taper to winged petioles that are rarely cut-pinnatifid. Within a short distance up the stem, cauline leaves become sessile, with a broad attachment to the flowering stem (Arthur Haines, New England Wild Flower Society, personal communication), to partly clasping. Cauline leaves are more or less reduced upwards. The stem and leaves have a distinctive bluish-gray hue (Crossley 1983). The inflorescence is narrow and elongate, with flower heads loosely ascending or occasionally nodding, in crowded clusters forming a dense or interrupted leafy thyrse. When in bud, the flowering end of the stem is bent almost perpendicular to the lower stem, but this straightens as the flowers open (Crossley 1983). Flowers are pink or purplish, occasionally white. Involucres are 9-14 mm long, purplish or blackish, sparsely to usually densely long-hirsute, and contain 12-15 flowers. The pappus is creamy to light brown. The diploid number is $2n=16$ (Hinds 2000).

Fernald (1950) separates white-flowered plants of *Prenanthes racemosa* (= *Nabalus racemosus*; see Taxonomic Relationships, History, and Synonymy) as forma *Rollándii* Vict. & Rousseau; this form has a yellowish pappus. Cronquist (1948) separates two subspecies based on number of flowers and involucral bracts, with the more northern and western plants (subspecies *multiflora*) having more of each. Gleason and Cronquist (1991) more fully describe this, with variety *racemosa* having about 8 (7-10) involucral bracts and about 14 (9-16) flowers per head, occurring from Quebec to New Jersey, west to Minnesota and Iowa, and variety *multiflora* (Cronq.) Cronq. having about 13 (10-14) involucral bracts and about 21 (17-26) flowers per head, occurring from Alberta and Colorado to Minnesota and Iowa, and occasional through the northern part of our range to Quebec and northern Maine. Some authors (e.g., Cochrane and Iltis 2000) doubt these divisions. Based on Cronquist (1948), our plants belong to subspecies *multiflora*, but this plan does not separate the different subtaxa, in part because not all

authors agree that these subtaxa are valid. Scoggan (1979) separates the various infraspecific taxa of *Prenanthes racemosa* as follows:

1. Phyllaries at most 10; flowers commonly not more than 15.....ssp. *racemosa*
 2. Leaves merely minutely dentate.....var. *racemosa*
 3. Flowers pink.....forma *racemosa*
 3. Flowers whitish (known only from the type locality, Longueuil, near Montreal, Quebec).....forma *rollandii* Vict. & Rousseau
 2. Leaves more or less lyrate-pinnatifidvar. *pinnatifida* Gray
 1. Phyllaries 10 or more; flowers up to 25 or more.....ssp. *multiflora* Cronq.

Other *Nabalus* species that occur in Aroostook County, Maine and in New Brunswick are *N. altissimus* and *N. trifoliatus* (Campbell et al. 1995, Hinds 2000). *Nabalus racemosus* separates from other *Nabalus* species in Maine (including *N. albus*, *N. boottii* [S1], *N. nana* [S1]) and New Brunswick by the stem leaves, which in *N. racemosus* are sessile, but at least the lower stem leaves are petioled in the other species (Scoggan 1979, Haines and Vining 1998). The lowermost basal leaves in *N. racemosus* taper to long petioles, but lower stem leaves are sessile, while other *Nabalus* species in Maine have petioled basal leaves and also petioled lower stem leaves; only the upper stem leaves on these species are sessile (Haines, personal communication). In addition, phyllaries are long-hirsute in *N. racemosus* and glabrous or minutely puberulent near the apex in other species in Maine (Haines and Vining 1998). The diploid number of *N. altissimus* and *N. trifoliatus* is $2n=16$ (Hinds 2000).

A hybrid between *Nabalus racemosus* and *N. trifoliatus* is known as *N. x mainensis* (Gray) Heller (Fernald 1950, Scoggan 1979). The stem in *N. x mainensis* is 0.5-1 m tall and leafy (Fernald 1950). As in *N. racemosus*, stem leaves of *N. x mainensis* are sessile, but the leaf blade is ovate and more abruptly narrowed to the short petiole; flower heads are persistently drooping on slender pedicels and glabrous (Fernald 1950). It is local in distribution, and has been found in northern New Brunswick, northern Maine, and eastern Quebec (Fernald 1950, Scoggan 1979). Campbell et al. (1995) list this hybrid for Aroostook County, and it is suspected to occur at ME .016 (St. Francis) and is documented as historic from ME .014 (Fort Kent). The Maine Natural Areas Program (MNAP) ranks *N. x mainensis* as State Historic (SH). Haines and Vining (1998) do not include it in their Maine flora. In Canada, it is known from the St. John River system in New Brunswick, as well as from Rivière-du-Loup, Temiscouata County, eastern Quebec, and Sandy Cove, Digby County, Nova Scotia (Scoggan 1979). Only one *N. x mainensis* plant, and also one plant of *N. racemosus*, was found at the sea cliffs of Sandy Cove, Nova Scotia (Smith and Erskine 1954). Hinds (2000) includes a note about *N. x mainensis* in New Brunswick, based on Scoggan (1979).

TAXONOMIC RELATIONSHIPS, HISTORY, AND SYNONYMY

The French botanist Andre Michaux first described this North American taxon as *Prenanthes racemosa* in 1803 (Milstead 1964, see below). The generic name comes from the Greek, for “*prenes*,” meaning drooping, and “*anthe*,” meaning flower (Fernald 1950). In 1833, the name was changed to *Nabalus racemosus* by Hooker, and to *Harpalyce racemosa* by Beck (Milstead 1964). In 1838, de Candolle used Hooker’s *Nabalus racemosus*. *Nabalus racemosus* was changed to *Prenanthes racemosa* Michx. for Gray’s “new” manual in the 1880’s (Foerste 1884).

Recently, DNA testing has shown the genus *Prenanthes* to be a polyphyletic group, with North American species separate from European species (Kim et al. 1996). There are also morphological differences between European *Prenanthes* and North American *Nabalus*. With *Prenanthes*, the leaves are chiefly cauline and not strongly reduced upward on the stem, the capitula has few flowers and few principal phyllaries (usually 5 or less), the corolla is often pubescent at the summit of the tubular portion, the pappus is pale (nearly white), the ovary has few vascular bundles (usually about 5), and the base chromosome number is $n=9$ (Haines, personal communication). With *Nabalus*, the leaves are basally disposed and strongly reduced upward with the lower much larger and more petiolate than the upper, the capitula has 5-30 flowers and 5-15 principal phyllaries, the corolla is glabrous, the pappus is darker (light brown, yellow-brown, or red-brown), the ovary has more vascular bundles (usually 5-20), and the base chromosome number is $n=8$ (Haines, personal communication). Because of this cytological and morphological evidence, our North American material should be referred to as *Nabalus racemosus* (Michx.) Hook. Currently, the author for *Nabalus racemosus* is cited by some as DC., but it should properly be Hooker (Kanchi Gandhi, Nomenclatural Editor of Flora of North America, personal communication).

Synonymy for Nabalus racemosus, including subtaxa.

- Prenanthes racemosa* Michx., *Flora Boreali-Americana* 2: 84. 1803
- Harpalyce racemosa* (Michx.) Don ex Beck, *Bot. N. and Mid. States*, p. 168. 1833
- Nabalus racemosus* (Michx.) Hook., *Flora Boreali-Americana* 1: 294. 1833
- Nabalus racemosus* (Michx.) DC., *Prodromus Systematis Naturalis Regni Vegetabilis* 7: 242. 1838
- Prenanthes racemosa* forma *rollandii* Vict. & J. Rousseau, *Contributions de l’Institut Botanique de l’Université de Montréal* 36: 52. 1940
- Prenanthes racemosa* subspecies *multiflora* Cronquist, *Rhodora* 50: 30. 1948
- Prenanthes racemosa* subspecies *racemosa* Cronquist, *Rhodora* 50: 30. 1948
- Prenanthes racemosa* variety *pinnatifida* A. Gray, *Synoptical Flora of North America* 1: 433. 1884
- Prenanthes racemosa* forma *racemosa* (Fernald 1950, Scoggan 1979)
- Prenanthes racemosa* variety *racemosa* (Scoggan 1979)
- Prenanthes racemosa* var. *multiflora* (Cronquist) Dorn (The Wisconsin State Herbarium 2002)

SPECIES BIOLOGY

There is little published on the biology of *Nabalus racemosus*. It is a perennial herb that flowers in August and September (Fernald 1950). The pappus suggests wind dispersal of the achene, but given its habitat in Maine, water dispersal is also likely.

Ripe seed collected on prairie remnants in Wisconsin, and cold-stratified out-of-doors for four months had a 100% germination percentage (Greene and Curtis 1950). Seed is available commercially from Prairie Moon Nursery (2002). Their original seed sources are from the driftless regions of southeast Minnesota, southwest Wisconsin, northeast Iowa, and northwest Illinois. The commercial seed is from plants they grow organically in outdoor nursery beds.

Parasitic fungi recorded on *Nabalus racemosus* in Wisconsin include an undetermined powdery mildew (Dane County, September 2, 1949), *Ascochyta* sp. on leaves (Lafayette Co, near Platteville, August 4, 1951), and *Septoria nabali* (Dane County, near Sauk City, September 16, 1944) (Greene 1950, 1952, 1945, respectively). *Puccinia nabali*, a rust fungus, was reported on *N. racemosus* (Michx.) Hook., Seven Islands, Saguenay County, Quebec, August 6, 1907 (Arthur 1910).

Nabalus racemosus was one of seven species in a northwestern Minnesota prairie study that showed a significant increase in flowering following spring fire in more than one habitat (Pemble et al. 1981 in Collins and Wallace 1990). Because the nutrient stimulus to grassland and some forb production disappears after one or occasionally two years, the effect of fires on prairie ecosystem function is transitory (Collins and Wallace 1990).

HABITAT/ECOLOGY

The habitat of *Nabalus racemosus* in Maine is typically cobbly shores of rivers with annual ice scour and flooding. For *Pedicularis furbishiae* (Furbish's lousewort, S2 in Maine and an endemic to the St. John River system), these disturbances create a dynamic mosaic of changing populations (Gawler et al. 1987) and a metapopulation structure (Menges 1990). It may be possible that *N. racemosus* follows a similar population pattern. However, one of the effects of ice scour on the banks where *P. furbishiae* occurs is to shear off the substrate along with plants, while on the flatter, cobbly areas where *N. racemosus* grows, the ice has more of a sheet action, so therefore is less likely to remove substrate and plants (Don Cameron, Maine Natural Areas Program [MNAP], personal communication; Sue Gawler, Gawler Conservation Services, personal communication). Though it is unclear if ice scour and flooding disturbances create a metapopulation structure for *N. racemosus*, these disturbances likely reduce competition from woody species and may stimulate flowering (as per Collins and Wallace 1990).

Rangewide, habitats for *Nabalus racemosus* include: stream banks, river banks, shores in Maine (Haines and Vining 1998); calcareous river banks, shores and damp prairies (Fernald 1950); damp, calcareous river shores (Vickery and Gawler 1983); shores, meadows, and thickets in New Brunswick (Hinds 2000); alder willow swamps of central Colorado's Montane Zone of the Rocky Mountains (Rydberg 1920); low prairie sites in North Dakota (USGS Prairie Wildlife Research Center 2002); meadow grass association of the brush prairie in northwestern Minnesota (Ewing 1924); prairie communities, lakeside wetlands, and agricultural and successional fields in Illinois (ILPIN 2002); with aspens in northern Lower Michigan (Gates 1930); and fens, wet prairies, and meadows in Ohio (Schneider 1993).

In New England, *Nabalus racemosus* is restricted to calcareous river shore communities. It is only found in northern Maine, primarily along the St. John River, but also along the Aroostook River. It is typically found in communities that are the result of cyclical ice scour during spring flood events. In most cases, *N. racemosus* is found in association with seeps, in sunny locations along wide and open river banks (Cameron, personal communication). Flood scouring maintains these seeps as open groundwater discharge sites (Brumback 2001). As with *Pedicularis furbishiae*, although river disturbance is responsible for major features of habitat, microscale habitat variations likely determine the actual distribution of *N. racemosus* individuals (Gawler et al. 1987).

The St. John River is one of the larger North American rivers that drain into the Atlantic Ocean (Ruggles and Watt 1975). It is 420 miles (676 km) long with a total fall of 1,578 feet (481 m), drains an area of 21,210 square miles (54,939 square km) (Ruggles and Watt 1975), and 36% of its watershed is in Maine (Haines 2001). The major industry in the river basin is pulp and paper production, with food processing, especially that based on the potato harvest, second (Ruggles and Watt 1975). The dominant vegetation along the river corridor in Maine is boreal forest and associated northern hardwoods (Gawler et al. 1987). The upper area of the river is the longest stretch of free-flowing river remaining in the northeastern United States, and it flows north and east almost 199 miles (320 km) before it is dammed at Grand Falls, New Brunswick (Gawler et al. 1987). The St. John River is consistently rated as one of Maine's highest quality canoeing rivers, and it is of economic importance to commercial guides and outfitters (LURC 2002). Because there is little headwater storage, there are high water level fluctuations throughout the year, and because it flows northward, headwater melts first in the spring, resulting in ice drives, ice jams, and flooding downstream (Gawler et al. 1987). These disturbance features, along with the river size and geology of the area, create a habitat that supports many plant species that are considered rare in the northeast (Gawler et al. 1987). In Maine, only Mt. Katahdin in Baxter State Park harbors more state-listed rare plants than the St. John River (Haines 2001).

THREATS TO TAXON

Potential threats to *Nabalus racemosus* in Maine include: disruption of the current disturbance regime due to damming; river bank disturbance that may result in

hydrological disruption to seep areas or upland clearing for camps, etc.; and invasion by non-native plant species.

Disruption of Current Disturbance Regimes

Disruption of ice scour and flooding regimes caused by dams can significantly affect the river shore habitat and lead to local extirpations (Gawler et al. 1987, Brumback 2001, Haines 2001). Hydroelectric development on the St. John River basin began in 1906 with the construction of the Tinker Dam on the Aroostook River at Aroostook Junction in New Brunswick; this dam was rebuilt in 1965 (Ruggles and Watt 1975). Across the border, at Fort Fairfield (ME .009), was a “fantastic” rare plant station (see Status of Maine occurrences), and *Nabalus racemosus* was observed here as late as 1938. Until 2000, when it was found in an unlikely spot on the Aroostook River, Fort Fairfield was the only known US location of *Symphyotrichum anticostense* (Anticosti aster, formerly ranked SX, now S1), and this occurrence was extirpated from inundation associated with Tinker Dam in the early 1900’s (Haines 2000). Hydroelectric dams are believed to be the cause of declines observed in this aster in Somerville, New Brunswick (Labrecque and Brouillet 1990). Aggressive weeds have since colonized the area, and the aster is a poor competitor against them (Labrecque and Brouillet 1990). Dams and associated hydrologic changes have also been linked to the loss of several occurrences of *Carex garberi* in the Connecticut River (Brumback 2001).

The threat of impoundment from dam construction seems unlikely because of the interest in keeping rivers in Maine free-flowing. However, this sentiment may change over time (Cameron, personal communication).

Natural disturbances from ice scour and inundation are important to maintaining the natural communities and rare species on the St. John River. These disturbances limit woody succession and dense vegetation in many areas, and this is important for *Pedicularis furbishiae* (Gawler et al. 1987), and likely also for *Nabalus racemosus*. In Ohio, threats to *N. racemosus* include succession and overgrowth by woody species (Schneider 1993). In Maine, overgrowth by woody species is unlikely due to habitat dynamics.

River Bank Disturbances

Because *Nabalus racemosus* is often associated with seepage areas, any activity, such as well-drilling, that changes the hydrology and drainage on adjacent lands may be detrimental. This is unlikely to be an issue on lands owned by The Nature Conservancy or forest products companies. Upland harvest for agriculture or camps has been shown to have an adverse impact to *Pedicularis furbishiae* (U. S. Fish and Wildlife Service 1983 in Brumback 2001), but this is generally prohibited along many stretches of the St. John River by various easements and protection plans (see current conservation measures in New England).

Potential river bank disturbance threats include vehicle traffic, illegal gravel mining, and cattle grazing. In St. John Plantation, farm vehicle traffic across the river channel to Hunnewell Island has created a wide roadbed (Haines 2001). It is unknown if this has impacted any rare plant occurrences. Illegal gravel mining in New Brunswick has caused serious declines to *Oxytropis campestris* var. *johannensis* habitat (Haines 2001), and likely also habitat for other rare plants along the St. John River. Cattle grazing was noted near ME .008 (St. Francis) and was considered a potential threat to the river bank community there (see Status of Maine Occurrences). The immediacy of this threat is unclear; though it is not likely that grazing near the site would affect the *Nabalus racemosus* population there. Dumping of cut vegetation by private landowners has been a concern at some areas (Brumbach 2001). Impoundment is indicated on field forms as a potential threat to the *N. racemosus* population at ME .025 (T12 R16 WELS)

Invasion by Non-native Plant Species

Common non-native species that are prevalent on some stretches of the St. John River include *Fallopia japonica* (Japanese knotweed), *Hieracium lachenalii* (European hawkweed), *Hypericum perforatum* (common St. Johnswort), *Melilotus albus* (white sweet-clover), *Phalaris arundinacea* (reed canarygrass), and *Vicia cracca* (cow vetch) (Haines 2001). *Lythrum salicaria* (purple loosestrife) recently arrived along the St. John River in Maine from a garden seed source in Quebec (Josh Royte, The Nature Conservancy, personal communication). The site where this occurs is not large, and it is being managed by hand removal of *L. salicaria* stems (Royte, personal communication). *Lythrum salicaria* has also been observed recently (2000) on the Aroostook River near the confluence with the Little Matawaska River (Georgia Hall, Woodlot Alternatives, Inc., personal communication).

DISTRIBUTION AND STATUS

General Status

Nabalus racemosus ranges from New Brunswick and Nova Scotia to British Columbia, south to Montana, South Dakota, Ohio, Illinois, and northern Maine (Fernald 1950, Hinds 2000; Figure 1). Former areas of its range include Missouri, northern New Jersey, southeastern New York, and Pennsylvania (Fernald 1950, NatureServe 2001; Steve Grund, Pennsylvania Natural Heritage Program, personal communication). Reports of distribution in northern Vermont may be based on Blake (1914) who indicates one or two plants, likely introduced, along a railroad bed in Swanton on the east shore of Lake Champlain, four miles south of the Canadian border.

NatureServe (2001) ranks *Nabalus racemosus* as globally secure, G5, but as uncertain in its national status in the United States and Canada, N?. Since its distribution is only in North America, it would seem that it would also be stable in both countries (see

Table 1). In New England, it is considered a *Flora Conservanda* Division 2 species, indicating it is a regionally rare taxon with generally fewer than 20 current occurrences within New England (Brumback and Mehrhoff et al. 1996). This classification includes species with more than 20 occurrences that are at the edge of their range in New England. In Maine, *N. racemosus* is an S3 species, indicating it is rare in the state but not imperiled. The state legal status in Maine is Special Concern (SC), indicating *N. racemosus* is rare, but not sufficiently so to be considered Threatened or Endangered. The federal wetland indicator status in the northeast of *N. racemosus* is FACW- (USDA, NRCS 2002).

Blake (1914) suggested that the Vermont plants along the railroad may have been introduced, and that this species had not previously been recorded from the state. Seven historic occurrences are recorded from developed areas around New York City prior to 1918, in “meadow” habitat. These were extirpated by development (Steve Young, New York Natural Heritage Program, personal communication). The species was reported as not infrequent on Long Island (Grier 1925). In New Jersey, historic occurrences are reported from Bergen, Hudson, and Morris Counties (New Jersey Natural Heritage 2001). In Ohio, *Nabalus racemosus* has been considered Potentially Threatened since 1982, an upgrade from its previous status of Threatened (Schneider 1993).

Two historic occurrences are recorded from western Pennsylvania, where *Nabalus racemosus* is ranked SX (Grund, personal communication). One occurrence is dated 1964 and is from a large fen in Lawrence County. This fen is extant and still has many rare species, but surrounding agriculture has impacted the fen and may be responsible for extirpation of *N. racemosus* at this site. The other occurrence is dated 1965 and is from a species list of a prairie site in Butler County. This site is also extant, and it is actively managed with a burning regime (Grund, personal communication). Neither site has been surveyed for *N. racemosus*, and it is possible, though unlikely, that it may be found in Pennsylvania (Grund, personal communication). Although NatureServe (2001) lists *N. racemosus* as SR in Pennsylvania, the Pennsylvania Code (2003, 17 PA code § 45.11) lists and legally classifies it as extirpated.

Nabalus racemosus was only recently added to the tracking list in New Brunswick (Sean Blaney, Atlantic Canada Conservation Centre, personal communication). It is only dependably present in New Brunswick on the upper St. John River, above Edmundston. There are scattered stations as far as the Mactaquac Dam, above Fredericton, but some of these have been lost due to dam development. Interestingly, *N. racemosus* has been found just west of Fredericton on gravelly, open conditions along an old railway bed (now a bike trail) that follows the St. John River (Blaney, personal communication).

Table 1. Occurrence and status of <i>Nabalus racemosus</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)
Wyoming (S1)	Maine (S3, SC): 31 extant, 4 historic, and 1 extirpated occurrences, all in Aroostook County	Vermont (SR): 1 or 2 plants, likely introduced (Blake 1914)	Missouri (SH): Greene County (Bush 1931)
	Illinois (S?)	Colorado (SR)	New Jersey (SH, E): occurrences in 3 counties
Newfoundland Island (S1S2)	Iowa (S3)	Indiana (SR)	New York (SX): 7 historic occurrences, extirpated by development (Young, New York Natural Heritage Program, personal communication)
Nova Scotia (S1)	Kentucky (S?)	Minnesota (SR)	Pennsylvania (SX): 2 historic occurrences (Grund, personal communication)
	Michigan (S?)	Montana (SR)	
	Nebraska (S?)	North Dakota (SR): Lunell 1917	
	Ohio (S3, PT)	South Dakota (SR)	
		Wisconsin (SR)	
	Alberta (S3)		
	British Columbia (S?)	Labrador and Newfoundland (SR)	
	Manitoba (S4)	Quebec (SR): (Bowman 1932, Potter 1934, Fernald 1951), see text below	
	New Brunswick (S3)		
	Ontario (S5)		
	Saskatchewan (S4?)		

In Quebec, *Nabalus racemosus* is reported from Charlton Island in James Bay and along the east and south coasts of James Bay (Potter 1934), from the shore of the Matemek River, a small stream that empties into the Gulf of St. Lawrence (Bowman 1932), and from the lower Restigouche River near Matapedia on the Gaspé Peninsula (Fernald 1951). In Nova Scotia, *N. racemosus* was first collected from a cliff edge in Digby County in 1948, but it was previously reported from Sydney Mines in Cape Breton (Erskine 1951). *Nabalus racemosus* was only recently added to the flora of Newfoundland Island (Hay et al. 1990).

Nabalus racemosus has been reported from Leeds and Butte, North Dakota (Lunell 1917). It is also reported in Shepard's *Flora of Greene County, Missouri* (Bush 1931).

Status of All New England Occurrences -- Current and Historic

There are 38 records for *Nabalus racemosus* in Maine, all in Aroostook County. In 2003, two of these were merged with other occurrences, giving a current total of 36 occurrences in Maine. Of these, 28 are on the St. John River, and all of these are extant. Of the St. John River occurrences, 1 is ranked "AB," 5 are "B," 4 are "BC," 4 are "C," and 14 are "E," simply indicating extant. There are 3 extant (all ranked "B"), 3 historic, and 1 extirpated occurrences on the Aroostook River (see Figures 2 and 3). There is one historic occurrence from an "open dry field" (ME .010 [Ashland]). The EO Rank Specifications are not up-to-date for this taxon, but MNAP is updating rank specifications of all rare species, beginning with the rarer species in the state (Cameron, personal communication). *Nabalus racemosus* was reported from Maine as early as 1879 (Pringle and Gilbert 1879) along the shores of the St. John River.

See Figures 2 and 3 for current and historic distributions, respectively, of *Nabalus racemosus*. Table 2 summarizes the status of each occurrence.

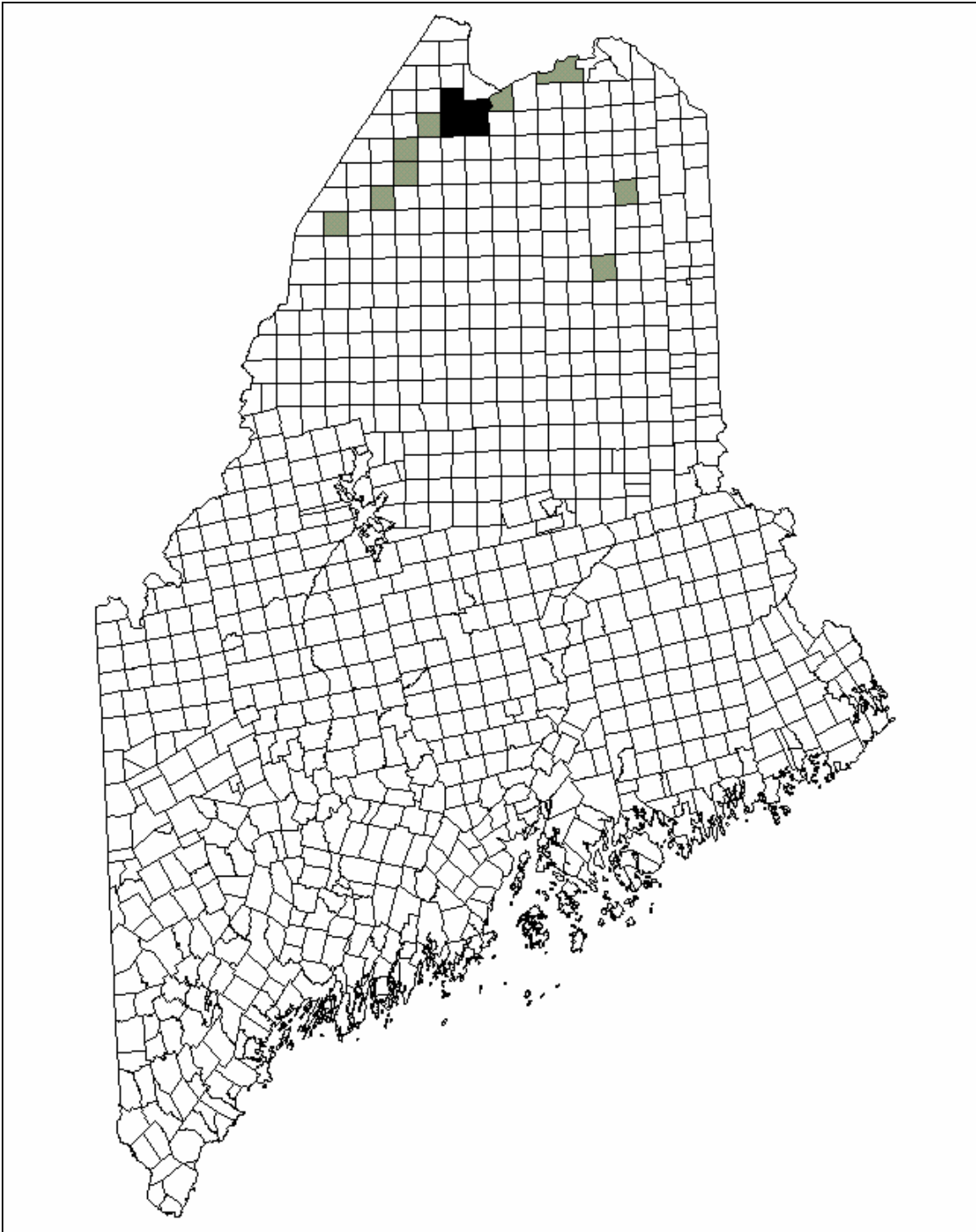


Figure 2. Extant occurrences of *Nabalus racemosus* in New England. Town boundaries for Maine are shown. Towns shaded in gray have one to five extant occurrences of the taxon. Towns shaded in black have more than five occurrences.

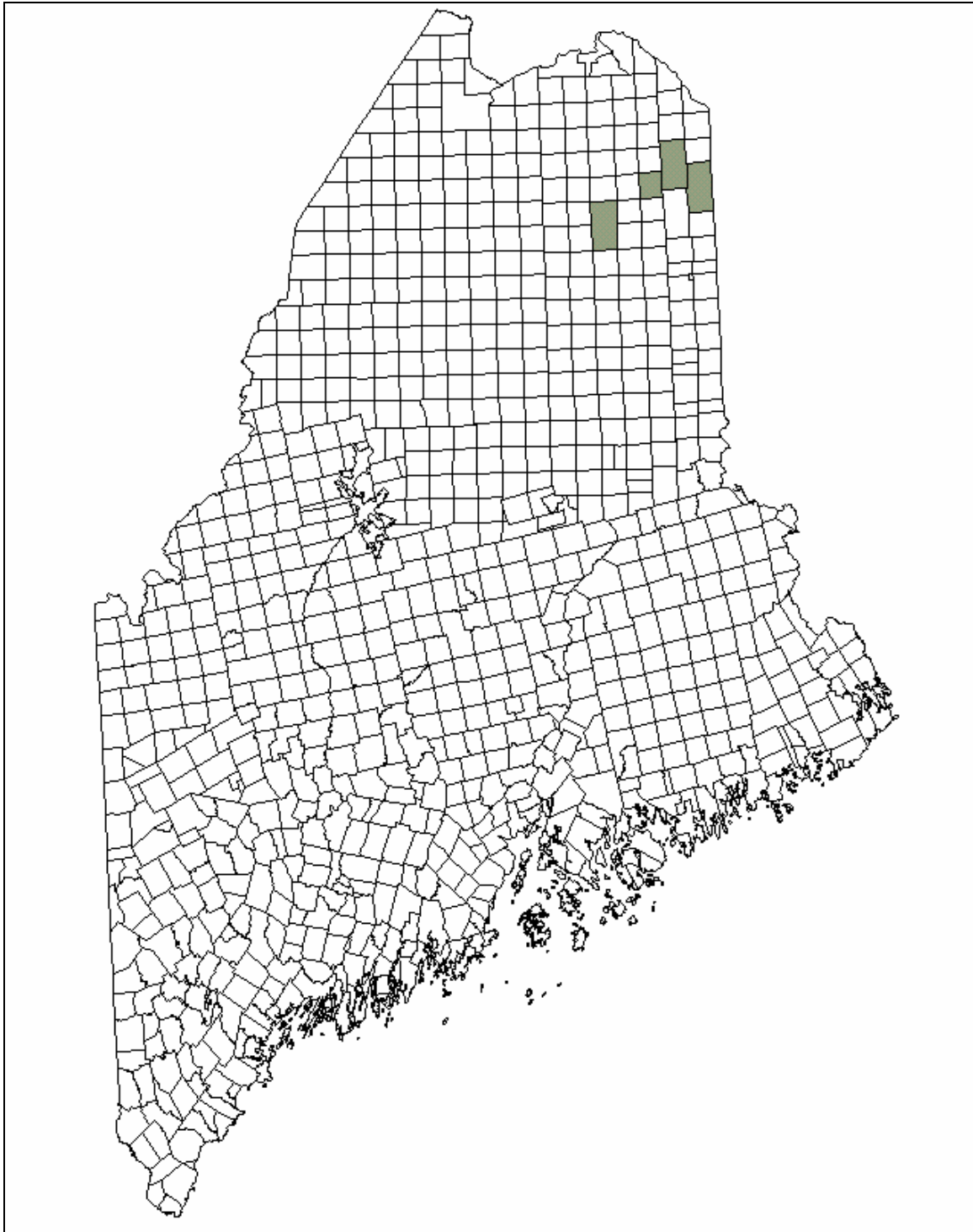


Figure 3. Historic occurrences of *Nabalus racemosus* in New England. Towns shaded in gray have one to five historic records of the taxon.

Table 2. New England Occurrence Records for *Nabalis racemosus*. Shaded occurrences are considered extant.

State	EO #	County	Town
ME	.001	Aroostook	Masardis
ME	.002	Aroostook	Allagash
ME	.003	Aroostook	Wade
ME	.004	Aroostook	Allagash
ME	.005	Aroostook	Allagash
ME	.006	Aroostook	Allagash
ME	.007	Aroostook	T15 R13 WELS
ME	.008	Aroostook	St. Francis
ME	.009	Aroostook	Fort Fairfield
ME	.010	Aroostook	Ashland
ME	.011	Aroostook	Caribou
ME	.012	Aroostook	Washburn
ME	.013	Aroostook	T13 R14 WELS
ME	.014	Aroostook	Allagash
ME	.015	Aroostook	St. Francis
ME	.016	Aroostook	St. Francis
ME	.017	Aroostook	T15 R13 WELS
ME	.018	Aroostook	Allagash
ME	.019	Aroostook	St. Francis
ME	.020	Aroostook	T15 R13 WELS
ME	.021	Aroostook	T16 R12 WELS
ME	.022	Aroostook	St. John Plantation
ME	.023	Aroostook	T12 R16 WELS
ME	.024	Aroostook	T12 R16 WELS
ME	.025	Aroostook	T12 R16 WELS
ME	.026	Aroostook	T12 R16 WELS
ME	.027	Aroostook	T15 R13 WELS
ME	.028	Aroostook	T16 R12 WELS
ME	.029	Aroostook	T16 R12 WELS
ME	.030	Aroostook	T16 R12 WELS
ME	.031	Aroostook	Allagash
ME	.032	Aroostook	Allagash
ME	.033	Aroostook	St. Francis
ME	.034	Aroostook	Fort Kent
ME	.035	Aroostook	T14 R13 WELS
ME	.036	Aroostook	T16 R12 WELS
ME	.037	Aroostook	Wade
ME	.038	Aroostook	Wade

II. CONSERVATION

CONSERVATION OBJECTIVES FOR THE TAXON IN NEW ENGLAND

Most of the extant (28 of 31) occurrences of *Nabalus racemosus* occur on the St. John River, so conservation within this river system will preserve the majority of occurrences in Maine and New England. Currently, significant stretches of the St. John River receive some form of conservation protection. Because suitable habitat is relatively abundant along this river, it is likely that more occurrences of *N. racemosus* will be found. To date, most occurrences of *N. racemosus* on the St. John River have been found as a result of surveys for lousewort (Gawler, personal communication). *Nabalus racemosus* is well-distributed along the St. John River upstream of Allagash, and where found, tends to be abundant, though details are not often documented (Gawler, personal communication). *Nabalus racemosus* may be more abundant than currently known, because suitable habitat is abundant on the St. John River and may also exist on other northern Maine rivers that have received relatively low survey effort. River candidates for survey include Allagash River, Aroostook River, Big Black River, Little Madawaska River, and unimpounded areas of the St. Francis River.

Of the four historic occurrences in Maine, one is at a known location and likely still extant. The other three are based on old collections that do not provide enough details to relocate. However, all four are from the Aroostook River. These and two recently discovered (2001) occurrences on the Aroostook River point to a need for more survey effort along this river for *Nabalus racemosus* and other rarities. Haines' (2000) rediscovery of *Symphyotrichum anticostense* (Anticosti aster) along the Aroostook River emphasizes this need. The Aroostook River currently has no conservation protection for its shoreline or the rare plants that occur there.

The major conservation objective for *Nabalus racemosus* in Maine is to have no fewer than the current number of extant occurrences (28) in 20 years. Ideally, the conservation objective in 20 years is for a total of 35 or more extant occurrences of *N. racemosus*, with at least 6 of these on the Aroostook River (where there are currently 3 occurrences) and/or other northern rivers where there are currently no occurrences recorded. This is a reasonable goal, as it is likely that more occurrences will be found. There are currently no "A" ranked *N. racemosus* populations on any river in Maine, though there are one ranked "AB" and 8 ranked "B." Ideally, within 20 years we will have one or two "A" ranked populations. This may not be realistic because of river dynamics. The other major conservation objective for *N. racemosus* in Maine is to have conservation protection along the Aroostook River, similar to that on the St. John River.

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IV. APPENDICES

- 1. Species with Recent Nomenclatural Changes**
- 2. An Explanation of Conservation Ranks Used by The Nature Conservancy and NatureServe**

1. Species with Recent Nomenclatural Changes

<u>Current name</u>	<u>Synonymy</u>	<u>Common Name</u>
<i>Dasiphora floribunda</i>	<i>Pentaphylloides floribunda</i> <i>Potentilla fruticosa</i>	shrubby cinquefoil
<i>Doellingeria umbellata</i>	<i>Aster umbellatus</i>	flat-topped white aster
<i>Gentianella amarella</i> ssp. <i>acuta</i>	<i>Gentiana amarella</i>	northern gentian
<i>Nabalus racemosus</i>	<i>Prenanthes racemosa</i>	glaucous white lettuce
<i>Symphyotrichum boreale</i>	<i>Aster borealis</i>	northern bog aster
<i>Symphyotrichum novi-belgii</i>	<i>Aster novi-belgii</i>	New York aster
<i>Symphyotrichum puniceum</i>	<i>Aster puniceus</i>	bristly aster
<i>Triantha glutinosa</i>	<i>Tofieldia glutinosa</i>	sticky false asphodel
<i>Tricophorum cespitosum</i>	<i>Scirpus cespitosus</i>	tufted club-rush
<i>Tricophorum clintonii</i>	<i>Scirpus clintonii</i>	Clinton's bulrush
<i>Trisetum melicoides</i>	<i>Graphephorum melicoides</i>	graphephorum

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 EOs have received such ranks in all states, and ranks are not necessarily consistent among states as yet.