New England Plant Conservation Program

Conservation and Research Plan

Panicum flexile (Gattinger) Scribn.
Stiff Witch Grass

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Approved, Regional Advisory Council, May 2001

SUMMARY

Stiff witch grass, *Panicum flexile* (Gattinger) Scribn. (Poaceae), is a widely distributed annual grass found in wet or dry, usually open, calcareous habitats. Natural communities supporting this species share a relatively high frequency of natural disturbance events, such as downslope movement of rocky substrate (on calcareous bluffs) and seasonal ice scour (on marshes and lakeshore beaches). Stiff witch grass extends over much of Eastern and central North America. In New England it is rare, having been documented at two stations in Vermont and one in Connecticut. The Connecticut occurrence is now considered historical, and field surveys in 2000 confirmed only one of the Vermont occurrences. Morphological variation and character overlap with related taxa, particularly *Panicum capillare*, have caused problems with positive identification of *Panicum flexile*.

The primary conservation objective for this taxon in New England is ongoing protection of the single site at which it is known to occur, a Nature Conservancy property in southwestern Vermont. Other priorities are to conduct an exhaustive search for the plant at the second Vermont site (where it was not located in 2000), and to search for new populations of the plant at sites with suitable habitat in southwestern Vermont.

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) 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:

Richardson, Leif L. and Elizabeth H. Thompson. 2001. *Panicum flexile* (Gattinger) Scribn. (Stiff Witch Grass) Conservation and Research Plan. New England Wild Flower Society, Framingham, Massachusetts, USA. http://www.newfs.org

I. BACKGROUND

INTRODUCTION

Stiff witch grass, *Panicum flexile* (Gattinger) Scribn. (Poaceae), is a slender annual found in a variety of wet and dry, usually open habitats. Sites supporting the species are typically calcareous and characterized by moderate to high levels of natural disturbance. The species is widespread in North America, ranging from southern Ontario and Québec south to Florida and Texas, and west to North Dakota (Britton and Brown 1913, Hitchcock 1950, Dore and Mcneill 1980, Gleason and Cronquist 1991, Darbyshire and Cayouette 1995, Magee and Ahles 1999). Stiff witch grass belongs to the *Panicum capillare* species complex, a group of five species that are not easily distinguished (Darbyshire and Cayouette 1995). There is great morphological overlap between the species, and the extent to which they are reproductively isolated is not known.

Stiff witch grass forms a fibrous bundle of roots. Leaves are both basal and caulescent, and have sheaths that are usually pubescent. It bears its spikelets in an erect, ascending panicle whose height is 2-3 times its width (Gleason and Cronquist 1991). Fruiting pedicels of most specimens are hairy, but inflorescence pulvini are usually not. Spikelets are glabrous and produce a single terminal fertile floret. While many species of *Panicum* have prominent second glumes, those of *P. flexile* are characterized by an especially attenuated, pointed apex, and are often longer than the lemmas they subtend (Darbyshire and Cayouette 1995).

Like other grasses, stiff witch grass is presumed to be wind-pollinated. Seed dispersal occurs in fall and is probably facilitated by wind or gravity. Germination studies with the closely related *P. capillare* showed that seeds were dispersed in a dormant state in October, then became nondormant soon thereafter (Baskin and Baskin 1985). When exposed to light, *P. capillare* seeds readily germinated from November to May for three years after their production.

Stiff witch grass possesses the state ranks S1 in Vermont and SH in Connecticut. In Maine and Massachusetts it is ranked SR, having been reported, but without conclusive documentation. Globally, the plant is ranked G5. It is widespread and locally abundant in other parts of its range (such as Kentucky), and New England populations represent the northern and eastern extents of its range. Because of problems with positive identification, some reports of *P. flexile* may constitute occurrences of another species such as *P. capillare*. Similarly, collections identified as other members of the *P. capillare* complex may be *P. flexile*.

General threats to the species include successional change in habitat, residential development, recreational use of lakeshore meadows, and limestone quarrying. Many sites

supporting this plant are of little value to people and are thus not threatened (i.e., serpentine barrens and limestone cliffs). The one confirmed population in New England is protected by the Nature Conservancy, and adequate levels of disturbance are likely to persist on the exposed cliff faces where the plant occurs. The second New England station is a private lake beach that is mowed and used as a boat access. *Panicum flexile* was not relocated here in 2000.

The intent of this Conservation Plan is to summarize existing information on the status of *P. flexile* in New England, then to recommend actions to protect and restore the species in an area that represents the northeastern edge of its historic range.

DESCRIPTION

Stiff witch grass is a tuft-forming, branching annual with stiff, ascending culms, 20-60 cm tall. Like other species of *Panicum*, each spikelet (the basic inflorescence unit of a grass, composed of one or more florets and their associated bracts) possesses a single fertile floret, the second glume (one of two bracts subtending the spikelet) is elongated, and the inflorescence is a much-branched panicle (Hitchcock 1950, Gleason and Cronquist 1991). Spikelets are narrowly lanceolate and 2.6-3.6 mm in length (Gleason and Cronquist 1991). The long second glume has a distinctly attenuated apex, and equals or exceeds the lemma (Darbyshire and Cayouette 1995). The narrowly ellipsoid fruits are straw-colored.

Stiff witch grass belongs to the *Panicum capillare* complex, a group of five closely related and morphologically similar species (see below). Stiff witch grass has often been confused with *P. capillare*. It may usually be distinguished from this and other complex members by its elongated panicle (2-3 times taller than wide), pubescent leaf sheaths, hairy fruiting pedicels (but pedicels of some U.S. collections are glabrous; Darbyshire and Cayouette 1995), glabrous inflorescence pulvini (nodal swellings), and glabrous internodes (Gleason and Cronquist 1991, Darbyshire and Cayouette 1995). The primary point of fruit disarticulation in *P. flexile*, *P. capillare*, and *P. philadelphicum* is in the rachilla just below the fertile floret; in the other two species, the entire spikelet usually disarticulates just below the glumes.

TAXONOMIC RELATIONSHIPS, HISTORY, AND SYNONYMY

Panicum flexile (Gattinger) Scribn. was first described by Scribner (1893). As currently understood, the species belongs to the *Panicum capillare* species complex, a group of intergrading species that also includes *P. capillare*, *Panicum gattingeri*, *Panicum philadelphicum*, and *Panicum tuckermanii* (Darbyshire and Cayouette 1995). These species are distinguished by growth habit, reproductive characters, and morphological characters. There is much overlap in character expression among the species, and some authors do not recognize all five. In a revision of the New World species of *Panicum*, Zuloaga recognizes only two of these species, *P. capillare* and *P. flexile*. Other authors (Voss 1972, Gleason and

Cronquist 1991) recognize three, placing *P. gattingeri* specimens under *P. capillare,* and subsuming *P. tuckermanni* in *P. philadelphicum*. Steyermark and Schmoll (1939) apparently recognize four in concluding that *P. tuckermanii* is a variety of *P. philadelphicum*. Early efforts to understand the *P. capillare* complex usually created five species (Hitchcock and Chase 1910, Fernald 1919). Synonyms for *P. flexile* include *Chasea flexilis*, *Panicum capillare* var. *flexile*, *Panicum capillare* var. *minus*, *Panicum minus*, and *Panicum diffusum* (Hitchcock and Chase 1910, Zuloaga 1986, Soreng et al. 2000).

SPECIES BIOLOGY

Stiff witch grass is anemophilous, or wind-pollinated. Groups of individuals separated by at least one kilometer are therefore assumed to be functionally distinct populations. Fruits mature in fall, and spikelets disarticulate soon thereafter.

Seeds are probably dispersed passively by wind and gravity. Stiff witch grass seed dormancy and germination have not been studied, but the species may behave similarly to *P. capillare*, which was studied by Baskin and Baskin (1985). In *P. capillare*, seeds enter a nondormant phase in November after dispersal, and may germinate until the following May. In May, they become dormant until the next November, and the cycle repeats. In this study, three year-old seeds continued to be germinable during the nondormant period. During the nondormant period, *P. capillare* seeds will usually germinate only when exposed to light. Stiff witch grass may thus be inferred to germinate in fall and overwinter as a small tuft. Plants begin growing vegetatively in spring, then flower in mid-late summer. Most fruiting specimens examined at University of Vermont's Pringle Herbarium were collected in August and September (all but one, incidentally, were collected outside New England).

It is not known whether stiff witch grass forms mutualistic or antagonistic relationships with other organisms in its environment, such as herbivores, seed predators, endophytic fungi, or mycorrhizal fungi. No herbivory or other interactions were noted during 2000 field work.

HABITAT/ECOLOGY

Stiff witch grass is found in a variety of habitats, including moist or dry open woods, meadows, limestone bluffs, serpentine barrens, cedar glades, calcareous fens, and sandy plains (Beal 1896, Hitchcock 1950, Voss 1972, Dore and McNeill 1980, Tyndall and Farr 1989, Gleason and Cronquist 1991, Darbyshire and Cayouette 1995). Stiff witch grass is often a component of early-successional vegetation assemblages, and seems to require a moderate frequency of natural disturbance events. In our area it has been reported from two sites, one a lakeshore grassland, the other a temperate calcareous cliff.

THREATS TO TAXON

In a general sense, loss of habitat is the most significant threat to stiff witch grass. Natural communities that include stiff witch grass (see above) may be threatened by agricultural activities, timber harvest, residential development, recreational activities, limestone quarrying, changes in hydrology, fires, and secondary succession. The one known extant New England population, a protected Nature Conservancy property, faces little direct threat of anthropogenic habitat modification. There, the plants grow on a series of steep cliffs where downslope movement of rocks, soil, and other organic material is common. If the present natural disturbance regime were modified, the species might be threatened. Land managers at this site should therefore assess the level of present disturbance and monitor the populations response to disturbance.

Stiff witch grass was found at a second site in 1991 (but not relocated there in 2000) where human and natural disturbance events may affect the plant. Once a sandy beach, this cobble meadow was formed by construction of a nearby railroad causeway (Engstrom 1991, DiCesare 1993). The site is exposed to high winds and is frequently scoured by waves and ice. The owners mow the area each year and launch boats from it (Engstrom 1991). It is not known how these activities might affect stiff witch grass.

DISTRIBUTION AND STATUS

General Status

Stiff witch grass occurs from southern Ontario and Québec south to Florida and Texas, and west to North Dakota (Britton and Brown 1913, Hitchcock 1950, Dore and Mcneill 1980, Gleason and Cronquist 1991, Darbyshire and Cayouette 1995, and Table 1) Stiff witch grass historically occurred at six or more stations in New England, including those in Vermont, Massachusetts, and Connecticut (Seymour 1969). It is listed as Division 2 in the New England Wildflower Society's *Flora Conservanda:* New England (Brumback and Mehrhoff et al. 1996), meaning it is regionally rare, with fewer than 20 occurrences. Several large populations occur in upstate New York (New England Wildflower Society 2000). It is widely dispersed and sometimes locally abundant. The known historic and present distribution of the plant may be influenced by sampling effort and by confusion with similar species (e.g., *P. capillare*; see above). The United States and New England distributions of stiff witch grass are presented in Figures 1 and 2.

Table 1. Occurrence and status of *Panicum flexile* 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)
Louisiana (S1)	Illinois (S3)	Alabama (SR)	Connecticut (SH)
Maryland (S1)	Ontario (S4)	Arkansas (SR)	District of Columbia (SX)
New Jersey (S1)		Florida (SR)	West Virginia (SH)
New York (S2)		Georgia (SR)	
North Carolina (S1)		Indiana (SR)	
Pennsylvania (S2)		Iowa (SU)	
Texas (S1)		Kansas (SR)	
Vermont (S1): 2 EOs		Kentucky (unranked)	
Quebec (S2)		Maine (SR)	
		Massachusetts (SR)	
		Michigan (unranked)	
		Mississippi (SR)	
		Missouri (SR)	
		Nebraska (SR)	
		North Dakota (SU)	
		Ohio (SR)	
		Oklahoma (SR)	
		South Dakota (SU)	
		Tennessee (SR)	
		Utah (SR)	
		Virginia (SR)	
		Wisconsin (SR)	
		Manitoba (SR)	

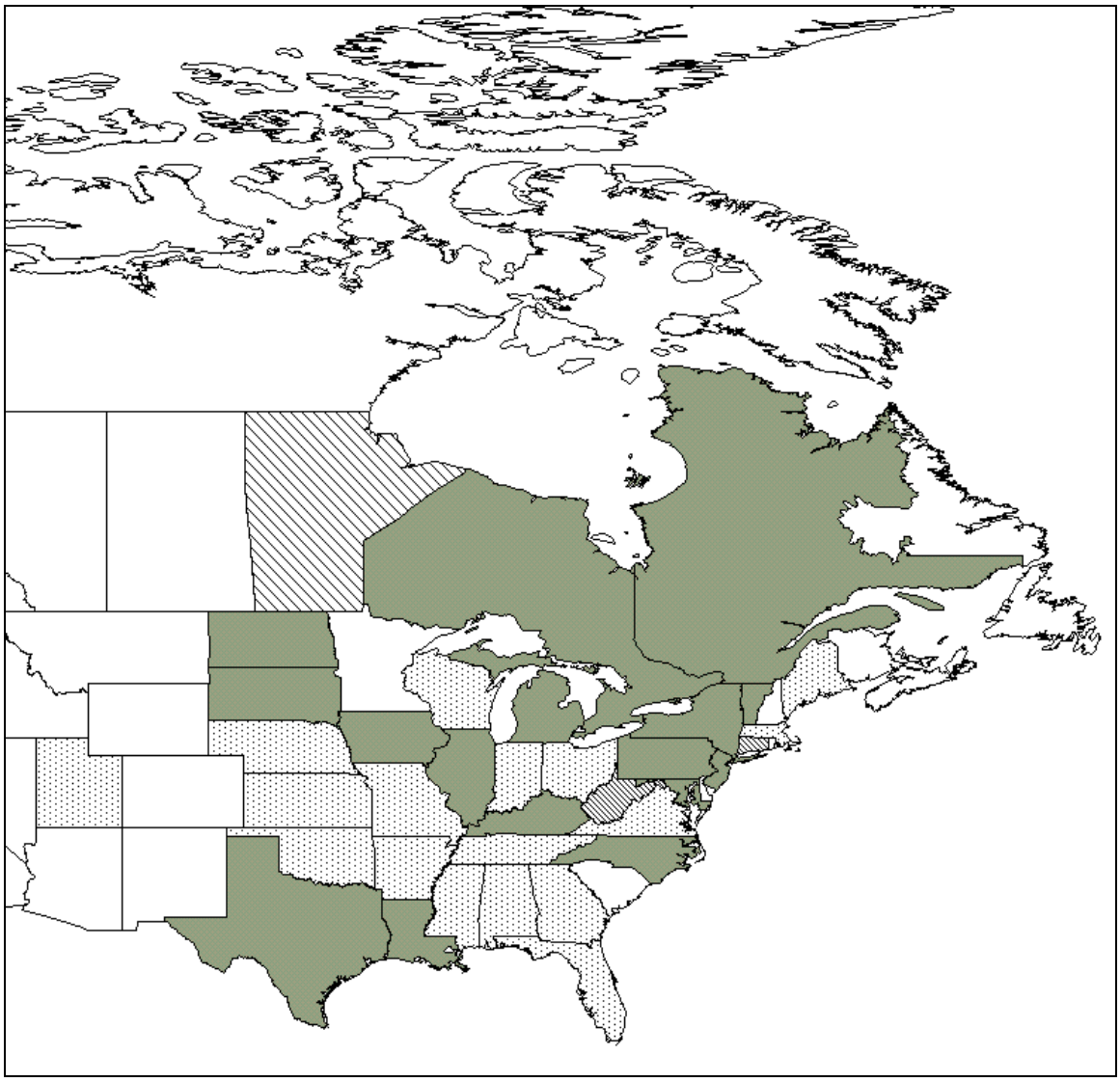

Figure 1. Occurrences of *Panicum flexile* in North America. States and provinces shaded in gray have extant occurrences of the taxon. States with diagonal hatching are considered "historic" or "presumed extirpated," where the taxon no longer occurs. Stippled states are ranked "SR," where the species is reported but unverified (see Appendix for explanation of ranks).

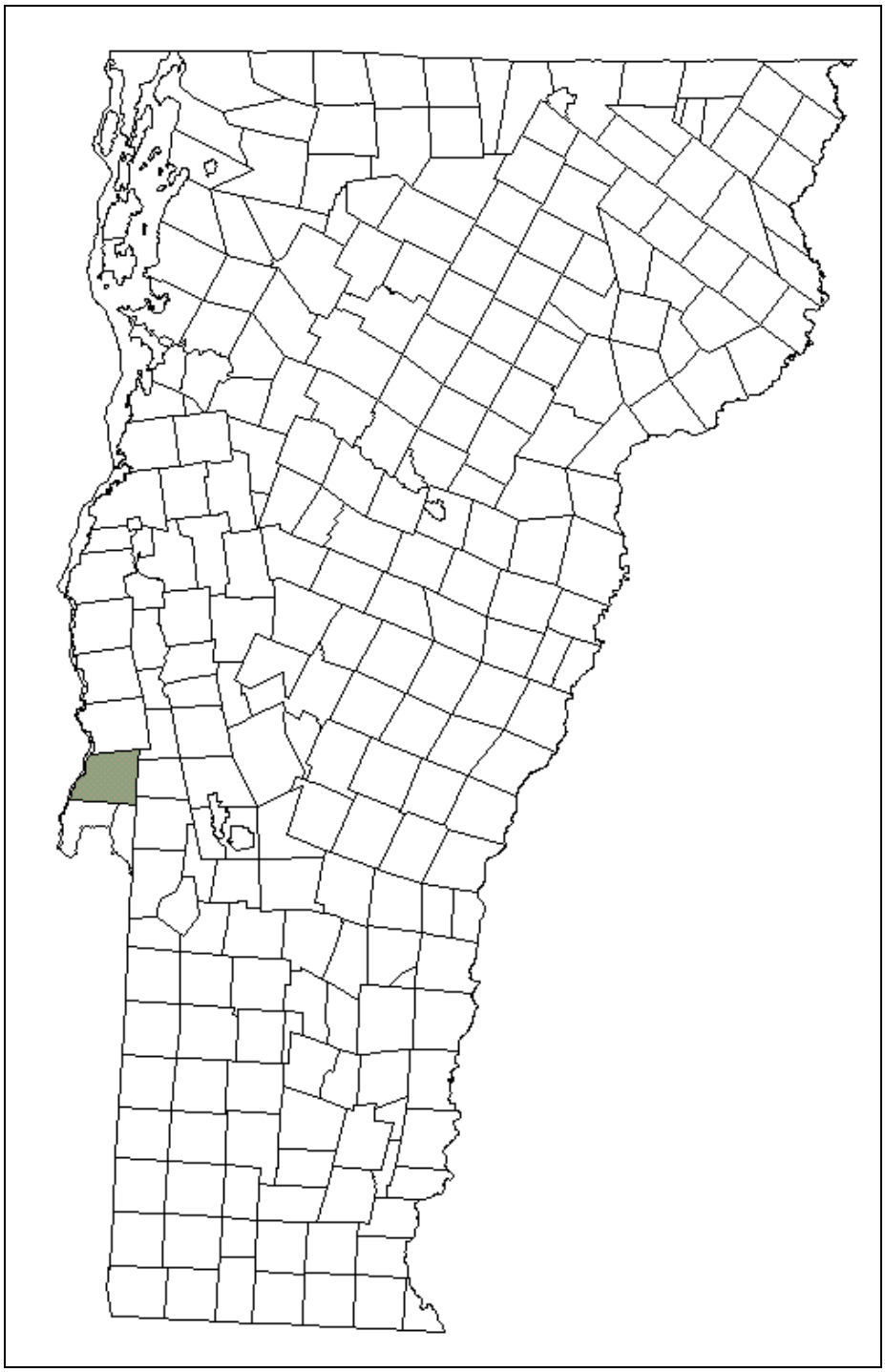

Figure 2. Occurrences of *Panicum flexile* in New England. Town boundaries for Vermont (the only New England state with confirmed occurrences) are shown. The town shaded in gray (Benson) has one extant occurrence. Another occurrence at Colchester has not been confirmed.

Status of All New England Occurrences-Current and Historic

Stiff witch grass reportedly occurs at two stations in New England, both in Vermont. It historically occurred at several other sites in Massachusetts and Connecticut, but has not been found at these places for many years.

Table 2 describes the two extant stiff witch grass stations, or Element Occurrences (EOs). The sites are also described below in narrative form. Each station is described by its EO number and the name of the town in which it occurs. Each is given an EO rank, a qualitative approximation of the quality of an occurrence (a function of number of individuals, population viability, area of habitat, successional status, etc.) and the degree to which it is threatened. Ranks range from "A" to "D", where a rank of "A" indicates a high quality EO that is little threatened, and "D" describes an EO that is of poor quality and threatened. A rank of "E" is given to occurrences about which existing information is insufficient to provide a qualitative score.

CURRENT CONSERVATION MEASURES IN NEW ENGLAND

Stiff witch grass is listed as SR in Maine, SR in Massachusetts, SH in Connecticut, and S1 in Vermont, where it is a state-listed endangered species. The single confirmed Vermont population is on land protected by The Nature Conservancy. The reserve is used by hikers, but is otherwise not affected by human activities. This population is in a relatively inaccessible location (described above), and will probably not be disturbed by use of hiking trails. This station is not explicitly managed to support a level of disturbance conducive to long-term persistence of the stiff witch grass population. However, natural disturbance events appear to provide the successional characteristics this plant requires (*e.g.*, high light, exposed soil and rock, etc.).

Table 2. New England Occurrence Records for *Panicum flexile.* The shaded occurrence is considered extant.

State	Element Occurrence Number	County	Town
VT	**.001**	**Rutland**	**Benson**
VT	.002	Chittenden	Colchester

II. CONSERVATION

CONSERVATION OBJECTIVES FOR TAXON IN NEW ENGLAND

The primary conservation objectives for stiff witch grass in New England are to continue safeguarding the single known population in Vermont (VT .001), and to search for new populations where suitable habitat occurs. The second site for which stiff witch grass has recently been reported (VT .002) should be revisited next year.

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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 **C** that is, a great risk of extinction. S1 indicates critical imperilment within a particular state, province, or other subnational jurisdiction **C** 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 **C** 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 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.