New England Plant Conservation Program

Rosa acicularis Lindley
ssp. *sayi* (Schwein.) W. H. Lewis
Bristly, Needle-spine, or Prickly Rose

Conservation and Research Plan
for New England

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SUMMARY

Rosa acicularis Lindley ssp. *sayi* (Schwein.) W. H. Lewis, variously known as bristly, needle-spine, or prickly rose, is a small, sparsely branched, very bristly, deciduous, perennial, rhizomatous shrub of the Rosaceae (Rose family). The species is almost circumboreal. *Rosa acicularis* ssp. *acicularis* ranges from Sweden eastward to Alaska. There, it overlaps with the American ssp. *sayi*, which ranges across Canada, down the Rocky Mountains to northern New Mexico, into the upper Midwest and Great Lakes region, to New York and New England, with a disjunct population in West Virginia. Across its range, it grows in a wide variety of forested and open habitats. *Rosa acicularis* ssp. *sayi* is globally secure and locally abundant in many states and provinces. Known New England populations are (or were) found in woods, on rocky outcrops or cliffs, and along river or lake shores, apparently limited to calcareous rock, rich sediments, or areas influenced by run-off from nearby calcareous rock.

In New England, *Flora Conservanda* lists the taxon (subspecies) as Division 2, a regionally rare taxon with fewer than 20 occurrences seen since 1970. The only currently known populations in New England are one occurrence in New Hampshire, three in Vermont, and one in Massachusetts. Several of these are in need of expert confirmation of the taxon's identification. Its presence in Maine is strongly suspected. Due to the notoriously confusing nature of roses (great variability within species, species with overlapping characteristics, and frequent hybridization), the true degree of rarity of *R. acicularis* in New England and any population trends in the region are unknown. Many historic records are questionable because of difficulty of identification, and lack of useful location information makes others difficult to resurvey.

The main conservation objective at present is to maintain, through protection, monitoring, and management, at least four confirmed occurrences, one each in Maine, New Hampshire, Vermont, and Massachusetts, with 50 or more clumps of stems (stems arising from or very near the same base) or >150 stems if all are crowded together and clumps not distinguishable, with 20% of the clumps (or of second year or older stems in crowded patches) producing mature fruit.

The first conservation priority is to seek expert confirmation of most extant and historic occurrences. With this information, it will be possible to assess current population levels and to search for historic occurrences. Permanent protection through acquisition, conservation easement, or land management agreement may be necessary at any sites not already protected. Equally important will be education of landowners, land managers, and loggers who have timber rights over some of the Vermont occurrences. Periodic monitoring will help determine the need for habitat management for control of invasive species and herbivory or to improve fruit production. At sites with successful seed production, seed may be collected for seed-banking, if tests prove it to be viable.

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

Rosa acicularis Lindley ssp. *sayi* (Schwein.) W. H. Lewis, variously known as bristly, needle-spine, or prickly rose, is a small, sparsely branched, very bristly, deciduous, perennial, rhizomatous shrub of the Rosaceae (Rose family) with fragrant, pink flowers and glabrous, scarlet fruits with persistent, connivent sepals. The species is almost circumboreal, with *R. acicularis* ssp. *acicularis* ranging from Sweden eastward to Alaska, where it overlaps with the American ssp. *sayi*, which ranges across Canada, down the Rocky Mountains to northern New Mexico, into the upper Midwest and Great Lakes region, to New York and New England, with a disjunct population in West Virginia. Across its range, it grows in a wide variety of forested and open habitats, with a wide variety of soil and moisture conditions. It is drought-tolerant, disturbance-tolerant, and fire-resistant. Seed production may be relatively low, especially in shaded habitats, but plants spread readily by rhizomes, forming large clones that persist for decades or even centuries. Known New England populations are (or were) found in woods, on rocky outcrops or cliffs, and along river or lake shores, apparently limited to calcareous rock, rich sediments, or areas influenced by run-off from nearby calcareous rock.

The global rank for *Rosa acicularis* ssp. *sayi* is G5T5 (the subspecies is demonstrably widespread, abundant, and secure globally, though it may be quite rare in parts of its range, especially at the periphery). It is common in Alaska, much of Canada, and several western states but rare in Iowa, Illinois, New York, New Brunswick, and West Virginia. In New England, *Rosa acicularis* ssp. *sayi* is accorded the state ranks of S1 in Vermont and Massachusetts and SH in New Hampshire. (If a newly-found occurrence in New Hampshire is confirmed, its rank in that state will change to S1.) It is not tracked in Maine or Connecticut and has probably never occurred in Rhode Island. *Flora Conservanda* lists the taxon (subspecies) as Division 2, a regionally rare taxon with fewer than 20 occurrences (seen since 1970) in New England (Brumback and Mehrhoff et al. 1996). The only currently known populations in New England are one occurrence in New Hampshire, three in Vermont, and one in Massachusetts. Several of these are in need of expert confirmation of the taxon's identification. Based on herbarium specimens and anecdotal reports, its presence in Maine is strongly suspected, but it has not been confirmed there recently. Due to the notoriously confusing nature of roses (great variability within species, species with overlapping characteristics, and frequent hybridization), the true degree of rarity of *R. acicularis* in New England and any population trends in the region are unknown. Many historic records are questionable because of difficulty of identification, and lack of useful locational information makes others difficult to resurvey.

Seed production at known occurrences was extremely low in 2002. Herbivory, gall infestations, canopy closure, human impacts (trampling, potential for damage by heavy logging

equipment), and competition from invasive alien species are threats to the taxon in New England. The main conservation objective for *Rosa acicularis* ssp. *sayi* is to maintain, through protection, monitoring, and management, at least four confirmed occurrences, one each in Maine, New Hampshire, Vermont, and Massachusetts, with 50 or more clumps of stems (stems arising from or very near the same base) or >150 stems if all are crowded together and clumps not distinguishable, with 20% of the clumps (or of second year or older stems in crowded patches) producing mature fruit.

This conservation plan summarizes available information about the taxonomy, ecology, extant and historic occurrences, and conservation status of *Rosa acicularis* ssp. *sayi* in New England. It also presents proposed actions to secure the long-term survival of the taxon in New England.

DESCRIPTION

The following description is a composite based largely on Lewis' (1957b and 1959) work, but also draws from Gleason and Cronquist (1991), Great Plains Flora Association (1986), and personal observation.

Rosa acicularis ssp. *sayi* is a small, deciduous shrub in the Rosaceae (Rose family). Stems are generally less than 1m tall and are densely beset with more or less straight, needle-like bristles or, rarely, with both bristles and prickles. Bristles extend to the apex of the floral branches, occasionally with only a few toward the apex. Stem color is usually green to brown, or often gray and minutely warty-appearing on older basal portions where bristles have broken off. Leaves are pinnately compound, with five to seven leaflets, usually glabrous above, puberulent beneath. (Some floras report the number of leaflets to be up to nine, but this may be the result of confusion from misidentified herbarium specimens. Until the new *Flora of North America* treatment of roses is available, it is probably wiser to follow Lewis' [1959] description: leaves 3–7-foliolate.) Leaflets are elliptic or oval, 1.5–4.5cm long, averaging 55% as wide as long. Margins are singly or biserrately toothed, sometimes with few or many gland-tips. Petioles are usually pubescent and often stipitate glandular and slightly bristly, the bristles and glands sometimes continuing along the underside of the rachis. Stipules are adnate, having tips free less than half the length of the stipule, margins usually with many stipitate glands, and the average width of the auricle 4.6mm. The five-petaled, pink flowers are fragrant and usually grow singly (occasionally two or three) at the ends of side branches off the previous year's stems. The five sepals are usually stipitate glandular and puberulent on the outside, tomentose within. They persist, becoming more or less connivent, closing back in to form a loose "beak" on the fruit. The pedicel is usually glabrous, rarely glandular. The hypanthium is glabrous. The fruit, a "hip," is scarlet or red but becomes blue or dark purple in dried specimens. (Gleason and Cronquist's [1991] description of blue or purple fruits is quite misleading on this point, apparently being based on herbarium material rather than fresh specimens.) Fruit shape is variable, elliptic, globose, or pyriform (pear shaped), often with a contracted neck below the

sepals. Fruits can reportedly be up to 2cm in diameter and may persist all winter. Achenes, generally 15–30 in number, are 3.8–4.5mm long, with stiff hairs along one side. The chromosome number is 2*n*=42 (also see discussion of ploidy levels below).

In New England, *Rosa acicularis* ssp. *sayi* often grows with *R. blanda* or *R. carolina*. *Rosa blanda* has similar leaves, may be quite bristly on lower portions of the stem, and has persistent sepals, but live plants can be easily distinguished by their reddish, often shiny stems. Hybrids of *R. blanda* may have prickles extending to the apex of flowering stems and have frequently been misidentified as *R. acicularis*, but a characteristic red stem inherited from the *R. blanda* parent often makes it possible to distinguish these.

Distinguishing *Rosa acicularis* from *R. carolina* can be more of a problem. Table 1 summarizes some useful distinctions based on Lewis' (1957b) descriptions and this author's observations of New England populations in 2002. *Rosa carolina* is notoriously variable, so distinctions are not always clear.

Table 1. Traits Useful for Distinguishing *Rosa acicularis* from *R. carolina*

Trait	***Rosa acicularis***	***Rosa carolina***
Leaflet appearance (live material)	generally larger, paler, dull	generally smaller, darker green, slightly shinier
Sepals	persistent, connivent on mature fruit	mostly eventually deciduous; if persistent, not connivent
Hypanthium	usually entirely glabrous	usually stipitate glandular
Prickles/Bristles	bristles generally straight, all similar, may be unequal in length; armature usually present to apex of flowering stem	bristles and prickles of different sizes and shapes often present on same plant; straight to somewhat recurved; pairs of distinct infrastipular prickles often present; armature sometimes (but not usually) present to apex of flowering stem

Another confusing factor is the lack of a good, widely accepted definition that distinguishes among thorns, prickles, and bristles on roses. The terms seem to be used interchangeably by some authors. There seems to be some ill-defined distinction in diameter, with thorns most robust and bristles the finest. Definitions offered by some authors (Lewis 1957b, Anonymous in *Davidsonia* 1978) are not consistent. Erlanson (1934) went so far as to state that: "Prickles on the same bush frequently vary in form and direction, so that it is useless

to distinguish species by this characteristic." The most noticeable difference between *Rosa carolina* and *R. acicularis* is the density of bristles on *R. acicularis*, but this feature is not easy to quantify.

Once one has seen *Rosa acicularis*, typical plants are not difficult to identify, but botanists unfamiliar with the species have been fooled, and herbarium collections still contain a fair number of apparently misidentified specimens. The best way to learn to identify the species is to visit a known population. The next best way is to study specimens annotated by Lewis, as these can be accepted with confidence as correctly identified specimens, but one must bear in mind the loss of features such as true fruit color and appearance of live leaves.

There are many rose plants that do not fit the "typical" description of any species. Because each species can exhibit a wide range of variability of characters, it becomes very difficult to determine what might be a hybrid population. Lewis (1957b) reports that more than 90% of fruits of *Rosa blanda* x *acicularis* abort while still small, so this may be one useful characteristic, but it seems possible that adverse environmental conditions (such as drought or a hard frost in late spring) might cause the same outcome in a non-hybrid population. For atypical plants (and many of the questionable specimens in herbaria may fall into this category), it may be impossible to determine conclusively the species (or hybrid parentage) by examination of gross morphology. Ziola and Dugle (1970) report that the most reliable way to distinguish *R. acicularis* from diploid rose species is by pollen size or size of stomata.

TAXONOMIC RELATIONSHIPS, HISTORY, AND SYNONYMY

The following history of *Rosa acicularis* is a summary of information from Lewis' Monograph of the genus *Rosa* in North America east of the Rocky Mountains (1957b). Citations in this section (except Erlanson 1934) are indirect and are listed in Appendix 2.

Rosa acicularis was first described by Tradescant (1656) under the name *R. moscovita* based on specimens presumably brought to England by his father from the Dvina River in Russia. Because the system of botanical nomenclature did not begin until 1753, the name is considered invalid. Gmelin (1768) described two forms of the species but did not use the binomial system. Pallas (1784) apparently confused *R. acicularis* with *R. alpina* L. The species was known by that name until Lindley clarified the distinction with his publication of *R. acicularis* in 1820.

Marschall von Bieberstein's (1819) description of *Rosa oxycantha* predates Lindley's description, but Crépin (1876) considered it to be a description of a hybrid between *R. acicularis* Lindl. and *R. pimpinellifolia* L., and Lewis placed it "in doubtful synonymy under *R. acicularis* Lindl."

At least 30 names for various Eurasian forms of *R. acicularis* were published or used between 1753 and 1936 (see Lewis 1957b for details), but Morner (1923) found that they could not be satisfactorily separated into regional races.

Lindley (1820) was unaware of the occurrence of *Rosa acicularis* in North America. Schweinitz (1824) collected plants at the mouth of the St. Peter's River in Minnesota that he described as a new species, *R. sayi*. Borrer (1832) confused *R. acicularis* Lindl. with *R. blanda* Ait. and *R. majalis* Herrm. Macoun and Gibson (1875) incorrectly used the name *R. stricta* Muhl., which refers to a different species. Crépin (1876) called the American plants *R. acicularis* Lindl. var. *bourgeauiana* Crép. or, as a synonym, *R. bourgeauiana* Crép.

Watson (1885) separated North American specimens into the more northerly, typical *R. acicularis* Lindl., the more southerly *R. sayi* Schwein., and another with larger prickles and elongated hypanthia, *R. engelmanni* Wats. Crépin (1896) believed that all three should be included in *R. acicularis*. He thought more data would be required to determine whether the American and Eurasian populations should be recognized as distinct species. Erlanson (1925) named var. *rotunda*, var. *sayiana*, and var. *lacorum* on the basis of hypanthium shape and leaf characteristics, but later found these characteristics to be inconsistent (Erlanson 1934). Raup (1947) named a var. *cucurbiformis* with gourd-shaped hypanthia.

Other names suggested at various times include *R. blanda* Ait. var. *aciculata* Ckll. (Cockerell 1889), *R. acicularis* Lindl. var. *engelmanni* (Wats.) Rehd. (Rehder 1902), *R. acicularis* Lindl. var. s*ayi* Rehd. (Rehder 1902), *R. aciculata* Ckll. (Cockerell 1904), *R. collaris* Rydb. (Rydberg 1917), *R. butleri* Rydb. (Rydberg 1918), and *R. suavis* Nakai (Hara 1952).

Based on extensive comparison of morphology and cytology, Lewis (1957b) separated the species into *R. acicularis* Lindl. ssp. *acicularis* native to Eurasia and *R. acicularis* Lindl. ssp. *sayi* (Schwein.) Lewis native to North America. He also named a form of the Eurasian subspecies *R. acicularis* Lindl. ssp. *acicularis* f. *alba* Lewis and a form of the American subspecies with double flowers *R. acicularis* Lindl. ssp. *sayi* (Schwein.) Lewis f. *plena* Lewis. Apparently no taxonomic treatment of native American roses has been published since Lewis' work.

SPECIES BIOLOGY

In much of what is written about *Rosa acicularis*, no distinction is made between subspecies. Studies done in Alaska may refer to either ssp. *acicularis* or ssp. *sayi*, or both. Based on Lewis' (1957b and 1959) work, it seems reasonable to conclude that reports from the rest of the North American continent refer to *R. acicularis* ssp. *sayi*. Therefore, it will be referred to simply as *Rosa acicularis* throughout the remainder of this report unless a distinction needs to be made.

Many investigators have examined ploidy levels in roses, and Lewis (1957b) presents tables that show results for native American roses from various studies. Results for some species, notably *Rosa carolina*, are somewhat inconsistent and probably reflect the broad range of characters exhibited by the species and the consequent difficulty of identification. Nevertheless, there seems to be general agreement about chromosome numbers. Native roses found in New England can be categorized as follows:

- Hexaploid ($2n = 42$) – *Rosa acicularis* ssp. *sayi*
- Tetraploid ($2n = 28$) – *R. carolina, R. virginiana*
- Diploid ($2n = 14$) – *R. blanda, R. nitida, R. palustris, R. setigera*

It appears that the size of both pollen and the guard cells of leaf stomates increases with chromosome number, and Ziola and Dugle (1970) found this to be useful for distinguishing between diploid and hexaploid species. It is less reliable for distinguishing either of those from tetraploids, since there is some overlap in the size ranges.

Erlanson (1938) reported interesting observations about the physiological effects of polyploidy in roses. The higher polyploids are slower-growing, have shorter flowering laterals and a one- to few-flowered inflorescence, and are the earliest-flowering roses. They respond to slight increases in temperature, putting out foliage and flower buds very early in spring. This behavior suits them well in arctic or boreal habitats where growing seasons are very short, but becomes problematic in areas where alternating spring thaws and late freezes can badly damage the new growth. She found that an octoploid *Rosa acicularis* (which would have been classified as ssp. *acicularis* by Lewis) transplanted from Alaska to Ann Arbor, Michigan, was frequently severely damaged by late frosts so that in some years no flowers were produced. Although *R. acicularis* ssp. *sayi* is not quite so precocious, it is conceivable that it is subject to similar limitations in New England, where spring weather can be extremely erratic.

Roses are notorious (or prized, depending on one's point of view) for their tendency to hybridize. Nevertheless, Erlanson (1929) postulates that wide crosses are presumably infrequent in nature because of the tendency of diploid, tetraploid, and hexaploid roses to flower at distinct times. She reports that hexaploids, which are boreal and alpine in distribution, bloom earliest; tetraploids, which are more temperate and southern, bloom later; and diploids are intermediate in both distribution and bloom time. She also reports that bloom times are consistent over a wide geographical range. Flowering dates for New England roses outlined by Seymour (1993) suggest more overlap among species in this region, although *Rosa acicularis* appears to have a relatively early and much shorter blooming period (June 11–23) than the others. No doubt, the very narrow range of dates for *R. acicularis* is partly an artifact of very limited information on the species in New England. It should also be noted that, for other species, Seymour's dates represent information collected over many years, from southern Connecticut to northern Maine, and over a broad range of elevations. While Erlanson's observations in 1929 may hold true within a particular growing season and among rose

populations growing at similar elevations or within a smaller geographical area, she noted later (Erlanson 1934) that the period of anthesis for individual bushes of early-flowering roses is prolonged in early, mild springs, thereby allowing more overlap with later bloomers. In the West, natural hybrids occur between *R. acicularis* and the hexaploid *R. nutkana*, and Erlanson (1934) reported creation of semi-fertile artificial hybrids of *Rosa blanda* x *acicularis*, but it is not known whether or how frequently natural hybrids occur between *R. acicularis* and roses of other ploidy levels. Ziola and Dugle (1970) mention a possible *R. acicularis*–diploid cross in Manitoba, but suggest that it may instead be a case of chemically induced autopolyploids genetically modified by herbicides.

The showy, fragrant flowers of *Rosa acicularis* are attractive to insects. They are reportedly a major source of nectar for bees kept by beekeepers in Alaska (Petersen 1989). New England populations visited by this author in 2002 were already past blooming, but moderate fruit production at NH .003 (Moultonborough) suggests that pollinators are available and are doing their job. Low fruit production at some New England populations (VT .001, [Manchester] and MA .003 [Lanesborough]) appears to be due to problems other than failure of pollination.

Rosa acicularis falls prey to many typical rose diseases and pests. Watson et al. (1980) report that it is susceptible to leaf rusts, leaf spots, powdery mildew, stem canker, and crown gall. Plants at VT .001 (Manchester) appear to be severely affected by an unknown gall-former (possibly some species of *Diplolepis* wasp) that causes floral branches to produce irregularly shaped galls instead of flowers or fruit (personal observation).

Many observers have reported on the value of *Rosa acicularis* as a nutritious resource for wildlife (Martin et al. 1951, Wilkins 1957, Hatler 1972, Wallmo et al. 1972, Densmore and Zasada 1977, Wolff 1978, Pease et al. 1979, Viereck and Dyrness 1979, Mace 1986). All above-ground parts of *R. acicularis* are eaten by one type of animal or another. In areas where *R. acicularis* is common, its hips are an important food source for songbirds, gamebirds, small mammals, rabbits, snowshoe hares, beavers, and bears. The hips may be less palatable to birds than other fruits, with the result that they tend to remain on the plants and serve as a winter food supply. Buds are eaten by upland gamebirds. Stems and foliage are eaten by rabbits, hares, beavers, bears, and a wide variety of ungulates (white-tailed deer, mule deer, pronghorn, elk, and mountain sheep). *Rosa acicularis* is reportedly a preferred food of snowshoe hares in Alaska.

New England populations of *Rosa acicularis* showed signs of herbivory. At all sites visited by the author in 2002, there was at least some insect damage to foliage, sometimes resulting in numerous, sizable, circular holes in leaflets, but no pests were observed. Most of the stems at the Massachusetts occurrence appeared to have been nipped off at the tips, with the result that only plants at the very edge of the cliff succeeded in producing fruit. Most cuts were at about the same height, suggesting the work of deer, but cleanness of cuts was not noted, so rabbits cannot be excluded as possible culprits.

Rosa acicularis may provide nesting sites and useful cover for birds and small mammals (Martin et al. 1951, Thornburg 1982), but it seems unlikely that New England occurrences are dense or robust enough to provide much cover (personal observation).

In regions where *Rosa acicularis* is common, many parts of the plant have been used by humans, as well. Authors on this topic usually fail to distinguish between rose species, so this information refers to native roses in general. Native Americans reportedly boiled roots to make a solution that was used in compresses to reduce swelling, gargled to relieve sore throats or tonsillitis, drunk as a remedy for mouth bleeding, or inhaled as a vapor for nose bleeding (Hart 1976). Hips may have been used by some tribes only as emergency food because of a belief that they caused itching (Harrington 1976, Hart 1976). Several authors have written about uses for other parts of the plant (Viereck and Little 1972, Harrington 1976, Hart 1976, Moore 1979). Leaves, flowers, and buds can be used for tea; petals can be eaten raw or used in perfume; buds and flowers can be used to make a solution for eyewash; hips are used for jelly, syrup, jam, marmalade, and catsup; hips can be dried and ground into a powder that is added to baked goods; green hips can be peeled and cooked; and young shoots have been cooked as a potherb.

Densmore and Zasada (1977) studied germination requirements of Alaskan *Rosa acicularis*. They made no distinction between subspecies, both of which are known to occur in Alaska, so it is unclear whether they were dealing with *R. acicularis* ssp. *acicularis* or ssp. *sayi* or both. Based on laboratory experiments and field observations, they suggested the following description of the germination ecology of *R. acicularis*. They found that, in interior Alaska, many seeds are dispersed prior to snowmelt by birds and mammals that eat the fruit. Few or none of those seeds germinate during the first spring. Other fruits remain on the plant through winter, are shed when leaves appear, and decompose rapidly. In either case (defecated or simply dropped), the seeds undergo warm stratification during the summer followed by cold stratification the second winter. After cold stratification, the seeds can germinate over a wide range of temperatures soon after snowmelt, taking advantage of early spring moisture and growing vigorously at low temperatures.

They surmise that *Rosa acicularis* is well adapted to survival and dispersal in its harsh northern range. Edible hips increase chances of dispersal by animals to suitable locations. Complex dormancy mechanisms help insure germination at a favorable time of year and may spread germination of one year's seed crop over several years. Though the number of seeds is small, large seed size contributes to rapid production of a large root system. Plants then spread vegetatively by rhizomes over a wide area, forming clones that they say may be capable of persisting for hundreds of years.

Evidence of this species' potential for extreme vigor and even aggressiveness was documented by Koller (1981). At the Arnold Arboretum in Jamaica Plain, Massachusetts, a specimen of *Rosa acicularis* grown from a seed collected in Boulder, Colorado, in 1909 was

still thriving in cultivation after 72 years, requiring periodic "grubbing out" at the edges to prevent further spread beyond its allotted 15-foot (4.5m) space.

Although *Rosa acicularis* produces many fine roots in the top 20cm of soil, deep roots may reach 140cm (Strong and LaRoi 1986). In studies in Alaska, Calmes and Zasada (1982) found rhizomes 20–30cm below the surface, in mineral soil beneath deep organic horizons. At this depth, rhizomes are protected and can resprout after fire or other disturbances.

HABITAT/ECOLOGY

Much of what is known about habitats and ecology of *Rosa acicularis* was summarized by Crane (1990) in an exhaustive literature review done for the USDA Forest Service Fire Effects Information System. Much of the following information is derived from that report, but all original sources that could be found have been verified.

Because *R. acicularis* occurs over a huge geographic area, it appears in a wide assortment of habitat types, including forests and more open areas. Plant communities in which it is found vary from region to region. In northern Alaska, at dry sites at treeline, it is associated with willows (*Salix* spp.), alders (*Alnus* spp.), *Viburnum edule*, and herbs (Viereck 1979). It is common in boreal forests under white spruce (*Picea glauca*) or in relatively open black spruce (*P. mariana*) forests (Dyrness and Grigal 1979). It is very common in northern hardwood forests dominated by birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*) (Dyrness et al. 1986), as well as in transition areas between spruce and birch forests (Brown and West 1970). In British Columbia, it occurs in boreal spruce forests as well as subboreal spruce (*Picea glauca x engelmannii*) stands (Pojar et al. 1984, Klinka et al. 1990). *Rosa acicularis* is common in quaking aspen (*Populus tremuloides*) "parkland" and even in open grassland from Alaska, through Alberta, and into northern Montana (Daubenmire 1953, Lynch 1955, Anderson and Bailey 1980). In Alberta, it occurs in poplar (*Populus balsamifera* and *P. tremuloides*), spruce (*Picea glauca*), and lodgepole pine (*Pinus contorta*) stands (Corns 1983). In northern Montana, it is found at low frequency in groves of black cottonwood (*Populus trichocarpa*) (Lynch 1955). It is associated with spruce (*Picea engelmannii*), fir (*Abies lasiocarpa*), pine (*Pinus contorta*), and Douglas fir (*Pseudotsuga menziesii*) stands in the northern Rocky Mountains (Reed 1976, Crane et al. 1983, Steele et al. 1983), with pine (*Pinus ponderosa*) and aspen (*Populus tremuloides*) in the Bighorn Mountains of Wyoming and the Black Hills of South Dakota (Hoffman and Alexander 1976, Steinauer 1981, Hoffman and Alexander 1987), and only with ponderosa pine (*Pinus ponderosa*) in southern Wyoming (Alexander et al. 1986). Crane (1990) also lists it as occurring in the following "plant associations:" Great Lakes spruce-fir forest, Great Lakes pine forest, and maple-basswood forest; as well as additional "cover types:" jack pine, balsam fir, eastern white pine, limber pine, and western red cedar-western hemlock.

Aside from the above-mentioned forest types, *Rosa acicularis* reportedly is common with aspen in previously burned areas and occurs in thickets, on roadsides, and in bogs in Alaska (Viereck and Little 1972). It is infrequent to locally common on wooded hillsides, stream banks, and rocky bluffs and ledges in the Great Plains and Alberta (Stephens 1973, Great Plains Flora Association 1986). Voss (1985) describes its habitats in the Great Lakes region as including sandy and gravelly shores, sandy woodlands with jack pine (*Pinus banksiana*) and oak (*Quercus* spp.), rocky ridges and shores, moist thickets, swamps, and openings in conifer forests. In New York, extant occurrences are in open, rocky grassland areas on calcareous summits (Steve Young, New York Natural Heritage Program, personal communication).

In northwestern Illinois, in Jo Daviess County, *Rosa acicularis* occurs on unusual, moss-covered, algific, north-facing limestone talus. Because of persistent ice within the talus, surface temperatures reach only 42° F even on 90° days in summer. Growth of larger woody species is inhibited by the low temperature (Kenneth Robertson, Illinois Natural History Survey, personal communication; Post 2000).

Extant New England occurrences and herbarium records annotated by Lewis have been on and around rocky ledges or outcrops (NH .003 [Moultonborough], VT .001 [Manchester], VT .006 [Addison-Weybridge], VT .008 [Bridport], VT herbarium records, and MA .003, [Lanesborough]), river shores (NH .001 [Plainfield]), or in rocky woods (VT herbarium records). Other reported New England occurrences have been along roadsides or railroads, river floodplain, lake shores, and along the coast of Maine.

In Vermont and Massachusetts, *Rosa acicularis* occurs along the ecotone between calcareous cliff communities and dry woods dominated by hop hornbeam (*Ostrya virginiana*) (MA .003 [Lanesborough]) or red oak (*Quercus rubra*) and hop hornbeam (*Ostrya virginiana*) (VT .001 [Manchester]). At another site in Vermont, it reportedly grows on a rocky ridge in dry oak-hickory-red cedar woods where hop hornbeam (*Ostrya virginiana*) is present along with several oak species (*Quercus rubra, Q. prinoides, Q. alba*) and two hickory species (*Carya ovata* and *C. cordiformis*) (VT .008 [Bridport]). In New Hampshire, it grows at the edge of open ledges and on rocky outcrops in rich but somewhat dry red oak (*Quercus rubra*)-white ash (*Fraxinus americana*)-sugar maple (*Acer saccharum*) forest where hop hornbeam (*Ostrya virginiana*) is also present (NH .003 [Moultonborough]). The one New England occurrence visited by this author in 2002 where hop hornbeam (*Ostrya virginiana*) was not noted was VT .006b (Weybridge), where the mixed hardwood forest dominated by sugar maple (*Acer saccharum*) has been selectively logged and may be somewhat atypical. Although presence of hop hornbeam (*Ostrya virginiana*) seems to stand out as a possible indicator of appropriate habitat at upland occurrences of *R. acicularis* in New Hampshire, Vermont, and Massachusetts, it is likely that any occurrences near rivers, lakeshores, the seacoast, or northern Maine would occur in quite different natural communities.

Soils

According to Watson et al. (1980) in their manual of plants suitable for reclamation in Alberta, *R. acicularis* is tolerant of acidic soils and adapted to a wide range of soil textures and moistures. They recommend it for re-vegetation of moist to wet sites in Alaska and Alberta. It is also drought-tolerant and competes well with seeded grasses when used for reclamation of amended oil sand tailings in Alberta (Watson et al. 1980, Fedkenheuer et al. 1980).

Other reports appear to be somewhat contradictory, hinting that its preferred soil conditions vary from region to region. Some authors report that, in interior Alaska and on the Saskatchewan and Mackenzie river deltas, it does best on seasonally flooded alluvial soils but does not thrive on peats or in basins with poor drainage (Dirschl and Coupland 1972, Dyrness and Grigal 1979, Pearce et al. 1988). Whereas in Alaska it grows on nutrient-poor gravels subject to rapid freezing and thawing, in Alberta it apparently does not grow in the poorest sites (Watson et al. 1980, Corns and Annas 1986). In British Columbia, it is found on fine or coarse-textured soils (Pojar et al. 1984, Klinka et al. 1990). Site conditions for *Rosa acicularis* in Minnesota have been described as moderate to poor and dry (Bakuzis and Hansen 1962). Reed (1976) reported that it grows on soils close to neutral pH in Wyoming. Many Ontario specimens at Gray Herbarium have useful habitat descriptions and mention a wide variety of substrates including: rocky shelves, river gravels, clay banks, sandy banks, wet sands, stony beach, gravelly soil in open woods, limestone woods edge, and calcareous till slopes. Specimens from Québec mention dry field, dry pasture, calcareous shore, and dolomite escarpment. As noted above, occurrences in northwestern Illinois are on limestone talus (Robertson, personal communication; Post 2000). New York occurrences are on calcareous rocky summits (Young, personal communication).

In New England, it appears that *Rosa acicularis* is drought-tolerant but may require nutrient-rich soils. It is found growing over calcareous bedrock in Massachusetts and Vermont (MA .003 [Lanesborough], VT .001 [Manchester], VT .006 [Addison-Weybridge], VT .008 [Bridport]). In New Hampshire (NH .003 [Moultonborough]) it is found in an area below and influenced by runoff from basalt ledges. Water samples collected on 18 October 2002 from a stream and seepage from a ledge near this rose site had pH values of 7.53 and 7.70, respectively (Scott Bailey, Hubbard Brook Experimental Forest, personal communication). Historic occurrences in New Hampshire along the Connecticut River (NH .001 [Plainfield], NH .002 [Woodsville]) were likely in rich sediments deposited by glacial Lake Hitchcock.

Elevation

Rosa acicularis occurrences range in elevation from the above-mentioned river deltas (presumably near sea level) to as high as about 3300m in Colorado and almost 3600m in Wyoming (Dittberner and Olson 1983). In New England, known extant occurrences are at elevations from about 190m (620 feet at VT .008 [Bridport]) to about 670m (2200 feet at VT

.001 [Manchester]), and historic occurrences annotated by Lewis have ranged down to close to sea level (West Bath, Maine).

Disturbance Tolerance

Rosa acicularis is an early colonizer of disturbed sites. In northern Montana grasslands, it is one of several shrub species that becomes established where rodents throw up bare soil (Lynch 1955). Watson et al. (1980) report that it invades exposed mineral soils, moves in after fire, and pioneers on riverine gravel bars along the eastern slopes of the Rocky Mountains. Around Lake Michigan, it is a dominant species at some stages of dune community succession (Cowles 1899).

Dyrness et al. (1988) report that within two years after logging (shelterwood or clearcutting) in Alaskan white spruce, *Rosa acicularis* becomes dominant, reaching or exceeding precutting cover and frequency values. Likewise, Wallmo et al. (1972) reported that, in Colorado, frequency of *R. acicularis* increases after logging. In Vermont (VT .006b Weybridge), it appears to have persisted for at least a century in an area that has been logged periodically.

Many authors have reported that *Rosa acicularis* grows on active floodplains (Viereck 1970, Dirschl and Coupland 1972, Dyrness and Grigal 1979, Pearce et al. 1988, Viereck 1989). Historic occurrences along the Connecticut River in New Hampshire were likely in areas subject to flooding at least every few years.

Rosa acicularis can resprout from the base of fire-killed stems or from deeper rhizomes, but its seeds are also fire-resistant and may be stimulated to germinate as a result of fire (Viereck and Schandelmeier 1980, Parminter 1983b, Parminter 1984). The species shows varying responses to fire depending on fire severity, site conditions, and timing. It reportedly occurs on almost all recently burned sites in some areas studied in Alaska, surviving because of the location of its rhizomes in mineral soil, below organic layers (Lutz 1953, Calmes and Zasada 1982). In British Columbia, its recovery depends on soil moisture, with increased abundance after fires on moist sites, but decreased abundance on drier sites (Hamilton 1988). Over a period of 24 years, annual spring burning of grassland in the aspen parkland of east-central Alberta resulted in severe reduction of *R. acicularis* frequency and cover (Anderson and Bailey 1979, 1980). Reports from Minnesota indicate reduced frequency after spring and summer wildfires in mixed conifer-hardwood stands (Krefting and Ahlgren 1974), increased *R. acicularis* biomass after a mid-May wildfire (Ohmann and Grigal 1966), and persistence in the understory of mixed aspen, birch, and jack pine stands 33 years after another wildfire (Ohmann et al. 1973). A review of prescribed burning in Ontario jack pine stands found *R. acicularis* to be a stable species, present before and after fires (McRae 1979). In northeastern broadleaf forests, *R. acicularis* recovers well only after light fires, becoming infrequent after more severe fires (Ahlgren 1960).

Light and Aspect

Although it grows best and produces fruit most successfully in open situations, *Rosa acicularis* can persist for at least many decades in the understory. It can be an understory dominant in mixed forests but decreases slightly as the canopy closes in black spruce taiga (Foote 1983, Parminter 1983a, Pojar et al. 1984, Dyrness et al. 1986).

Not enough information could be found to justify any generalizations about whether aspect is important to populations at the periphery of the species' range. In Illinois, *Rosa acicularis* grows on north-facing slopes (Robertson, personal communication). In New Hampshire (NH .003 [Moultonborough]), Vermont (VT .001 [Manchester], VT .006 [Addison-Weybridge], VT .008 [Bridport]), and Massachusetts (MA .003 [Lanesborough]) it grows on south- or west- facing slopes. Details about aspect of other New England or New York occurrences are not available.

THREATS TO *ROSA ACICULARIS* SSP. *SAYI*

It is unclear exactly how rare *Rosa acicularis* is or has ever been in New England. Problems with identification and the reluctance of many botanists to even try to identify roses to the species level have resulted in a situation where rare roses can apparently hide in plain sight, as they seem to have done at one recently discovered occurrence (NH .003 [Moultonborough]). Historic population levels are equally unclear, because the true identity of many herbarium specimens labeled or annotated as *Rosa acicularis* ssp. *sayi* is questionable. Old records also tend to have minimal location information, so it is difficult to check on the current status of historic occurrences annotated by Lewis during his taxonomic studies of native roses. Add to this the fact that this rose is not tracked in Maine or Connecticut, and it becomes impossible to accurately assess either its current degree of rarity in New England or any possible trends (increase, stability, or decline). Nevertheless, it does appear that this rose has never been common in New England, at least since botanists started studying the local flora. It is a more northerly species, and New England is at the edge of its range. It is possible that some historic occurrences in Vermont may have been lost to development, but one location in Middlebury may not have been searched in recent years, and until other historic specimens are confirmed, their status will be unknown.

Actual Threats

Several threats were evident at occurrences of *Rosa acicularis* (or probable *R. acicularis*) observed in 2002. At MA .003 (Lanesborough), almost all stems, except those at the very edge of the cliff, had been pruned at about the same height by some herbivore, with the result that almost no reproductive material remained. There were signs of minor herbivory at NH .003 (Moultonborough) as well, but this population fruited successfully. Since this species

can tolerate at least a moderate amount of herbivory, this should probably not cause concern unless a population shows signs of decline or complete reproductive failure because of severe herbivory.

Other possible threats to sexual reproduction were noted in 2002. At VT .001 (Manchester), fruit production was severely limited because of the prevalence of galls, probably caused by a species of *Diplolepis* wasp. At several sites (NH .003 [Moultonborough], VT .006b [Weybridge], VT .008 [Bridport]), part or all of the populations may have failed to produce fruit because of insufficient sunlight due to closing of the forest canopy. Although *R. acicularis* may persist for decades or centuries in shaded locations, it appears to prefer full sunlight for fruit production. Future observation of these sites may help determine whether the drought in 2002 suppressed fruit production and whether some patches with only aborted fruit (NH .003 [Moultonborough]) are actually hybrid clones incapable of producing mature fruit.

Another concern at some sites is physical disturbance by hikers or vehicles. Occurrences at NH .003 (Moultonborough) and VT .001 (Manchester) are vulnerable to trampling, and, in fact, the Vermont site is in recovery from past over-use. The occurrence at Weybridge, VT (VT .006b), is right next to a trail that was being used as a logging road in 2002. Trampling seems unlikely because of the position of the plants relative to the trail, but destruction by logging vehicles or dragged logs is a definite possibility.

Potential Threats

Real estate development is not a threat to clifftop occurrences of *Rosa acicularis* that are already owned by conservation entities, but could threaten unprotected hillside occurrences. The exact location of a newly discovered patch at VT .006b (Weybridge) relative to boundaries of protected property are not known, so it could be at risk. In any case, development near rare plant occurrences can serve to introduce alien species into the area.

Woody invasive alien species were noted at or near several occurrences (NH .003 [Moultonborough], VT .001 [Manchester], VT .008 [Bridport], MA .003 [Lanesborough]). Although none seemed to be in immediate danger from competition by or shading from invasive species, the potential threat is there.

Rosa acicularis flowers are showy and fragrant, so picking of flowers could become a threat to any population near a trail or at a popular hiking destination, especially if the number of visitors increases.

Logging could be a threat to any populations in wooded locations, such as NH .003 (Moultonborough) and VT .008 (Bridport), if not managed with protection of the rare species in mind. Thinning of the canopy and even some disturbance of soil are not likely to harm *Rosa acicularis*, but major churning of the soil by large equipment and possible resultant erosion

could be detrimental. This seems especially likely if logging is done when the ground is not frozen and if equipment is allowed to run directly through a rose population.

Theoretical Threats

The status of occurrences of *Rosa acicularis* near rivers in Maine and New Hampshire is unclear. Based on reports of this rose's affinity for river gravel bars in Canada and Alaska, it is reasonable to conclude that damming of rivers or other changes in hydrology could have a negative impact on the species. New dam creation could flood former habitat. Flood control could eliminate some areas where periodic scouring by floods and ice keeps the habitat open and hospitable to the rose.

Rosa acicularis is a boreal species, and New England is on the southeastern periphery of its range. One might worry, therefore, that global warming would seriously threaten populations here. This does not seem to be an immediate, direct threat. As reported by Koller (1981), *R. acicularis* has been thriving at Arnold Arboretum for many decades, and that location is in a coastal climate zone that is much milder than other New England sites. Still, competition from other species that increase their ranges or grow more densely in a warmer environment could become a concern as the climate warms. The ability of *R. acicularis* to reproduce sexually in warmer climates is unknown.

DISTRIBUTION AND STATUS

General Status

Lewis (1957a and 1959) found that *Rosa acicularis* has the widest geographical range of any species of *Rosa*. The distribution of *R. acicularis* ssp. *acicularis* reaches from Sweden across northern Eurasia to Alaska, where it overlaps with subspecies *sayi*, which is found in all Canadian territories and provinces east to Nova Scotia, across the northern tier of the United States, and south to New Mexico and West Virginia. The North American and New England distributions of *Rosa acicularis* ssp. *sayi* are illustrated in Figures 1, 2, and 3.

Rosa acicularis ssp. *sayi*'s global rank is G5T5, the subspecies being demonstrably widespread, abundant, and secure globally, though it may be quite rare in parts of its range, especially at the periphery. Similarly, in both the United States and Canada it is ranked N5. It is listed as rare (S1–S3) in nine states or provinces. Reports from five states or provinces are unverified, and, if it occurs in any of them, it is undoubtedly rare there. Its status in Maine is unclear, but it is probably rare there. It is reported from 19 other states and provinces and is common in most of them.

Lewis (1957b) reported that the species occurs south of the treeline in Yukon Territory, Manitoba, and Québec, and east of the Coast Mountains in British Columbia. In Alaska, western Canada (British Columbia, Alberta), and throughout the prairie provinces it is quite common (Looman and Best 1987), in some areas even being treated as an agricultural nuisance (Bowes 1981). It is the floral emblem of Alberta (Moss 1959). It is listed as secure (S5) in Manitoba and Ontario and as S4S5 in Wyoming (NatureServe 2002). The Great Plains Flora Association (1986) indicates that it is infrequent to locally common in northern North Dakota and the Black Hills, and scattered elsewhere in South Dakota. Hitchcock and Cronquist (1961) indicate that it is uncommon in Idaho and extends southward in the cordillera to northern New Mexico.

Lewis (1957b) mentioned specimen(s) recorded from eastern Washington, but did not include this/these among the specimens he examined and confirmed, so it is not known whether any occurrence there has been verified. NatureServe (2002) lists Kansas as a state where *Rosa acicularis* has been reported, but it seems that no other author, including the Great Plains Flora Association (1986), mentions this, so the accuracy of this listing is questionable. According to NatureServe (2002), it has been falsely reported from Nebraska.

Not surprisingly, the areas where *Rosa acicularis* is known to be rare are along the extreme eastern and southeastern edge of its range. The species' status in Nova Scotia (S1SE) and New Brunswick (S1) is under review, but previously reported specimens seem to be unavailable for reexamination. Sean Blaney has collected material from northwest New Brunswick near the Maine border that appears to be *Rosa acicularis* and for which he is seeking confirmation from Lewis (Sean Blaney, Atlantic Canada Conservation Data Centre, personal communication). Hinds (2000) lists it as having been reported from three locations in New Brunswick and suggests that it may have been introduced from further west, but "[t]he New Brunswick ranking committee (without dealing with the identification issue) decided that the Nepisiquit River records were almost certainly native, so the current rank is S1, rather than the former S1SE" (Blaney, personal communication).

There are two extant occurrences in northwestern Illinois, where it is listed as S1, E (Robertson, personal communication). According to NatureServe (2002), it is listed as S2 in Iowa, and the Iowa Natural Areas Inventory website (2002) lists it as E. Iowa occurrences were not among those studied by Lewis and are not mentioned by the Great Plains Flora Association (1986), so occurrences there may need confirmation. New York has 3 extant and 10 historic occurrences (the latter group perhaps including some misidentifications) centered around the Lake George-Lake Champlain region and lists it as S1, E (Young, personal communication). Lewis (1957b) reported its disjunct occurrence at one locality in Hampshire County, West Virginia with "a habitat more typical of boreal conditions," and it is listed as S1 in that state. In New England, *Flora Conservanda* lists *Rosa acicularis* ssp. *sayi* as Division 2, Regionally Rare (Brumback and Mehrhoff et al. 1996). All states and provinces with reported occurrences are listed in Table 2.

Table 2. Occurrence and status of *Rosa acicularis* ssp. *sayi* in the United States and Canada based on information from Natural Heritage Programs and herbarium specimens annotated by Lewis (1957b)

OCCURS & LISTED (AS S1, S2, OR T &E)	OCCURS & NOT LISTED (AS S1, S2, OR T & E)	OCCURRENCE REPORTED OR UNVERIFIED	HISTORIC (LIKELY EXTIRPATED)
Illinois (S1, E)	Alaska: herb. spec.*	Connecticut (SR)	
Iowa (S2, E)	Alberta: herb. spec.*	Kansas (SR)	
Massachusetts (S1, E): 1 extant occurrence	British Columbia: herb. spec.*	Nebraska (SRF)	
New Brunswick (S1) under review	Colorado: herb. spec.*	Rhode Island (SRF)	
New Hampshire (SH, E): 1 extant and 2 or more historic occurrences	Idaho: herb. spec.*	Washington: mentioned as having been reported there (Lewis 1957b)	
New York (S1): 3 extant and 10 historic occurrences	Maine (SR): 6 or more historic occurrences, 2 annotated by Lewis		
Nova Scotia (S1SE) under review, possibly exotic	Manitoba (S5)		
Vermont (S1, E): 3 extant and 11 historic occurrences	Michigan: herb. spec.*		
West Virginia (S1): at least one occurrence collected by Lewis (1957b)	Minnesota: herb. spec.*		
	Montana: herb. spec.*		
	New Mexico: herb. spec.*		
	North Dakota: herb. spec.*		
	Northwest Territories: herb. spec.*		
	Ontario (S5)		
	Quebec: herb. spec.*		
	Saskatchewan (S?)		
	South Dakota: herb. spec.*		
	Wisconsin: herb. spec.*		
	Wyoming (S4S5)		
	Yukon Territory: herb. spec.*		

* Herbarium specimen(s) annotated by Lewis (1957b). Other historic occurrences may not all be correctly identified. Occurrences in Illinois, Iowa, and Massachusetts were not mentioned by Lewis. (MA occurrence was discovered after he did his work; reason for omission of IL and IA occurrences not known.)

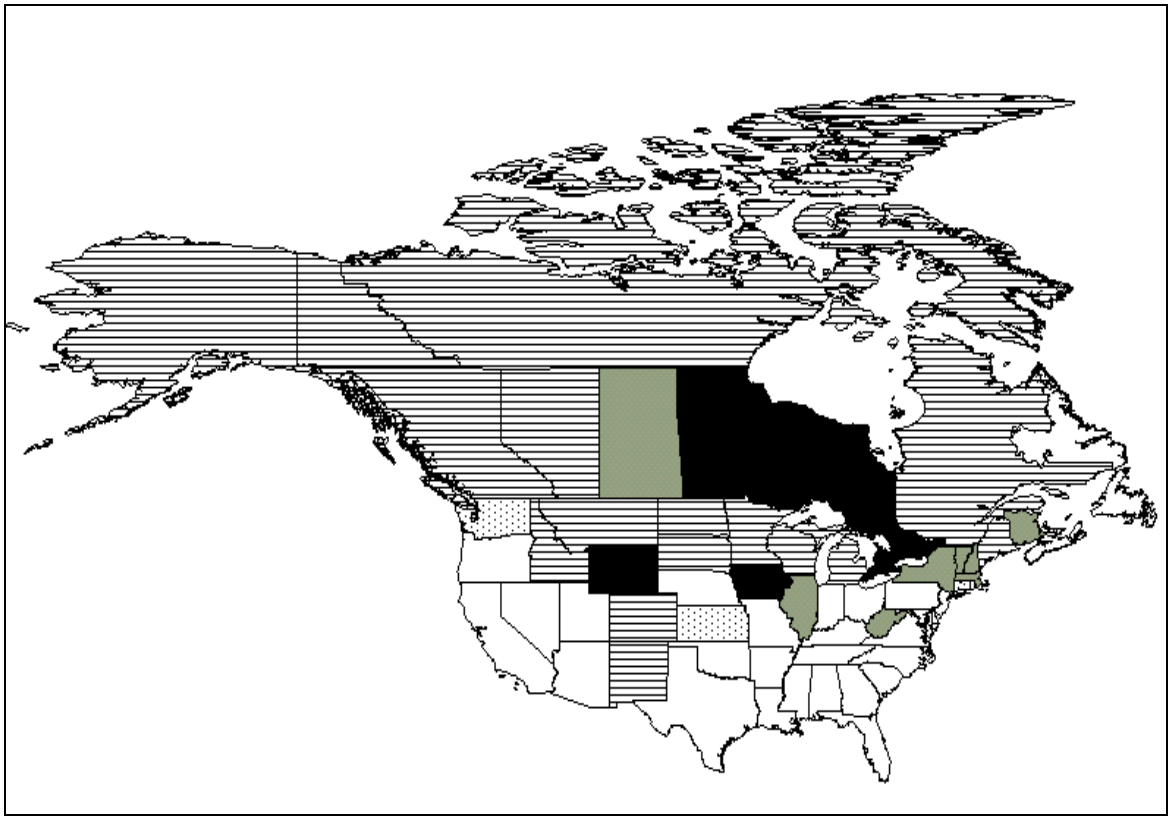

Figure 1. Occurrences of *Rosa acicularis* in North America. States and provinces shaded in gray have one to five (or an unspecified number of) current occurrences of the taxon. Areas shaded in black have more than five confirmed occurrences. Horizontal stripes indicate states and provinces in which herbarium specimens of the taxon have been verified; it is not known whether the taxon is still extant in all these areas, but the taxon is regarded as common in western Canada and Alaska. States with stippling are ranked "SR" (status "reported" but without further documentation). See Appendix for explanation of state ranks.

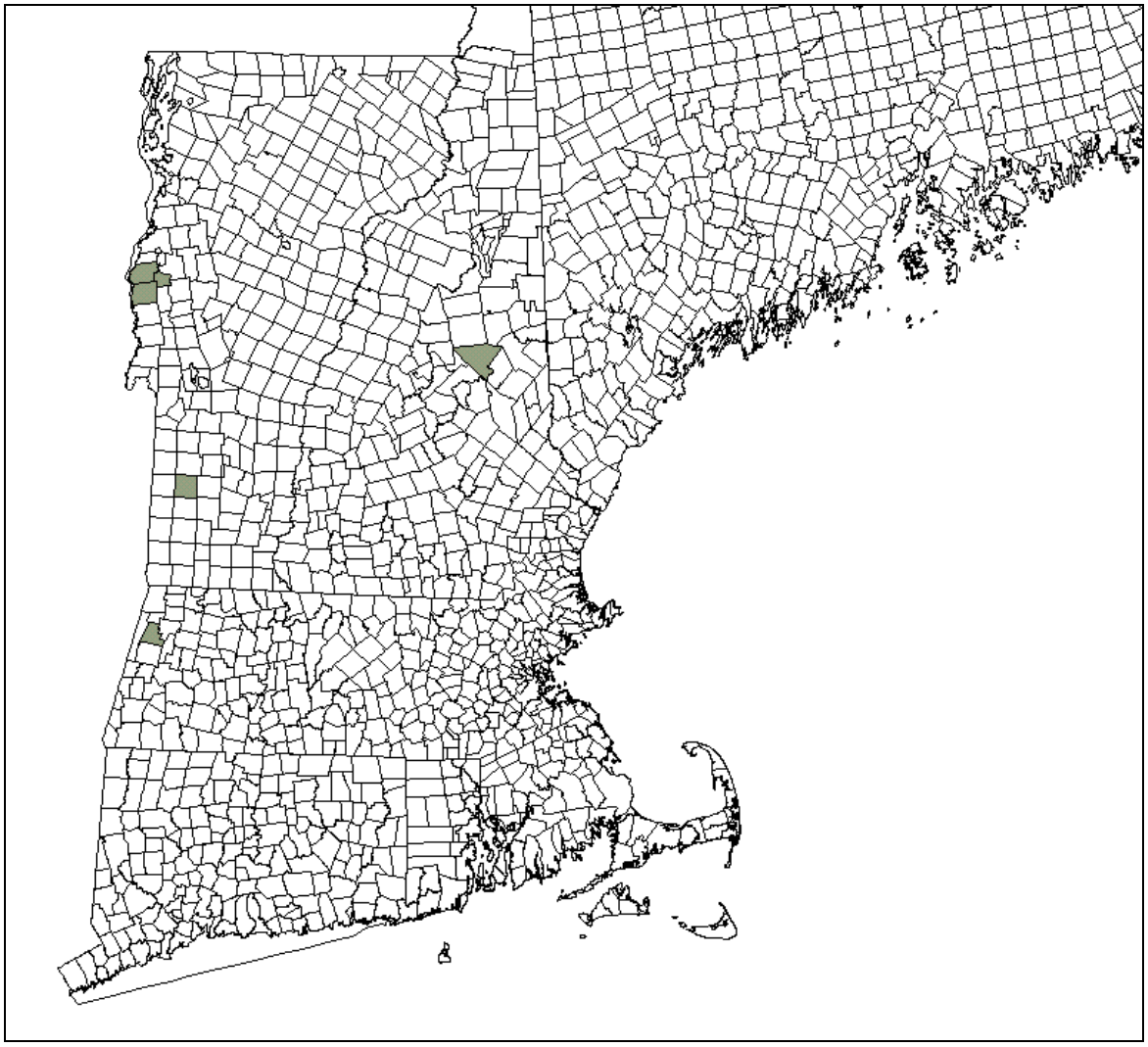

Figure 2. Extant occurrences of *Rosa acicularis* in New England. Town boundaries for New England states are shown. Towns shaded in gray have one to five extant occurrences of the taxon.

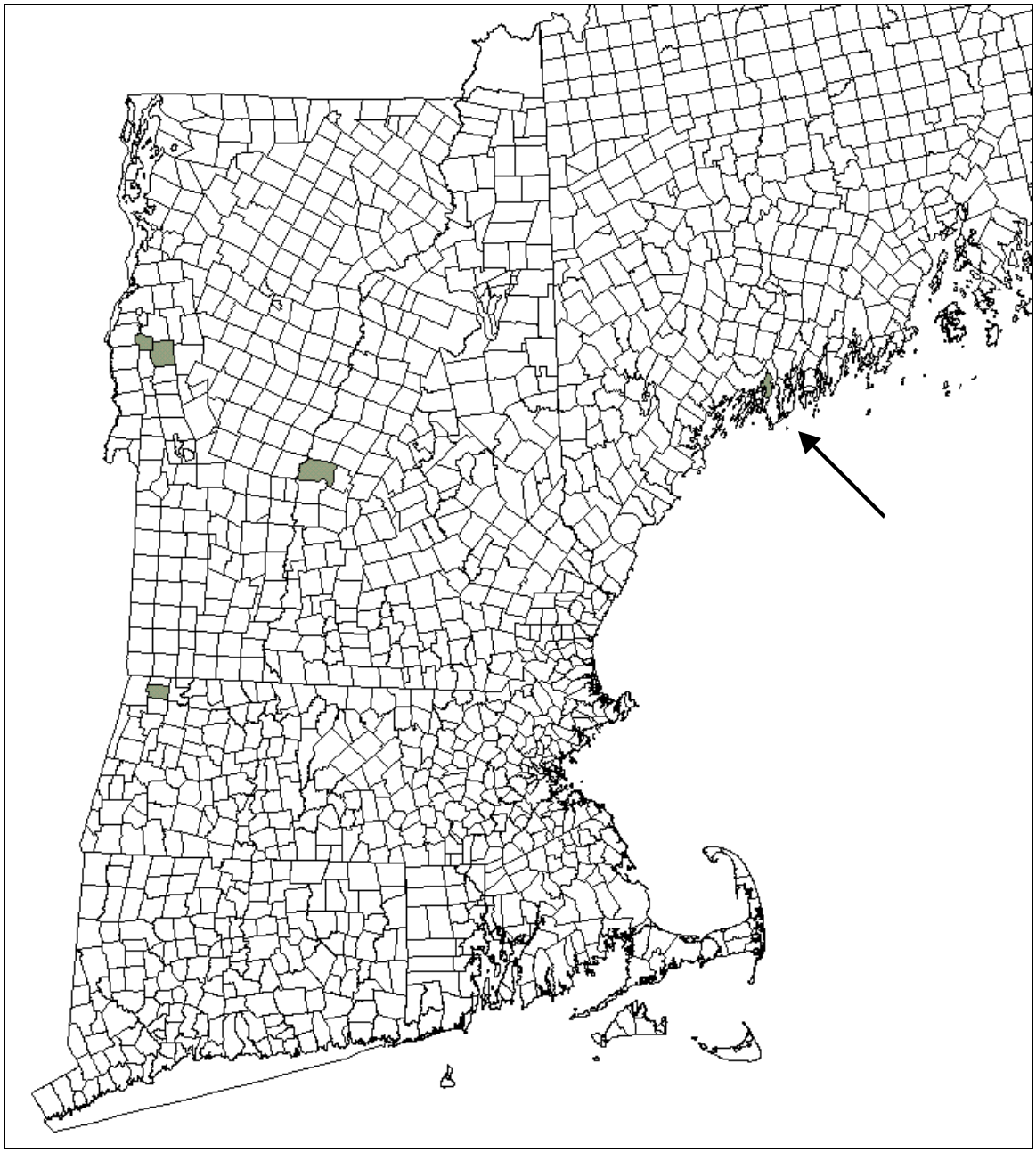

Figure 3. Confirmed historical occurrences of *Rosa acicularis* in New England. Towns shaded in gray have one to five confirmed historical records of the taxon. Arrow points to West Bath, Maine occurrence for clarity. A confirmed occurrence near Moosehead Lake in Piscataquis County does not appear on this map because no town name appears on the herbarium specimen.

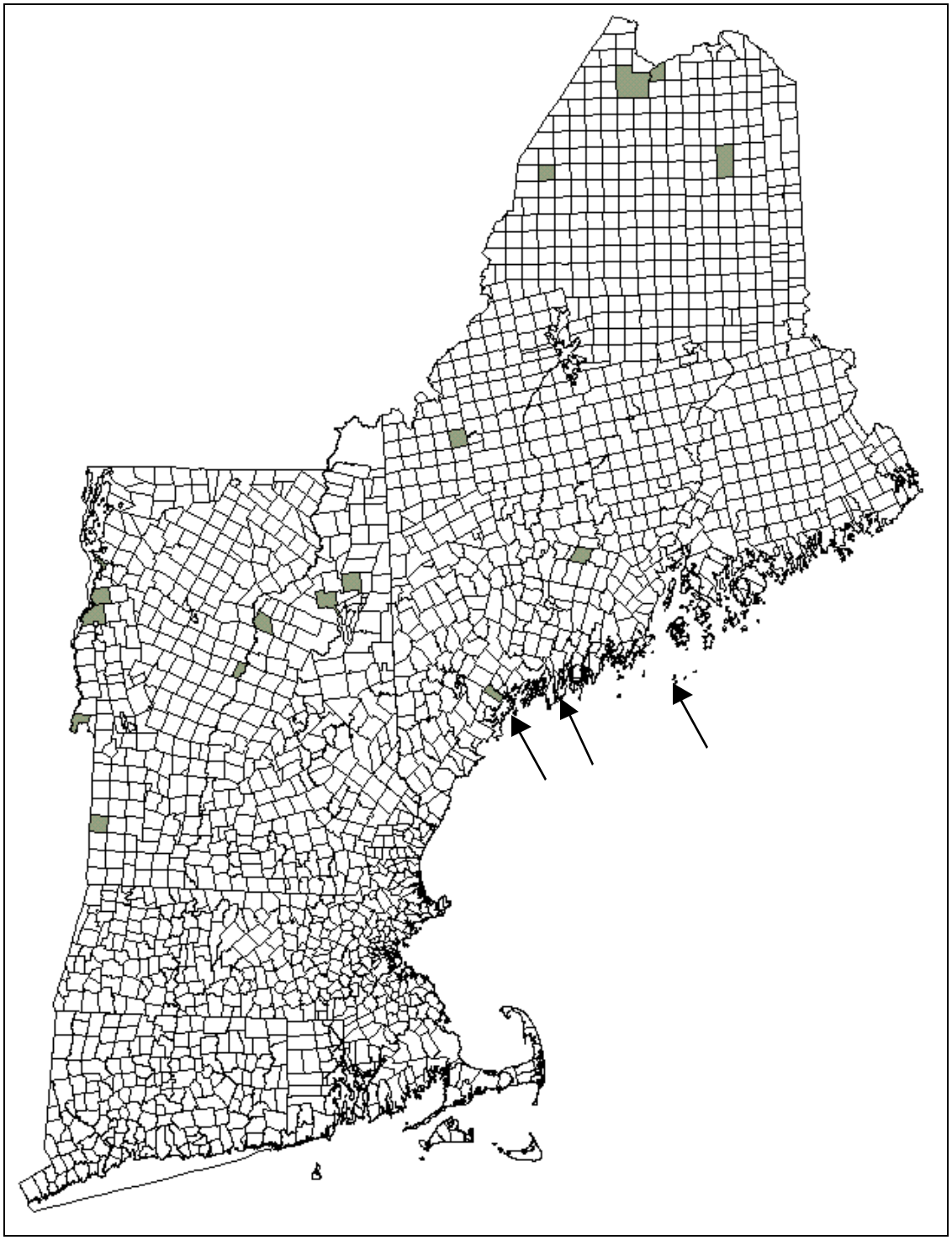

Figure 4. Unconfirmed historical occurrences of *Rosa acicularis* in New England. Towns shaded in gray have one to five herbarium records of the taxon for which the identification is in doubt based upon recent inspection by the author. Arrows point to Great Chebeague Island (left), West Bath (middle) and Matinicus Island (right) for clarity.

Status of All New England Occurrences – Current and Historical

Because of the difficulty of reliably identifying roses on the basis of gross morphological features and the resulting taxonomic confusion, a closer look at population numbers gives only a murky view of the status of *Rosa acicularis* in New England. In Maine, there are at least two historic occurrences annotated by Lewis (specimens at Harvard and Pennsylvania) and eight unconfirmed occurrences, most of which are at least questionable. No information is available about the taxon's current status in the state or whether the historic occurrences still exist. In New Hampshire, there is one historic occurrence annotated by Lewis (NH .001 [Plainfield]), at least three unconfirmed historic occurrences (including NH .002 [Woodsville]), and one unconfirmed extant occurrence (NH .003 [Moultonborough]). It is not known whether any of the historic occurrences still exist. In Vermont, there are three extant occurrences (VT .001 [Manchester], VT .006 [Addison-Weybridge], VT .008 [Bridport]), all from areas where many past collections were annotated by Lewis. Another historic collection (Middlebury) was annotated by Lewis. An additional three historic occurrences (West Haven, Arlington, and VT .005 [Ferrisburgh]) look convincing but have not yet been confirmed. Six other historic occurrences (including VT .002 [Burlington], VT .003 [Burlington], VT .004 [Burlington], and VT .007 [Burlington]) are unconfirmed and somewhat questionable. It is unknown whether any of the historic occurrences still exist. It is also unclear whether all the occurrences in Addison and Weybridge (VT .006 and historic specimens) should be regarded as one, two, three, or more occurrences, since all are on the same long ridge but perhaps widely separated. Currently, extant populations in both towns along that ridge are being tracked as VT .006. In Massachusetts, there is one extant occurrence (MA .003 [Lanesborough]) and at least two questionable historic collections.

Table 3. New England Occurrence Records for *Rosa acicularis* ssp. *sayi*. Shaded occurrences are considered extant.

State	EO #	County	Town
NH	.001	Sullivan	Plainfield
NH	.002	Grafton	Woodsville
NH	**.003**	**Carroll**	**Moultonborough**
VT	**.001**	**Bennington**	**Manchester**
VT	.002	Chittenden	Burlington
VT	.003	Chittenden	Burlington
VT	.004	Chittenden	Burlington
VT	.005	Addison	Ferrisburgh
VT	**.006a**	**Addison**	**Addison**
VT	**.006b**	**Addison**	**Weybridge**
VT	.007	Chittenden	Burlington
VT	**.008**	**Addison**	**Bridport**
MA	.001	Berkshire	N. Adams
MA	.002	Deleted	
MA	**.003**	**Berkshire**	**Lanesborough**
CT	No #	New Haven	Southbury

II. CONSERVATION

CONSERVATION OBJECTIVES FOR *ROSA ACICULARIS* SSP. *SAYI* IN NEW ENGLAND

The conservation objective for *Rosa acicularis* ssp. *sayi* is to maintain, through protection, monitoring, and management, at least four confirmed occurrences, one each in Maine, New Hampshire, Vermont, and Massachusetts, with 50 or more clumps of stems (stems arising from or very near the same base) or >150 stems if all are crowded together and clumps not distinguishable, with 20% of the clumps (or of second year or older stems in crowded patches) producing mature fruit. It is not practical to speak of number of plants, as the species is rhizomatous and no information is available on the likely extent of spread of roots. Some occurrences may require management to achieve and/or maintain the recommended size (number of stems or clumps). Because of the confusing nature of roses, it is recommended that the identity of any population be confirmed (including pollen measurement and karyotyping, if necessary) before any extraordinary protection measures are undertaken.

The goal of protecting four occurrences in New England reflects the number and condition of currently known populations in the region and the high probability that more "new" populations will be discovered in Maine if and when the species is tracked there. The size recommendation is based on observations of seemingly robust, healthy populations in New Hampshire and Massachusetts compared with some smaller, struggling, but long-persistent populations in Vermont.

Fruit production on 20% of clumps would represent a clear improvement over the performance of known populations at most locations in a droughty year (2002). This figure is based on performance of a patch in New Hampshire growing in full sun. It is possible that higher levels of fruit production may occur in more favorable growing seasons. Nevertheless, achievement of this goal would probably require intervention to protect plants from herbivory at one site and gall-forming insects at another, and to open the forest canopy to allow more light to reach other populations. Although individual clones of *Rosa acicularis* may be very long-lived, presumably some level of sexual reproduction is beneficial for maintaining the species' evolutionary capacity and overall viability. This goal may be revised downward if further research shows that lower levels of fruit production are sufficient for seedling recruitment.

The goal of protecting four occurrences is conservative and is based on the number of known or strongly suspected extant occurrences. The true degree of rarity of *Rosa acicularis* in New England is unknown, and there is a very strong possibility that other populations will be found, as roses seem to be able to hide in plain sight even in heavily botanized areas (i.e. they tend to be identified only as *Rosa* sp.). On the other hand, based on the limited number of locations with confirmed occurrences, it is probable that the species has always been rare in

New England. Within the past 20 years, only five occurrences have been observed in the region, one in New Hampshire, three in Vermont, and one in Massachusetts, and at least three of those need confirmation (NH .003 [Moultonborough], VT .006b [Weybridge], VT .008 [Bridport]). It is highly likely that more occurrences exist in Maine, where it should be added to the State's tracking list at least until its status there can be determined. This might not confer any real protection but would promote collection of information about the species.

These recommendations are not based on population viability studies. Most of the information available on this species was gleaned from studies performed in areas where the taxon is common enough to be considered a weed. No studies were found that examine its behavior as a rare species at the periphery of its range. It is known that individual clones can persist for decades or even centuries, so even minimal success at sexual reproduction may be enough to maintain populations in a region.

It is not certain whether some of the historic records for this taxon are correct identifications, and location information for many of them is very vague, so, even if they are truly *Rosa acicularis*, it is not known whether the occurrences are extant. As a result, it is hard to know whether the taxon is declining region-wide, is relatively stable, or could even be increasing in number. Historic specimens not already annotated by Lewis should be examined by him or some other rose expert. Then, a concerted effort to collect and study rose specimens from areas where *R. acicularis* was reported in the past could help answer questions about population trends. Until the answer is known, the need for population viability studies is questionable.

On the other hand, studies of viability of seed from New England occurrences, followed by seed-banking, could help protect local populations of *Rosa acicularis* by allowing for re-establishment in case of some disastrous event (such as severe forest fire). Any such re-introduction should not be undertaken without site-specific review by the New England Wild Flower Society, the relevant Natural Heritage Program, and other conservation partners that may be involved.

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IV. APPENDICES

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1. **Indirect Citations and Other Useful References Not Specifically Cited**

2. **Other New England Reports of *Rosa acicularis* ssp. *sayi.***

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

1. Indirect Citations and Other Useful References Not Specifically Cited

A. Indirect Citations from Lewis (1957b)

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2. Other New England Reports of *Rosa acicularis* ssp. *sayi*. Bold occurrences = confirmed identifications.

State	County	Town	Site Ownership	First Obs.	Last Obs.	Description	Population Size (date)	Comments
ME	Aroostook	Ashland	Unknown	1924	1924	Specimen at GH, coll. by R. C. Bean - shore of Aroostook River	Unknown	Atypical, with corymbs & dark, shiny stem, needs confirmation
ME	Aroostook	T11R16 WELS	Unknown	?	?	Somewhere near St. John River	Unknown	Verbal report from Charlie Cogbill not a positive identification, no herbarium specimen
ME	Aroostook	Allagash and/or St. Francis Townships	Unknown	1977	1977	Associated species of *Pedicularis furbishiae* mentioned by Macior (1978)	Unknown	No herbarium specimen? needs confirmation
ME	**Piscataquis**	**Unknown**	**Unknown**	**1868**	**1868**	**Specimen at PENN, coll. by C. E. & A. H. Smith near Moosehead Lake**	**Unknown**	**Originally labeled *R. blanda* Ait. but identified as *R. acicularis* ssp. *sayi* by Lewis (1957b)**
ME	Franklin	Eustis	Unknown	1966	1966	Specimen at GH, coll. by R. C. Bean & S. K. Harris - roadside	Unknown	Questionable ID, with glandular hypanthium & 9-11 leaflets/leaf; two specimens on sheet, neither appears to be *R. acicularis*
ME	Knox	Matinicus Island	Unknown	1921	1921	Specimen at GH, coll. by C.A. E. Long - old dry field	Unknown	Questionable ID, with 9 leaflets/leaf & white flowers, needs confirmation
ME	Kennebec	Winslow	Unknown	1934	1934	Specimen at GH, coll. by F. Hyland - sandy RR, 2-3' tall	Unknown	Looks more like *R. carolina*, with infrastipular prickles & glandular pedicels, needs confirmation
ME	**Sagadahoc**	**West Bath**	**Unknown**	**1902**	**1902**	**Specimen at GH, coll. by K. Furbish - Foster's Point**	**unknown**	**Annotated as *R. acicularis* ssp. *sayi* by W. H. Lewis 1956**
ME	Sagadahoc	West Bath	Unknown	1891	1902	Other specimens at GH, coll. by K. Furbish - some say "high land on beach" or "high land on shore border"	Unknown	Some atypical, with stout prickles and very foliose sepals, ann. *R. furbishiae* Rydb. ined. , need confirmation

2. Other New England Reports of *Rosa acicularis* ssp. *sayi*. Bold occurrences = confirmed identifications.

State	County	Town	Site Ownership	First Obs.	Last Obs.	Description	Population Size (date)	Comments
ME	Cumberland	Great Chebeague Island	Unknown	1902	1902	Specimen at GH, coll. by K. Furbish	Unknown	Atypical, with stout prickles and very foliose sepals, ann. as *R. furbishiae* Rydb. ined., needs confirmation
NH	Coos	Carroll	Railroad?	1910	1910	Specimen at GH, coll. by A. S. Pease - "by MCRR track between Twin Mtn. and White Mtn. Ho."	Unknown	Questionable ID, with 9 leaflets/leaf & corymbs rather than single flowers, needs confirmation
NH	Coos	Randolph	Railroad?	1909	1934	Specimen at GH, coll. by A. S. Pease - sandy soil by RR near Appalachia Station	3 plants	Questionable ID, with 9 leaflets/leaf & corymbs rather than single flowers, needs confirmation
VT	Chittenden	Charlotte	Unknown	1902	1902	Specimen at PH, coll. by C. G. Pringle - from a garden	Unknown	Probably not natural occurrence
VT	**Addison**	**Middlebury**	**Unknown**	**1900**	**1900**	**Specimen at GH, coll. by E. Brainerd - roadside on north line**	**Unknown**	**Annotated as *R. acicularis* ssp. *sayi* by W. H. Lewis 1956**
VT	**Addison**	**Weybridge**	**State of Vermont?**	**1897**	**1897**	**Specimen at GH, coll. by E. Brainerd - "edge of cliff (alt. 1300 ft.)"**	**Unknown**	**Annotated as *R. acicularis* ssp. *sayi* by W. H. Lewis 1956; probably NOT the same occurrence as extant one, which is mid-slope in woods**
VT	Orange	Fairlee	Unknown	1985	1985	Specimen at PH, coll. by P. F. Zika - under pines, roadside	Unknown	Zika was unsure of ID; probably NOT *R. acicularis*
VT	Rutland	West Haven	Unknown	1937	1937	Specimen at GH, coll. by C. H. Knowlton; rich open woods	Unknown	Looks like good ID, needs confirmation
VT	Bennington	Arlington	Unknown	1935	1935	Specimen at GH, coll. by NEBC fieldtrip group	Unknown	Fieldtrip report kept by NEBC??? looks like good ID, needs confirmation

2. Other New England Reports of *Rosa acicularis* ssp. *sayi*. Bold occurrences = confirmed identifications.

State	County	Town	Site Ownership	First Obs.	Last Obs.	Description	Population Size (date)	Comments
MA	Norfolk	unknown	State of MA	1893	1893	Specimen at GH, coll. by N. T. Kidder on state reservation "near piggery where several strange things appeared"	Unknown	Poorly pressed specimen; difficult to determine whether ID is correct

3. 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 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.