Antennaria howellii ssp. *canadensis*

Canada Pussytoes

Asteraceae

Antennaria howellii ssp. *canadensis* by Sean Blaney, 2017

***Antennaria howellii* ssp. *canadensis* Rare Plant Profile**

New Jersey Department of Environmental Protection
State Parks, Forests & Historic Sites
State Forest Fire Service & Forestry
Office of Natural Lands Management
New Jersey Natural Heritage Program

501 E. State St.
PO Box 420
Trenton, NJ 08625-0420

Prepared by:
Jill S. Dodds
jsdodds@biostarassociates.com

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For:
New Jersey Department of Environmental Protection
Office of Natural Lands Management
New Jersey Natural Heritage Program
natlands@dep.nj.gov

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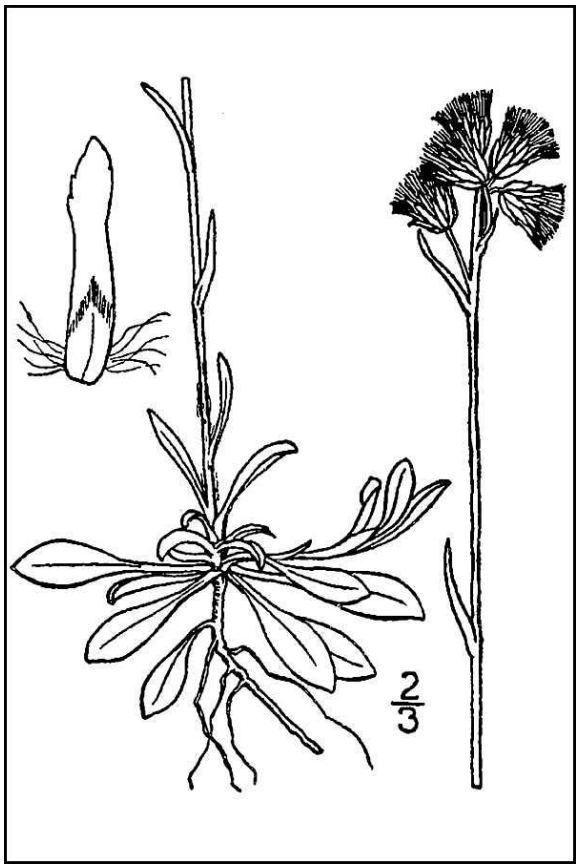
Life History

Antennaria howellii ssp. *canadensis* (Canada Pussytoes) is a stoloniferous perennial herb in the Asteraceae, Tribe Gnaphalieae. Flower heads in the Gnaphalieae typically have disc florets but lack ray florets. *Antennaria* is a dioecious genus, meaning that individual plants are either male or female. Dioecy separates *Antennaria* from all other members of the tribe except for *Anaphalis*, and the two genera can be distinguished by the presence or absence (respectively) of basal leaves at flowering time (Barkley et al. 2020). *Antennaria* species have fibrous roots and reproduce clonally, often forming mat-like colonies of staminate (male) or pistillate (female) plants via stolons or rhizomes (Arriagada 1998, Rhoads and Block 2007).



Left: Britton and Brown 1913, courtesy USDA NRCS 2023a. Right: Sean Blaney, 2017.

The basal leaves of *Antennaria howellii* ssp. *canadensis* are bright green and nearly smooth on the upper side but densely white-hairy below. They have a single prominent vein and are typically somewhat spatula-shaped with small points at the tips. While the basal leaves are 2–4 cm long and 6–9 mm wide, the stem leaves are linear and usually under 3 cm in length. The characteristics of the basal leaves are helpful for distinguishing *A. howellii* ssp. *canadensis* from other Antennarias that occur in New Jersey, which either have 3–5 prominent veins or are hairy on the upper surfaces of young leaves, but care should be taken because in some taxons the upper sides of the leaves can become smooth with age. The inflorescence of *A. howellii* ssp. *canadensis* has a small cluster of 3–7 flower heads at the end of a short (15–35 cm), hairy stem. The bracts at the base of each flower head have white or cream-colored tips. Individual flower

heads are 7–10 mm long in pistillate plants and a bit shorter in staminate plants. (See Greene 1898, Britton and Brown 1913, Fernald 1950, Gleason and Cronquist 1991, Bayer 2020).

Antennaria howellii ssp. *canadensis* may bloom from April to early June (Bayer 2020, Weakley et al. 2022). Fernald (1898) noted that Canada Pussytoes flowered late in comparison to other northeastern Antennarias. In 1933, *A. howellii* ssp. *canadensis* was reported to be blooming on April 23 in Carmel, New York despite unseasonably cold weather the preceding week (Friend 1933). During the mid 1940s, the earliest flowering date recorded for populations in the vicinity of Ithaca, New York was April 15 (Clausen 1945). Bartrum and Long found a population in Virginia on Memorial Day and noted that "the inflorescences were still mostly quite fresh and in good collecting condition" (Long 1913). New Jersey plants have most often been seen flowering during early or mid-May (Hough 1983, NJNHP 2022).

Pollinator Dynamics

Antennaria howellii is a polyploid complex made up of four subspecies which were apparently derived from hybridization among a group of "normal" diploid species including *Antennaria neglecta, A. plantaginifolia, A. racemosa,* and *A. virginica*. The progenitor species reproduce sexually but the *A. howellii* group are almost entirely agamospermous, developing seeds from unfertilized ovules. Since offspring produced in that way are genetically identical to their parent, nearly all *A. howellii* plants are female and staminate plants are very rare in the complex (Stebbins 1932a, 1932b; Bayer and Stebbins 1981, 1982, 1987). Some sources have erroneously reported that *A. howellii* populations are entirely carpellate but sexuality apparently persists in at least some of the subspecies, including *A. howellii* ssp. *canadensis*. Greene (1898) first described Canada Pussytoes without ever having seen male flowers but Stebbins (1932b) examined staminate plants from several locations. However, Stebbins never saw any sign of fertilization while studying embryonic development in numerous pistillate flowers so it is reasonable to conclude that pollination plays a very limited role in the reproduction of *Antennaria howellii* spp. *canadensis*.

Nevertheless, the documentation of even a small number of staminate clones in *Antennaria howellii* ssp. *canadensis* indicates that not all populations of the subspecies originated from seeds that developed via agamospermy. The diploid progenitors of the *Antennaria howellii* complex are unable to produce seeds without fertilization (Stebbins 1932a) and those species are visited by a wide variety of bees, flies, butterflies, and moths, many of which are likely to provide pollination services (Robertson 1929, Govindaraju 1988, Stubbs et al. 1992, LaManna et al. 2020). Any sexual reproduction that may occur in *A. howellii* ssp. *canadensis* is probably also facilitated by insects.

Seed Dispersal

The dry, single-seeded fruits of *Antennaria howellii* ssp. *canadensis* are only 1–1.5 mm long but they are crowned with a tuft of hairs (pappus) 7–9 mm in length (Bayer 2020). The pappus allows the seeds of *A. howellii* to be dispersed by wind (Walcott 1925, Chmielewski 2005).

Differences in the morphology of both seeds and pappi generally determine how far the propagules of any particular species can travel (Greene and Johnson 1990, Anderson 1993). In *A. howellii* the pappi of adjacent seeds often become entangled so that the propagules are dispersed as a ball, which is also distributed by wind (Chmielewski 2005).

The seeds of many Asteraceae, including most species of *Antennaria*, require a period of stratification before they can germinate (Deno 1993) but *A. howellii* seems to be an exception (Chmielewski 2005). During laboratory studies conducted by the latter author, the majority of *A. howellii* seeds germinated within ten days of sowing and others continued to sprout over a period of three months. Establishment does not appear to have been studied in the field. The Eurasian *Antennaria dioica* is known to form fungal associations (Wang and Qiu 2006) but no reports of mycorrhizae in other *Antennaria* species were found.

Habitat

All of the subspecies of *Antennaria howellii* tend to favor habitats that are dry and relatively open (Chmielewski 2005). *A. howellii* ssp. *canadensis* usually grows on sandy, gravelly, or rocky sites in open woods, dry fields, pastures, or barrens (Fernald 1898, Blake 1918, Lowry 1933, Angelo and Boufford 2012, Anderson and Hlina 2022, Weakley et al. 2022). Reported elevations range from 0–1500 meters above sea level (Bayer 2020). Canada Pussytoes has been found atop cliffs and ridges (Schofield 1955, NJNHP 2022) as well as on islands situated off of the Atlantic coast or those in lakes and ponds (Coburn 1920, Wise 1970, Winkler 2012).

Utilizing previously published information, Bazukis and Hansen (1959) ranked the community requirements of selected Minnesota forest species for moisture, nutrients, heat, and light in relative values from 1 (least) to 5 (greatest). *A. howellii* ssp. *canadensis* was ranked as having low requirements for moisture (1.0) and nutrients (1.2), relatively low requirements for heat (2.1), and a high requirement for light (5.0). However, the subspecies appears to have some tolerance for a broader range of habitat conditions. Harger (1913) noted its occasional presence in alluvial meadows in Connecticut, and the first population recorded in Virginia was found on a moist, shaded, woodland bank (Long 1913). Two Minnesota locations described by Ledin (1938) both had acid soils, open understories, and well-developed evergreen canopies—one site was characterized as having limited light and the other as dense shade.

Stallard (1929) observed that *Antennaria howellii* ssp. *canadensis* was a species that often appeared following disturbances. Populations have established in clearings near campgrounds (Coburn 1920) and on non-peaty portions of exposed lake bottoms (Nielsen and Moyle 1941). Bergman and Stallard (1916) described *A. howellii* ssp. *canadensis* as a secondary successional species of communities that developed following fires in places with sandy soils, noting that after lichens had initially colonized the sites the pussytoes appeared along with other herbs and grasses and occasionally persisted in gaps as forests matured. In Wisconsin, *A. howellii* ssp. *canadensis* was recently documented in some fire-adapted savanna habitats on glacial outwash barrens (Anderson and Hlina 2022). In other states it has been found in second growth forests with overstories of *Acer saccharum-Fagus* or *Pinus resinosa* (Woolett and Sigler 1928, Stallard 1929). Some established populations have been known to persist in sites where the plants have

been exposed to repeated disturbances, such as roadsides or mowed lawns (Cody et al. 1998, NJNHP 2022).

Wetland Indicator Status

Antennaria howellii ssp. *canadensis* is not included on the National Wetlands Plant List (NWPL). Any species not on the NWPL is considered to be Upland (UPL) in all regions where it occurs. The UPL designation means that it almost never occurs in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2023b)

ANHOC

Coefficient of Conservancy (Walz et al. 2020)

CoC = 8. Criteria for a value of 6 to 8: Native with a narrow range of ecological tolerances and typically associated with a stable community (Faber-Langendoen 2018).

Distribution and Range

The native range of *Antennaria howellii* ssp. *canadensis* extends from subarctic Canada to the northern United States (POWO 2023). The map in Figure 1 depicts the extent of Canada Pussytoes in North America.

The USDA PLANTS Database (2023b) shows records of *Antennaria howellii* ssp. *canadensis* in two New Jersey counties: Bergen and Sussex (Figure 2). There have also been reports of Canada Pussytoes from Hunterdon, Warren, and Morris Counties (Fables and Houda 1951, Snyder 2000, Mid-Atlantic Herbaria 2023). The data include historic observations and do not reflect the current distribution of the species.

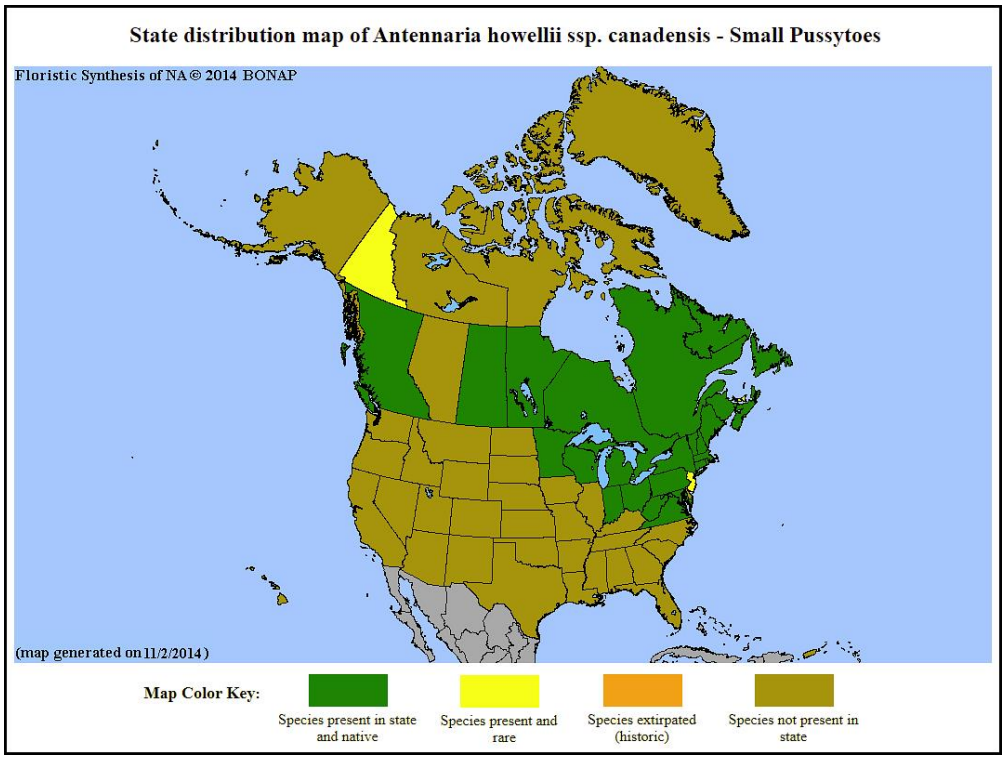


Figure 1. Distribution of A. howellii ssp. canadensis in North America, adapted from BONAP (Kartesz 2015).

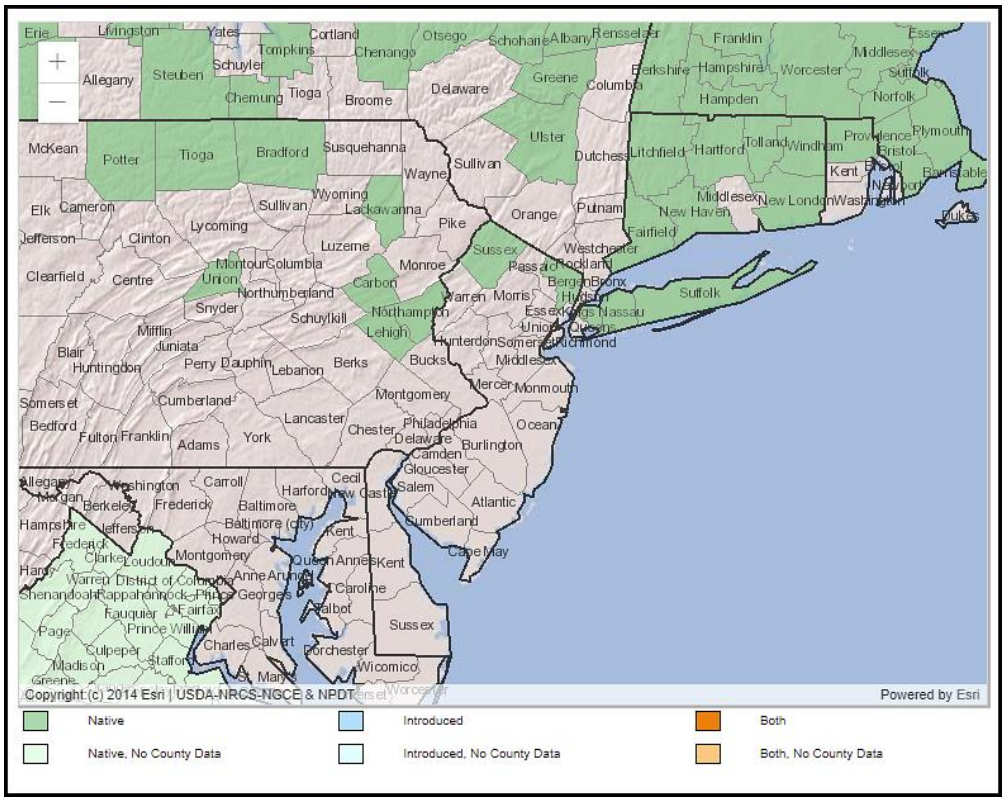


Figure 2. County records of A. howellii ssp. canadensis in New Jersey and vicinity (USDA NRCS 2023b).

Conservation Status

Antennaria howellii ssp. *canadensis* is considered globally secure. The G5T5 rank means the subspecies has a very low risk of extinction or collapse due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats. The question mark indicates that status of the taxon is in need of a review (NatureServe 2023). The map below (Figure 3) illustrates the conservation status of *A. howellii* ssp. *canadensis* throughout its range. Canada Pussytoes is apparently secure or unranked in most places where it occurs. The subspecies is vulnerable (moderate risk of extinction) in Newfoundland and critically imperiled (very high risk of extinction) in Prince Edward Island and New Jersey. There are a number of additional districts where *Antennaria howellii* has been listed without a subspecies designation: The species as a whole is critically imperiled in Tennessee, imperiled in West Virginia and the Yukon Territory, and vulnerable in Wyoming and Manitoba (NatureServe 2023). It is possible that *Antennaria howellii* ssp. *canadensis* is rare in additional states where it has only been reviewed at the species level.

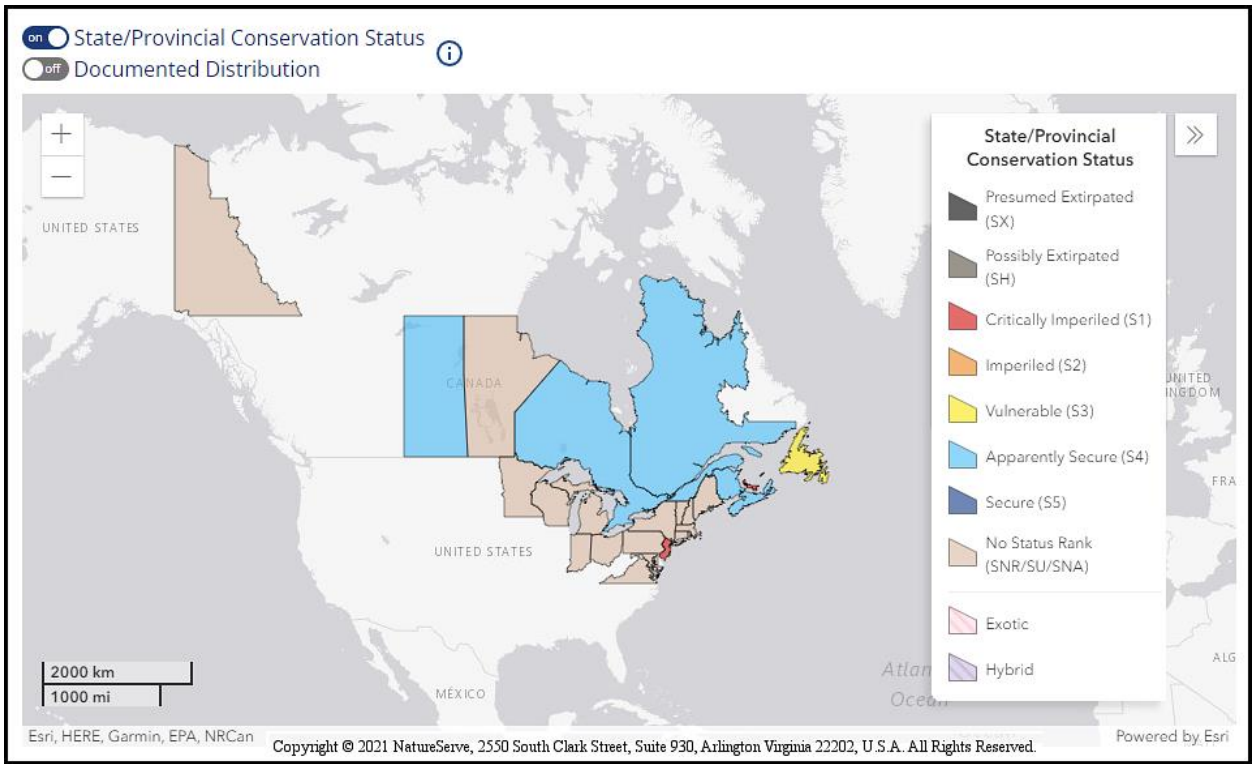


Figure 3. Conservation status of A. howellii ssp. canadensis in North America (NatureServe 2023).

The critically imperiled (S1) status of *Antennaria howellii* ssp. *canadensis* in New Jersey signifies five or fewer occurrences in the state (NJNHP 2022). A species with an S1 rank is typically either restricted to specialized habitats, geographically limited to a small area of the state, or significantly reduced in number from its previous status. Canada Pussytoes is also listed as an endangered species (E) in New Jersey, meaning that without intervention it has a high likelihood of extinction in the state. Although the presence of endangered flora may restrict development in certain communities, being listed does not currently provide broad statewide

protection for plants. Additional regional status codes assigned to the pussytoes signify that the species is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

The earliest New Jersey record of *Antennaria howellii* ssp. *canadensis* was based on an occurrence in the Palisades region. The Bergen County site was reported to be the southeastern end of the species' documented range by Taylor (1915), who was apparently unaware that a population had recently been discovered by Bartram and Long in Virginia (Long 1913). Canada Pussytoes is currently known to be extant at a single location in New Jersey, where it was first documented in 1993 (Snyder 2000). Available information suggests that the entire occurrence consists of a single staminate clone, as only male flowers have been observed at the site to date (NJNHP 2023).

Threats

McCabe (1989) observed a flower moth (*Eutricopis nexilis*, White-spotted Midget) visiting *Antennaria howellii* ssp. *canadensis* and later in the season found the moth's larvae on the flower heads. *Eutricopis nexilis* is a day-flying moth that is a specialist on *Antennaria* species: The female moths deposit their eggs in the blossoms and the larvae feed on both florets and developing seeds (Hardwick 1970). Loss of propagules to moth predation is probably a greater threat to more northerly populations of Canada Pussytoes, as searches of various insect-tracking sites turned up no records of *E. nexilis* for New Jersey. McCabe's observation from the Adirondack Mountains in New York seems to be the nearest documented record of the moth.

The New Jersey population of *Antennaria howellii* ssp. *canadensis* is located in a lawn where it is subject to some foot traffic (NJNHP 2022). The site is also regularly maintained by mowing and the plants are sometimes cut while still in bloom, which has impeded efforts to determine whether the occurrence includes any pistillate plants (Snyder, pers. comm.). However—since all of the plants appear to be staminate and thus would produce no seeds—the loss of flowering stems is not likely to significantly affect the population's ability to persist and the relatively low profile of the pussytoes may allow them to escape serious damage if the lawn is not cut too closely.

Bayer and Stebbins (1988) noted that the agamospermous Antennarias are more effective at spreading to new sites than the sexual species. Since *Antennaria* is dioecious, the species that require fertilization to develop fruit are only successful when both staminate and pistillate individuals occur in relatively close proximity. In contrast, agamospermous species like *A. howellii* are primarily female and their ability to produce seeds is not limited by a need for fertilization. New Jersey's population of *Antennaria howellii* ssp. *canadensis* is exceptional because staminate plants are so rare in the taxon. Unfortunately the apparent absence of pistillate plants means that the occurrence is restricted to vegetative reproduction and unable to colonize new sites.

As the climate continues to warm, plant communities in New Jersey are increasingly exposed to both higher temperatures and shifting precipitation patterns that increase the frequency and

intensity of local droughts and floods (Hill et al. 2020). *Antennaria howellii* ssp. *canadensis* is well adapted to dry conditions and the New Jersey population is not situated in a place where it is likely to experience extensive flooding. The potential impacts of high temperatures on Canada Pussytoes are not known. However, a taxon like *A. howellii* ssp. *canadensis* that is almost entirely clonal can be expected to have very low genetic variation throughout its range, and the limited variability in the species is likely to diminish its ability to adapt to a rapidly changing environment (Lande 1988, Jump and Peñuelas 2005).

Management Summary and Recommendations

In addition to being notable for its staminate flowers, the New Jersey population of *Antennaria howellii* ssp. *canadensis* may also be among the southernmost occurrences of the subspecies. Although some maps in the preceding figures show Canada Pussytoes as present in several states to the south (Maryland, Virginia, West Virginia), occurrences in those states are apparently unverified (Weakley et al. 2022, Virginia Botanical Associates 2023). New Jersey's population may benefit from periodic mowing that maintains its open habitat as long as the plants are not harmed by the activity. Adjusting mower blades for a higher cut or reducing the frequency of mowing could reduce the likelihood of direct damage to the pussytoes and might also help to discourage foot traffic in the immediate vicinity of the plants. Deferral of the first cut until after the blooming period has ended could also create an opportunity to thoroughly search the population for pistillate plants.

There may be additional populations of *Antennaria howellii* ssp. *canadensis* that have not been identified. The low and relatively inconspicuous plants could easily go unnoticed, particularly when flower stalks are not present. A population on a New Hampshire island first documented in 1909 was not found during a series of surveys that occurred between 1978 and 1985 but was subsequently relocated in 2011 (Holland and Sorrie 1989, Winkler 2012). The subspecies might also be overlooked when intermingled with similar plants: For example, Pretz (1915) reported a Pennsylvania population of *A. howellii* ssp. *canadensis* that co-occurred with *A. howellii* ssp. *neodioica*, *A. parlinii* ssp. *fallax*, *A. parlinii* ssp. *parlinii*, and *A. neglecta*. Nevertheless, it would be impractical to conduct targeted searches for new occurrences of Canada Pussytoes because it can occupy such a wide array of upland habitats.

There are several areas where additional research would be likely to yield useful information for conservation planning—examples include mycorrhizal associations, clone longevity, and heat tolerance. The clonal nature of *Antennaria howellii* ssp. *canadensis* might make it a good candidate for restoration in places where the subspecies is critically imperiled: If an individual population is threatened with extirpation due to poor habitat conditions it may be possible to transplant part of the genet to a more secure site in the vicinity.

Synonyms

The accepted botanical name of the taxon is *Antennaria howellii* ssp. *canadensis* (Greene) Bayer. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, POWO 2023,

USDA NRCS 2023b). Canada Pussytoes was first described as *Antennaria canadensis* by Greene (1898) and the name remained in use for a long time. Following work by Stebbins (1932a, 1932b) on sexuality and parthenogenesis in *Antennaria*, Cronquist (1945, Gleason and Cronquist 1991) treated Canada Pussytoes and several other polyploid taxons as varieties of *A. neglecta*. Studies by Bayer and Stebbins (1981, 1982) indicated that Canada Pussytoes and several other polyploid Antennarias were derived from more than one of the sexual species so the authors segregated them into a new complex under the name *Antennaria neodioica*. Upon the discovery that *A. howellii* was also part of the same complex that name took priority and the species was redescribed as *A. howellii* ssp. *canadensis* (Bayer 1989).

Botanical Synonyms	**Common Names**
Antennaria canadensis Greene	Canada Pussytoes
Antennaria canadensis var. *spathulata* Fernald	Canadian Pussytoes
Antennaria neglecta var. *canadensis* (Greene) Cronquist	Small Pussytoes
Antennaria neglecta var. *randii* (Fernald) Cronquist	Canadian Cat's-foot
Antennaria neodioica ssp. *canadensis* (Greene) Bayer & Stebbins	
Antennaria neodioica var. *randii* (Fernald) B. Boivin	
Antennaria randii Fernald	
Antennaria spathulata (Fernald) Fernald	

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