Rhododendron canadense

Rhodora

Ericaceae

Rhododendron canadense, courtesy Thomas L. Muller, Lady Bird Johnson Wildflower Center

***Rhododendron canadense* 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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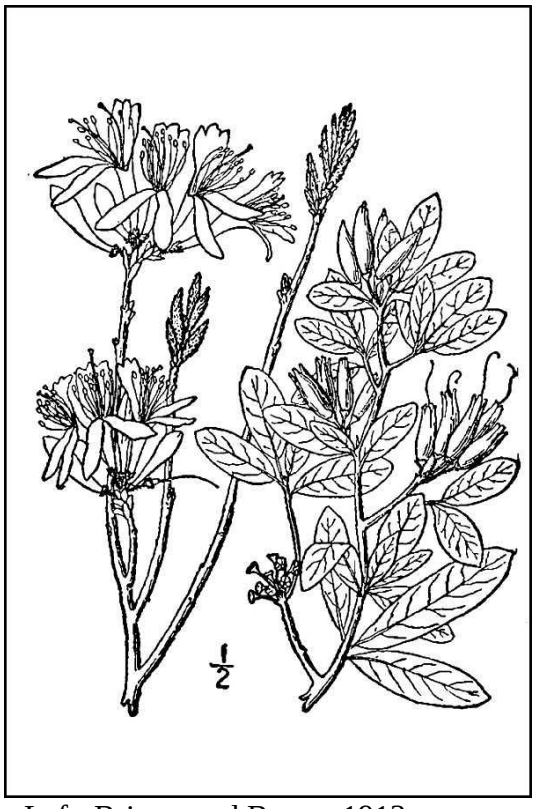
Life History

Rhododendron canadense (Rhodora) is a distinctive shrub in the Ericaceae. The plants are deeply rooted and capable of reproducing from rhizomes (Flinn and Wein 1997). The stems are erect and usually less than a meter tall with strongly ascending branches. The young twigs are hairy but the stems become smoother with age. *R. canadense* begins to bloom before its leaves have expanded, producing showy clusters of 3–9 flowers at the tips of the branches. Unlike other *Rhododendron* species which have petals united to form a floral tube, Rhodora has two-lipped flowers: The upper lip is three-lobed and the lower lip is divided nearly to the base into two flaring lobes. *R. canadense* flowers have 10 stamens, another unique feature in a genus where 5 is typical. The blooms are usually rose-purple or magenta, although a white-flowered form also occurs. The hairy leaves are oval but taper at the base, range between 1.0–8.3 cm in length and 0.4–3.0 cm in width, and often roll in along the edges. The upper surface of the leaves is generally a dull blue-green but a form with glossy, dark green leaves is known from western Nova Scotia. The fruits of *R. canadense* are densely hairy, five-parted capsules that are 1.0–1.5 cm long and curved at the base. (See Britton and Brown 1913, Wilson and Rehder 1921, Fernald 1950, Gleason and Cronquist 1991, Ryan 1995, Judd and Kron 2020).



Left: Britton and Brown 1913, courtesy USDA NRCS 2023a. Right: Mary Vaux Walcott.

Near the southern end of its range, *Rhododendron canadense* usually blooms during May (Wyman 1937, Rhoads and Block 2007, NJNHP 2022). At higher elevations and northern latitudes flowering occurs later, often extending through early June (Porter 1899, Wilson and Rehder 1921, Heinrich 1975). The leaves expand as the fruits develop and they are deciduous at the end of the season. Seeds are dispersed in the fall but the opened capsules remain on the

branches through the winter months. Winter twigs bear large terminal flower buds and smaller lateral leaf buds, both of which are purplish and downy (Ryan 1995).


Left: Courtesy Thomas L. Muller, Lady Bird Johnson Wildflower Center. Right: J. S. Dodds, 2021.

Pollinator Dynamics

The flowers of *Rhododendron canadense* are unscented (Mattrick, undated). They are pollinated by bees. Frequently reported visitors are bumblebees, including *Bombus fervidus*, *B. terricola*, *B. ternarius*, and *B. vagans*. All are generalists that forage on other plants as they come into bloom, so the spring-blooming *R. canadense* may be an important resource for the insects during the early part of the growing season (Heinrich 1975, McCallum and McLean 2017, Walker and Lundholm 2017, Dibble et al. 2018). An assortment of other bees have also been observed on Rhodora flowers, including *Andrena bradleyi*, *A. rufosignata*, *Augochlorella striata*, *Lasioglossum inconditum*, *Nomada depressa*, and *Sphecodes atlantis* (Stubbs et al. 1992, Walker and Lundholm 2017).

When a *Rhododendron canadense* flower first opens the style is bent as the lobes of the upper lip remain curled over the stigma, but when the floral parts have elongated to the point where the style is longer than the stamens it is released. The mechanism was first described during the 1880s as a means of avoiding self-pollination (Wilson and Rehder 1921), but while it probably promotes outcrossing recent investigations have shown that *R. canadense* can fall back on self-fertilization if pollinators become scarce. Pollination studies by Wheelwright et al. (2006) demonstrated that *Rhododendron canadense* is highly self-compatible. Fruit set was substantial (49.0–53.8%) when pollinators were excluded, although it was higher (79.1–86.7%) when they were not. In comparison to open-pollinated flowers the mean number of seeds increased slightly when flowers were hand-pollinated with either related or unrelated pollen but the differences were not significant, averaging from 161.1–186.4 seeds per fruit. Production was lower when pollinators were excluded and no hand-pollination occurred, but the plants still produced an average of 114.8 seeds per fruit.

Seed Dispersal and Establishment

The seeds of *Rhododendron canadense* are tiny and have terminal appendages which have alternately been described as wings or flattened tails (Campbell et al. 2003, Judd and Kron 2020). The mean number of seeds per capsule was reported as 184 by Campbell et al. (2003) and as 161.1 for open-pollinated plants in the aforementioned study by Wheelwright et al. (2006). The primary means of dispersal is wind (Mattrick undated). A moderate dispersal distance was calculated for *R. canadense* seeds based on features such as release height, fall time, and wing loading by Campbell et al. (2003), who also reported that the propagules do not float on water.

Nichols (1934) found that a period of exposure to cold temperatures improved germination rates for *Rhododendron canadense* but cold stratification was not essential. The seeds germinate best at the soil surface (Leopold 2005). Campbell and Rochefort (2003) reported that seedling emergence declined sharply with burial and was almost negligible at a depth of just 5 mm.

A fungal partner may be required, or at least advantageous, for seedling establishment. The small seeds of ericaceous plants have a limited amount of endosperm, which restricts their ability to develop without an external source of nutrients (Wei et al. 2022). *Rhododendron canadense* is presumed to form ericoid mycorrhizae (eg. St. Martin 2018) as they are predominant in the genus (Read 1983, Thormann 2006). Wang and Qiu (2006) observed that very few species in the Ericaceae are non-mycorrhizal. The presence of ericoid mycorrhizal fungi has been shown to promote seedling germination and establishment in other *Rhododendron* species, and in mature plants the mycorrhizae can enhance growth and improve tolerance to biotic and abiotic stresses (Thormann 2006, Mueller et al. 2022, Wei et al. 2022).

Habitat

Rhododendron canadense can thrive in a fairly broad array of growing conditions. The substrate may be wet, moist, or dry and sites may be open or shaded (Hough 1983, Leopold 2005, Judd and Kron 2020). Reported habitats include coniferous or mixed forests, wooded slopes, thickets, open rocky areas, lake margins, bogs, swamps, peaty wetlands and river banks at elevations of 0–1900 meters above sea level (Wilson and Rehder 1921, Fairbrothers and Hough 1973, Rhoads and Block 2007, Judd and Kron 2020). Extant occurrences in New Jersey are located in an open sphagnum bog and a calcareous fen, while noted habitats for historic occurrences in the state have included both dry and boggy thickets, dry banks, and bog edges (NJNHP 2022).

Rhodora plants in wet habitats are often situated in drier microsites within the communities. During a study of successional bogs on the Pocono Plateau, Harshberger (1909) observed that *Rhododendron canadense* was typically found in the zone between the wetter areas dominated by *Chamaedaphne calyculata* and the higher dry ground, co-occurring with species such as *Betula populifolia, B. lenta, Nemopanthus mucronatus, Larix laricina, Vaccinium corymbosum, Spiraea tomentosa, Kalmia polifolia, K. angustifolia,* or *Acer rubrum.* In a Maine bog, *R. canadense* was noted to grow on mounds and tussocks or in open forest along the edge of the wetland (Moore and Taylor 1921). Lakeshore populations in Nova Scotia were positioned in the

upper zone, about 0.25–1.0 meter above the water line, along with *Gaylussacia baccata*, *Alnus rugosa*, and *Myrica gale* (Keddy 1984).

In suitable habitats, *Rhododendron canadense* may be locally abundant (Rhoads and Block 2007). St. James and Mallik (2021) identified it as a dominant species of heath and shrub savanna communities at a site in Newfoundland. *R. canadense* is a characteristic species of Pocono till barrens, where it is dominant in some communities (Rhodora barrens) and also present in mixed heath barrens and Scrub Oak barrens (Latham et al. 1996). The Mesic Till Plain Barrens (*Pinus rigida - Quercus ilicifolia - Rhododendron canadense* Woodland) is a globally rare (G1) association shaped by both fire and unseasonable summer frosts (Latham et al. 1996, EEGNS 1998). Two rare communities in New Jersey where *Rhododendron canadense* may sometimes occur are Black Spruce Woodland Bog [*Picea mariana* / (*Vaccinium corymbosum, Gaylussacia baccata*) / *Sphagnum* spp. Woodland, S1] and Highbush Blueberry Bog Thicket [*Vaccinium corymbosum* / *Sphagnum* spp. Shrubland. S1S3] (Breden et al. 2001).

Anderson and Davis (1998) analyzed the vegetative composition of 30 peatland community types in Maine using data from 108 locations. *Rhododendron canadense* was found in seven of the peatland types, and some key habitat characteristics are summarized in Table 1.

Table 1. *Rhododendron canadense* in Maine Peatlands.

Community Type	mean pH	% H_2O in peat	% overstory	peat layer depth	Rhodora % cover
(Picea mariana - Larix laricina/Carex stricta - Rhododendron canadense - Rhododendron groenlandicum)	4.63	91.1	33	2.7	29.9
(Larix laricina/Nemopanthus mucronatus/Rhododendron canadense)	5.17	89.9	51.8	2.7	23.8
(Chamaedaphne calyculata- Rhododendron canadense- Myrica gale - Kalmia angustifolia)	4.59	90.3	3.4	1.2	19.8
(Chamaedaphne calyculata - Kalmia angustifolia - Rhododendron groenlandicum)	4.03	87.3	0.2	4.3	14.2
{Acer rubrum - Larix laricina/Ilex verticillata - Alnus incana ssp. *rugosa/Carex trisperma)*	5.21	92.7	65.1	4.9	13.2
{Alnus incana ssp. rugosa/Myrica gale - Spiraea alba var. *latifolia - Carex stricta - Calamagrostis canadensis)*	6.80	91.9	9.7	2.0	0.7
{Acer rubrum/Alnus incana ssp. *rugosa)*	no data*	no data*	no data*	no data*	0.2
* high water levels prevented data collection at one site					
Source: Anderson and Davis 1998					

Wetland Indicator Status

Rhododendron canadense is a facultative wetland species, meaning that it usually occurs in wetlands but may occur in nonwetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2023b)

RHCA6

Coefficient of Conservancy (Walz et al. 2020)

CoC = 10. Criteria for a value of 9 to 10: Native with a narrow range of ecological tolerances, high fidelity to particular habitat conditions, and sensitive to anthropogenic disturbance (Faber-Langendoen 2018).

Distribution and Range

The global range of *Rhododendron canadense* is restricted to the northeastern United States and eastern Canada (POWO 2023). The map in Figure 1 depicts the extent of *R. canadense* in North America.

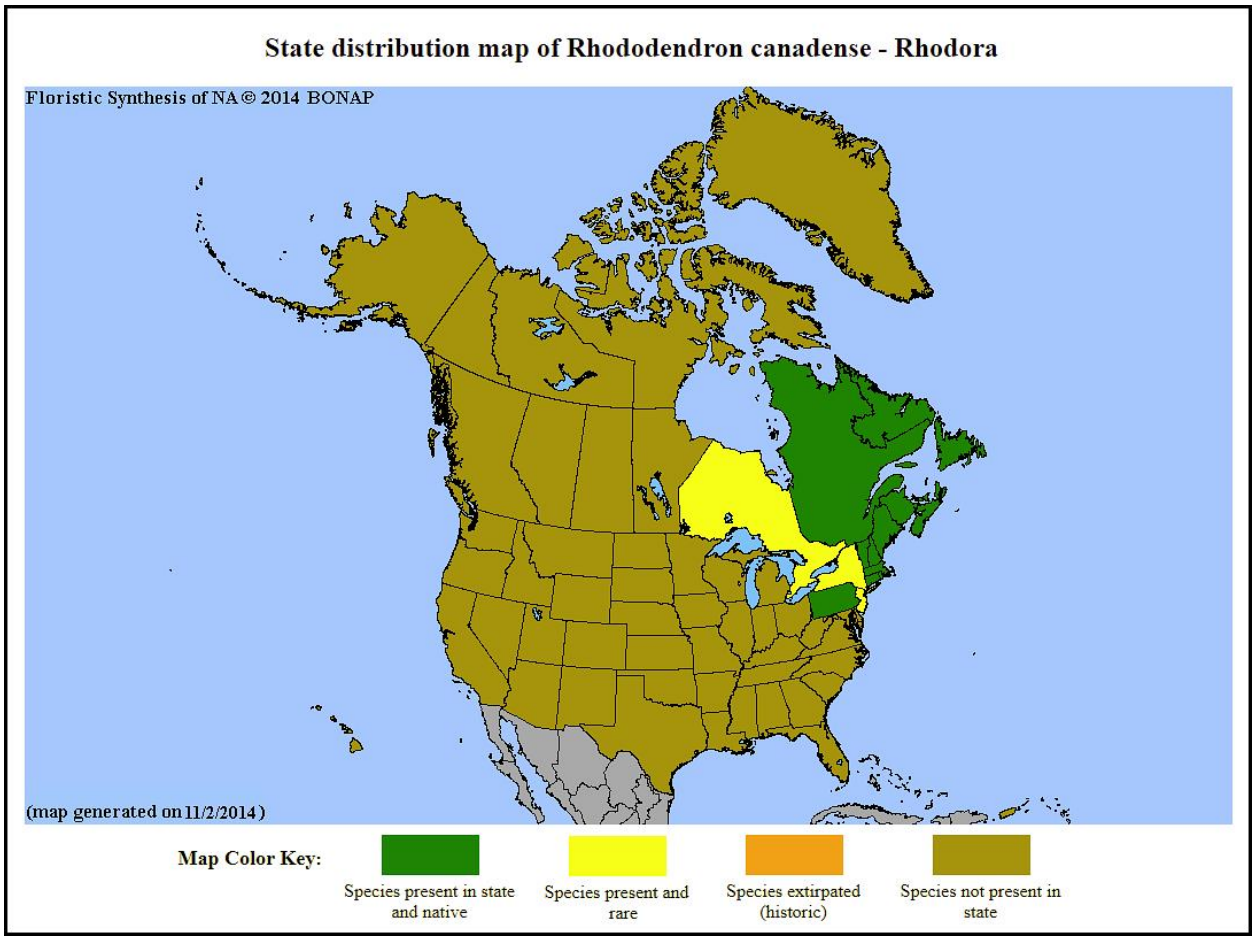


Figure 1. Distribution of R. canadense in North America, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2023b) shows records of *Rhododendron canadense* in five New Jersey counties: Bergen, Middlesex, Morris, Sussex, and Warren (Figure 2). The data include historic observations and do not reflect the current distribution of the species.

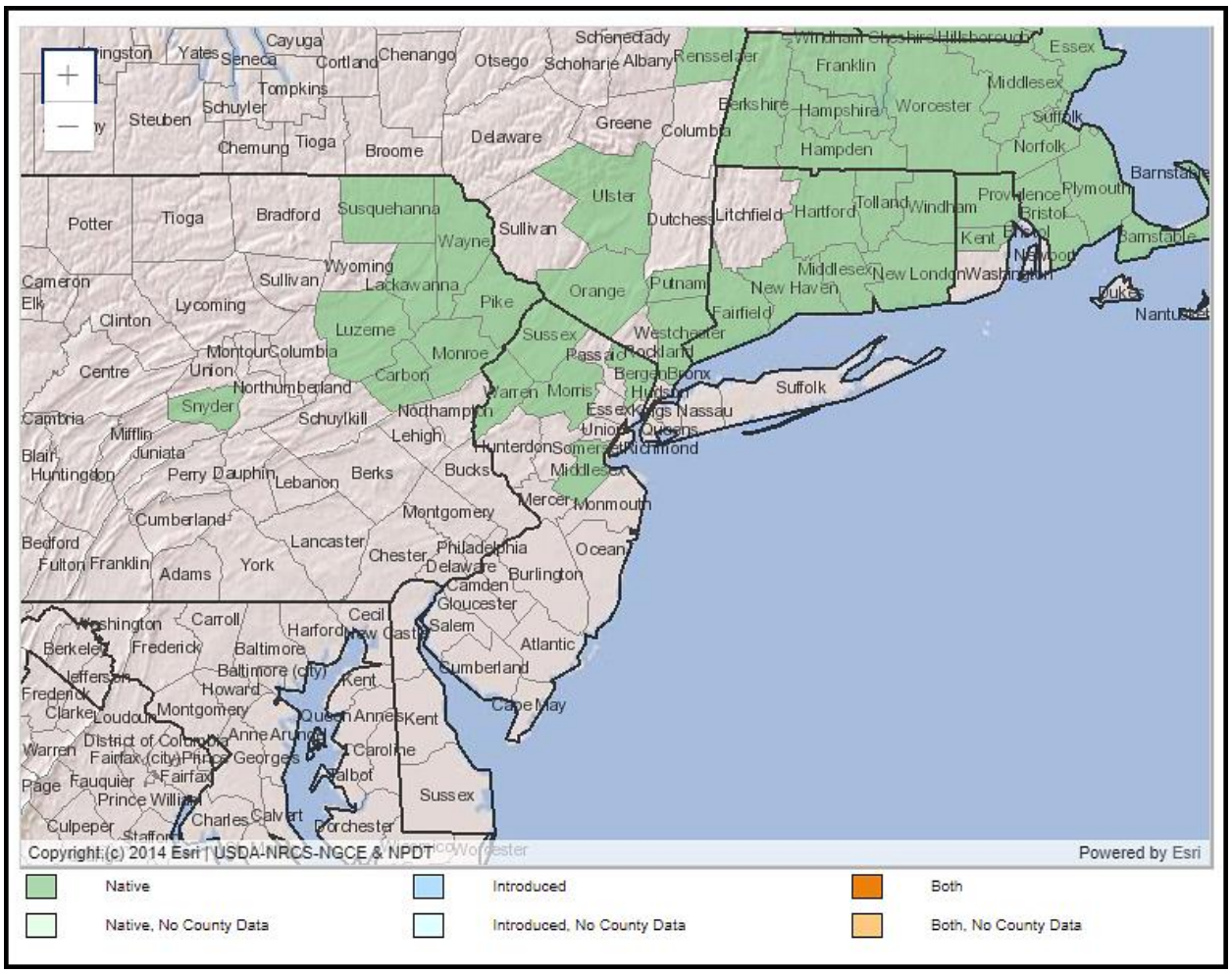


Figure 2. County records of R. canadense in New Jersey and vicinity (USDA NRCS 2023b).

Conservation Status

Rhododendron canadense is considered globally secure. The G5 rank means the species 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 (NatureServe 2023). The map below (Figure 3) illustrates the conservation status of Rhodora throughout its range. *R. canadense* is vulnerable (moderate risk of extinction) in one state, imperiled (high risk of extinction) in two states, and critically imperiled (very high risk of extinction) in one state and one province. In other provinces or states where the species occurs it is secure, apparently secure, or unranked.

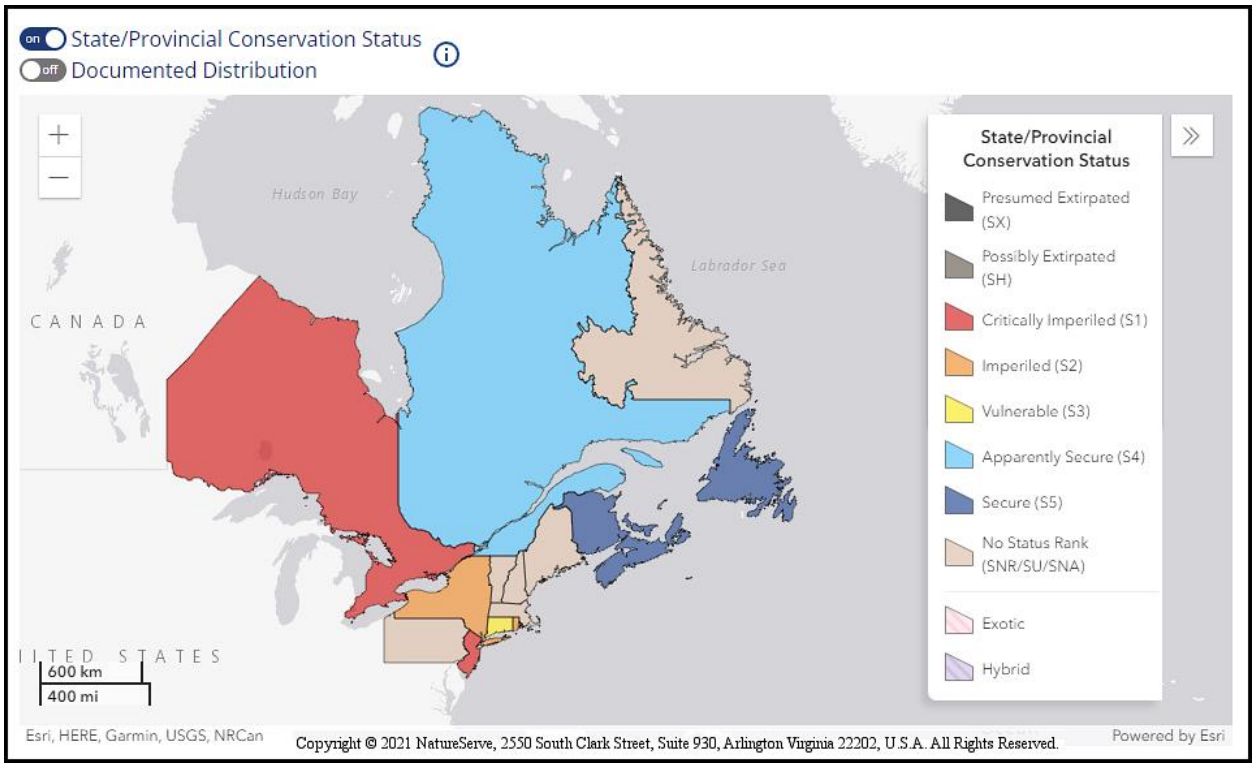


Figure 3. Conservation status of R. canadense in North America (NatureServe 2023).

New Jersey is the state where *Rhododendron canadense* is critically imperiled. The S1 rank signifies five or fewer occurrences in the state. 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. *R. canadense* 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 such as wetlands or coastal habitats, being listed does not currently provide broad statewide protection for the plants. Additional regional status codes assigned to the shrub 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).

With the exception of a single Middlesex County population that has not been seen since the 1930s, all of the known New Jersey occurrences of *Rhododendron canadense* have been situated in the northern part of the state. The first documented site in the state was in Morris County (Britton 1889) and additional populations were later found in Sussex and Warren counties (Taylor 1915, Fables 1956). Fairbrothers and Hough (1973) indicated that Rhodora was present in Warren County and there were fairly current records from Morris and Sussex, but all of the populations which were known at that time are now ranked as historical or extirpated. Two more recently discovered occurrences are currently thought to be extant, and both are located in Sussex County (NJNHP 2022).

Threats

Some populations of *Rhododendron canadense* have disappeared or declined as a result of habitat destruction or degradation. At least one of New Jersey's former populations was directly destroyed by development (NJNHP 2022). In a large metropolitan park in Massachusetts, *R. canadense* was one of many native plant species that disappeared from the site between 1894 and 1993: The losses were attributed to an increase in human activities such as the establishment of more roads and trails, forest thinning, increased ground fires, and trampling (Drayton and Primack 1996). The authors noted that the decline in native plants was accompanied by an increase in exotic species. Although no information was found regarding the impacts of exotic flora on *R. canadense*, the application of herbicides and mulch in an attempt to control another species that was perceived as a nuisance had detrimental effects on Rhodora, eliminating most of the plants in a test study (Krishnapillai 2009).

Habitat changes initiated by natural events such as flooding can also threaten *Rhododendron canadense*. One of New Jersey's extant occurrences was discovered at a time when the community was recovering from long-term inundation by beavers and only a single plant was found at the site despite intense searching (NJNHP 2022). During an attempt to restore habitat at several former peat mines in Quebec old drainage ditches were blocked, resulting in water level rises of 15–32 cm. The change generally favored the growth of sphagnous and herbaceous species but was detrimental to woody plants and caused a pronounced decline in *R. canadense*, which had previously become well-established in the abandoned ditches (González et al. 2013).

Natural successional processes may also become a threat to some populations of *Rhododendron canadense*. Latham et al. (1996) observed that prolonged periods without fire were changing the composition of the rare Pocono till barrens where *R. canadense* was characteristic. A recent study found that late successional stands in the barrens were dominated by *Pinus rigida*, *Quercus ilicifolia*, *Acer rubrum*, *Sassafras albidum*, and *Betula populifolia*. After mowing and burning were experimentally employed to re-establish the shrubland communities, *R. canadense* was a dominant component of the restored sites (Leuenberger et al. 2016).

Heavy browsing can be detrimental to *Rhododendron canadense*. Documented mammalian herbivores include Moose (*Alces alces*) and Snowshoe Hares (*Lepus americanus*), both of which rely primarily on woody plants for food during the winter months (Dodds 1960, Connor et al. 2000). Rhodora twigs with diameters in the range of 1.1–4.1 mm are most susceptible to browsing (Telfer 1969). Dodds (1960) noted that Snowshoe Hare damage can be severe because the animals tend to remain in one place for a long time when feeding in the winter. Frequent herbivory by moose, which were introduced to Newfoundland and subsequently became overabundant, triggered the decline of *R. canadense* in Gros Morne National Park (Connor et al. 2000, Gosse et al. 2011). In New Jersey, the most important herbivores are likely to be White-tailed Deer (*Odocoileus virginianus*). Skinner and Telfer (1974) reported only minor damage to *R. canadense* by White-tailed Deer in New Brunswick, Canada but their study was carried out during the growing season and did not include the winter months when deer are most likely to forage on twigs and buds. A significant decline in native shrub cover has resulted from high deer densities in New Jersey (Kelly 2019), and many other *Rhododendron* species are known to be highly vulnerable to deer browse (Perdomo et al. 2003). Although numerous Rhododendrons

produce toxic compounds none have been reported in *R. canadense* (Popescu and Kopp 2013), and the compounds do not appear to deter predation in any case.

Rhododendron canadense is well-suited for cool northern climates. The flower buds can tolerate winter temperatures as low as -30°C and vegetative buds can go as low as -40°C without injury (Sakai et al. 1986). Populations in the southern part of the species' range are likely to face new challenges as the climate warms, particularly in New Jersey where temperatures are rising faster than elsewhere in the northeast (Hill et al. 2020). Fortunately, there is evidence that *R. canadense* has some ability to adapt when climactic conditions shift. Buds typically harden in the winter to resist frost and deharden in the spring to resume growth, but Kalberer et al. (2007) found that while Rhodora buds deharden quickly in response to elevated temperatures they can also rapidly reharden if temperatures drop. The flexibility may help the shrubs respond to atypical weather patterns that result from climate change. *R. canadense* has also demonstrated the ability to adjust its blooming time in response to temperature (Delbart et al. 2015), although it does not appear to be advancing its flowering dates as much as other species in response to warmer spring weather (Elwood et al. 2013).

Research on other *Rhododendron* species (*R. catawbiense* and *R. maximum*) determined that seed germination rates were enhanced on soils with novel communities of ericoid mycorrhizae, a tendency that may help them to establish in new places and could enhance their ability to expand their ranges as the climate continues to change (Mueller et al. 2022). However, the potential advantage is still dependent on an effective means of long-distance dispersal and mycorrhizal relationships have not yet been studied in *R. canadense*. Hamlin et al. (2012) cited ongoing research in Massachusetts offering preliminary evidence that the ranges of certain species, including *Rhododendron canadense*, were shifting northward. If *R. canadense* does adjust its range in response to global warming that is likely to be good for the species as a whole but somber news for New Jersey populations.

Management Summary and Recommendations

No management needs have been identified for New Jersey's *Rhododendron canadense* populations (NJNHP 2022). An updated site visit is needed to evaluate the status of the occurrence where only a single plant was observed in order to determine whether the species has persisted or spread in the formerly disturbed habitat. Monitoring of the larger population should include an assessment of herbivory impacts.

Fire is likely to be an effective tool for managing threats from succession. Flinn and Wein (1977) determined that *Rhododendron canadense* is well adapted to survive fires, even relatively severe ones, because organs capable of reproduction tend to be situated well below the surface: Their study reported mean rhizome depths of 47 cm. Further experiments to test the shrub's ability to withstand elevated ground temperatures comparable to those that might result from fires indicated that *R. canadense* could produce abundant shoots following exposure to temperatures of 50°C, although no regrowth occurred following temperatures of 60°C (Flinn and Pringle 1983). Natural fire intervals of 18–26 years are typical for Rhodora-dominated shrublands (Latham 2003).

There are several areas where additional research would help determine the potential for *Rhododendron canadense* to maintain a presence in New Jersey. For example, a mechanism for long-distance dispersal has not been identified and the environmental conditions that favor establishment from seed have not been studied. While there is a great deal of information available about cold tolerance in *R. canadense*, the species' response to extended periods of high temperatures has not been documented.

Synonyms and Taxonomy

The accepted botanical name of the species is *Rhododendron canadense* (L.) Torr. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, POWO 2023, USDA NRCS 2023b). Taxonomists have long struggled to determine where *Rhododendron canadense* should be placed relative to other members of the genus because of its unusual floral morphology. Lattier et al. (2013) reported that *R. canadense* has less DNA and fewer chromosomes than other *Rhododendron* species, which might indicate a basal position in the genus but could also have occurred later as the result of a chromosomal fusion or deletion.

Botanical Synonyms	**Common Names**
Azalea canadensis (L.) Kuntze	Rhodora
Hochenwartia canadensis (L.) Crantz	
Rhodora canadensis L.	
Rhodora congesta Moench	

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On being asked, whence is the flower?

In May, when sea-winds pierced our solitudes,
I found the fresh Rhodora in the woods,
Spreading its leafless blooms in a damp nook,
To please the desert and the sluggish brook.
The purple petals fallen in the pool
Made the black water with their beauty gay;
Here might the red-bird come his plumes to cool,
And court the flower that cheapens his array.
Rhodora! if the sages ask thee why
This charm is wasted on the earth and sky,
Tell them, dear, that, if eyes were made for seeing,
Then beauty is its own excuse for Being;
Why thou wert there, O rival of the rose!
I never thought to ask; I never knew;
But in my simple ignorance suppose
The self-same power that brought me there, brought you.

~ Ralph Waldo Emerson, 1834