Rhododendron groenlandicum

Labrador Tea

Ericaceae

Rhododendron groenlandicum, Courtesy R. W. Smith, Lady Bird Johnson Wildflower Center

Rhododendron groenlandicum **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

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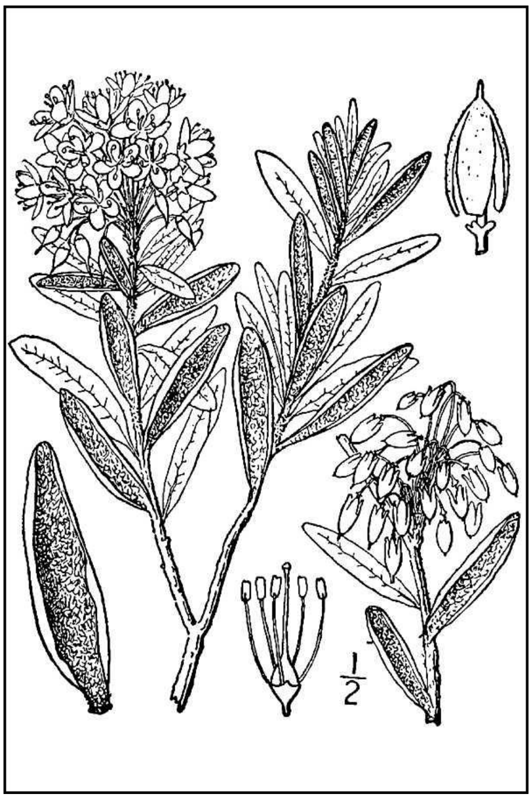
Life History

Rhododendron groenlandicum (Labrador Tea) is a long-lived, rhizomatous, evergreen shrub in the heath family. The stems can range from 0.2–1.5 meters in height but they are usually under a meter. The branches are reddish-brown to gray and new twigs are densely hairy but become smooth as they age. The leaves are alternate, oblong, and 2–5 cm long: They are dark green on top and have dense rusty brown hairs and inrolled margins below. Roundish clusters of 10–35 flowers develop at the ends of the branches. Each flower is held on a 12–25 mm long stalk that may be straight or slightly curved. The flowers are approximately 1 cm wide and have 5 small sepals, five bright white petals, and 5–8 stamens. The fruits are narrow, dry capsules about 5–7 mm in length with persistent floral styles. (See Britton and Brown 1913, Fernald 1950, Gleason and Cronquist 1991, Ryan 1995, Leopold 2005, Hébert and Thiffault 2011, Judd and Kron 2020).




Left: Britton and Brown 1913, courtesy USDA NRCS 2023a. Right: Mary Vaux Walcott, 1925.

Rhododendron groenlandicum reproduces clonally. The primary mechanism of vegetative reproduction is layering: Stems that come into contact with the substrate develop roots while still attached to the parent plants. Damaged plants can also readily resprout from root crowns or rhizomes, the latter of which usually grow within 15–50 cm of the surface (Hébert and Thiffault 2011). *R. groenlandicum* leaves persist for two years and are shed during the autumn of the second year (Karlin 1976). Consequently, mature plants usually have three age classes of leaves during a growing season—new leaves, leaves from the prior year, and two-year-old leaves. When the plants have wintered beneath a layer of snow the older leaves are brown at snowmelt but turn green within about two weeks (Jobidon 1995), and newly produced leaves become fully extended by late June or early July (Karlin 1976). In New Jersey, *R. groenlandicum* can bloom from late April to June but late May is typical (Hough 1983, NJNHP 2022). The stems elongate right after flowering, usually between the end of June and the beginning of August (Hébert and Thiffault 2011, Jobidon 1995). Fruit development can continue into August (Hough 1983), and the fruits may persist on the plants through the winter months (Hébert and Thiffault 2011).

Courtesy Stephanie Brundage, Lady Bird Johnson Wildflower Center.

<u>Pollinator Dynamics</u>

Rhododendron groenlandicum is pollinated by insects. The flowers are aromatic and small amounts of nectar are secreted at the base of the ovaries (Lovell and Lovell 1936, Genders 1997). The open structure of the flowers makes foraging easy for would-be pollinators (Reader 1977). The insects found visiting *R. groenlandicum* blooms are primarily bees although diurnal clearwing sphinx moths (*Hemaris thysbe*, *H. diffinis*), butterflies, beetles, and an assortment of flies have also been reported (Lovell and Lovell 1936, Fleming 1970, Reader 1977, Moisan-Deserres et al. 2014). Bees appear to be the most effective pollinators (Lovell and Lovell 1936, Reader 1977). The vast majority of bee species documented on Labrador Tea have been bumblebees (*Bombus* spp.) and solitary bees in the genus *Andrena*, but *Apis mellifera*, *Colletes inaequalis*, and *Osmia atriventris* have also been noted (Lovell and Lovell 1936, Reader 1975, Les 2017, Hilty 2020). Reader (1975) observed that ericaceous bog plants avoid competing for pollinators by staggering their flowering times.

Examination of flowers and floral buds led Lovell and Lovell (1936) to suspect that *Rhododendron groenlandicum* was sometimes self-pollinated, and that was subsequently confirmed. Hand-pollination experiments conducted by Reader (1977) showed that fruit development could readily occur when the plants were fertilized with their own pollen. The exclusion of insects significantly reduced seed set, so even when *R. groenlandicum* flowers were fertilized with related pollen they benefitted from pollinator activity (Reader 1977). Movement of the flowers by wind might also facilitate some self-pollination (Les 2017). However, self-fertilization can result in lower fruit set and fewer seeds per fruit (Wheelwright et al. 2006).

Seed Dispersal and Establishment

Mature capsules of *Rhododendron groenlandicum* split from the base to release their seeds (Judd and Kron 2020). Karlin (1976) observed that an average *R. groenlandicum* flower produced more than 50 seeds, and means of up to 133 seeds per flower have been reported (Les 2017). The small, slightly winged seeds are easily dispersed by wind (Karlin 1976, Campbell and Rochefort 2003). Roughly 20% of Labrador Tea seeds are able to float, so some water dispersal may also occur (Les 2017). Campbell et al. (2003) found that the species had a high potential to reach new sites and was one of the most frequent colonizers of restored peatlands.

Rhododendron groenlandicum seeds do not require a period of dormancy and they can germinate well when fresh. However, germination is most likely to occur in the spring when conditions are most favorable, and the seeds do not seem to be harmed by wintering. Seeds that don't germinate during the first year are not likely to establish, as seed viability decreases with age and *R. groenlandicum* does not maintain a seed bank (Karlin 1976).

The most favorable substrate for seed germination and establishment of *Rhododendron groenlandicum* is moist peat or a low, slow-growing moss. Light is required, and optimal conditions include a low pH (around 5.5), steady moisture, and average daily temperatures around 17°C (Karlin 1976, Karlin and Bliss 1983). The seeds also need to remain close to the surface: Germination rates decline steeply with depth and seeds buried more than 5 mm below the surface are not likely to sprout (Campbell and Rochefort 2003). *R. groenlandicum* seedlings are small and they grow slowly, which puts them at a competitive disadvantage with other plants (Karlin 1976). The slow growth and relatively short period of suitable conditions contributes to a low rate of recruitment from seed in the species (Jobidon 1995). Seedlings are more likely to be found at disturbed sites than in established bogs (Hébert and Thiffault 2011), although a study of restored oil sands sites in Alberta found that colonization was low and seedlings were still small after five years (Smreciu et al. 2013). The challenges of establishment and low rates of success underscore the importance of clonal reproduction for *R. groenlandicum* (Karlin 1976, Karlin and Bliss 1983).

Habitat

Who that has traveled by the Canadian Pacific Railway in June, along the north shore of Lake Superior and across the boggy country traversed by that railroad, has not noticed the masses of low bushes covered with feathery heads of white flowers? When the mountains are reached we still find the shrub growing luxuriantly in full sunshine or adapting itself to more shaded situations, provided the ground is sufficiently wet. ~ Mary Vaux Walcott, 1925

Rhododendron groenlandicum is a characteristic species of boreal habitats that are described as bogs, muskeg, peaty wetlands, or tundra (Lewis and Dowding 1926, Fairbrothers and Hough

1973, Angelo 1979, Rhoads and Block 2007, Anderson 2011). It has also been found in completely different habitats such as sandstone cliffs, ledges, and talus slopes. *R. groenlandicum* can grow in lowlands and in alpine communities: Reported elevations range from 0–2800 meters above sea level (Les 2017, Judd and Kron 2020). In the bog communities where it typically occurs, Labrador Tea resides on slightly elevated microsites that are usually drier and more acidic than the surrounding area (Karlin 1976). Moore and Taylor (1921) reported that the *R. groenlandicum* plants in a Maine wetland were found on mounds of *Sphagnum* spp., on *Polytrichum strictum* tussocks, and along the forested edges of the bog. In subarctic and boreal parts of Canada the species can grow on palsas, which are peat mounds with frozen permafrost cores (Railton and Sparling 1973).

Data from 2,704 plots in British Columbia was used to calculate Labrador Tea's microsite preferences such as elevation (5–1950 meters, average = 853 m) and slope gradient (0–173 percent, average = 8%) (Klinkenberg 2020). Klinkenberg also quantified the most favorable moisture regime as 5 (subhygric) on a scale of 0 (very xeric) to 8 (hydric) and identified the nutrient regime as B (poor). A more comprehensive description of the soil and moisture regimes is provided by the B. C. Ministry of Forests (1998). In a subhygric water regime the primary water sources are seepage and precipitation and water is removed slowly enough to keep soil wet for a significant part of growing season. A poor nutrient regime, which has a low amount of available nutrients, is associated with sites where the water pH usually falls between 4.5 and 5.5.

Rhododendron groenlandicum requires open habitat to develop from seed, but established plants can persist as the canopy closes (Karlin 1976). Humbert et al. (2007) classified Labrador Tea as a relatively shade-intolerant species, ranking it as a 7 on a scale from 1 (very tolerant) to 9 (very intolerant). While the plants are more likely to be found in gaps and open places than below a closed canopy (Hébert and Thiffault 2011), some habitats are deeply shaded (Les 2017). According to Hébert and Thiffault (2011), *R. groenlandicum* has high plasticity in terms of leaf mass per unit area, which could signify that the species is able to grow in a broad range of light conditions.

Rhododendron groenlandicum is often co-dominant with other heath species in the shrub layer of vegetative communities that fall within the Black Spruce (*Picea mariana*) Saturated Woodland Alliance (Breden et al. 2001). In New Jersey, the sites where *R. groenlandicum* has been found have had the characteristic mixture of ericaceous shrubs but the dominant trees were identified as *Larix laricina* at one location and *Pinus strobus* at another (NJNHP 2022). Anderson and Davis (1998) analyzed the vegetative composition of 30 peatland community types in Maine using data from 108 locations. *Rhododendron groenlandicum* was found in eleven of the peatland types, and some key habitat characteristics are summarized in Table 1.

Table 1. *Rhododendron groenlandicum* in Maine Peatlands.

Community Type	mean pH	% H_2O in peat	% overstory	peat layer depth	Labrador Tea % cover
(Picea mariana - Larix laricina/Carex stricta - Rhododendron canadense - Rhododendron groenlandicum)	4.63	91.1	33	2.7	13.0

(Picea mariana - Chamaedaphne calyculata - Kalmia angustifolia - Rhododendron groenlandicum/Picea mariana)	4.16	89.3	8.4	4.4	10.5
(Chamaedaphne calyculata - Kalmia angustifolia - Rhododendron groenlandicum)	4.03	87.3	0.2	4.3	8.5
(Picea mariana/Picea mariana/Picea mariana - Rhododendron groenlandicum- Maianthemum trifolium)	4.27	94.0	27.1	2.3	8.1
(Picea mariana/Picea mariana/Picea mariana- Rhododendron groenlandicum- Vaccinium myrtllloides)	4.21	85.5	40.6	4.6	6.1
(Kalmia angustifolia-Chamaedaphne calyculata - Gaylussacia dumosa var. *bigeloviana/Sphagnum capillifolium)*	3.87	84.3	1.5	3.8	5.7
(Acer rubrum - Larix laricina/Ilex verticillata - Alnus incana ssp. *rugosa/Carex trisperma)*	5.21	92.7	65.1	4.9	5.1
(Gaylussacia dumosa var. *bigeloviana/Empetrum nigrum)*	4.18	91.8	2.2	4.0	4.0
(Picea mariana - Acer rubrum/Nemopanthus mucronatus- Viburnum nudum var. *cassinoides/Carex trisperma)*	4.60	90.8	71.3	2.7	3.1
(Chamaedaphne calyculata- Rhododendron canadense- Myrica gale - Kalmia angustifolia)	4.59	90.3	3.4	1.2	1.7
(Trichophorum cespitosum- Carex lasiocarpa- Rhynchospora alba - Trichophorum alpinum - Muhlenbergia glomerata)	7.89	88.0	7.2	4.8	0.2
Source: Anderson and Davis 1998					

Rhododendron groenlandicum is mycorrhizal and can form partnerships with a variety of fungi. Mycorrhizae have been found in *R. groenlandicum* plants from forested bogs and from alpine sites (Treu et al. 1996, Massicotte et al. 2005, Kennedy et al. 2018). The shrubs are capable of hosting multiple fungal species simultaneously. The majority of Labrador Tea's fungal relationships produce ericaceous mycorrhizae, a type that is found only in plants in the Ericaceae and Diapensiaceae, but some result in the formation of more common ectomycorrhizae (Wang and Qiu 2006, Kennedy et al. 2018). Kennedy et al. (2018) found that the presence of *R. groenlandicum* had a strong influence on the composition of mycorrhizal communities.

Rhododendron groenlandicum has long been associated with poor germination and growth in *Picea mariana*. Lavoie et al. (2006) found that *P. mariana* trees did not increase their growth or nutrient storage when aboveground portions of *R. groenlandicum* were removed and concluded that the shrubs were not necessarily harmful to the conifers. However, the perceived detrimental effects may have been due to belowground competition, as the mycorrhizae formed by *R. groenlandicum* allow the shrubs to obtain nitrogen from the soil that would otherwise be available for the trees (Hébert and Thiffault 2011).

Although *Rhododendron groenlandicum* can persist in shaded sites, the species benefits from certain disturbances (eg. logging, fire) that open up the canopy (Karlin 1976). Partial harvests of

Picea mariana that increased light availability stimulated a higher rate of photosynthesis in *R. groenlandicum* (Hébert et al. 2010), and at sites where harvesters left residual forest patches the cover of Labrador Tea was significantly higher in clearcuts than in tree retention areas (Lachance et al. 2013). Fire is a common natural occurrence in northern bogs (Transeau 1903, Foster 1985, Gucker 2006) and following a burn *Rhododendron groenlandicum* regenerates rapidly by vegetative means, often increasing in density and blooming more profusely (Foster 1985, Harper et al. 2004, Anderson 2011). While Labrador Tea may respond differently to fires of varying intensity, its rhizomes are usually positioned far enough beneath the surface to permit survival even after severe burns (Lecomte et al. 2005, Gucker 2006).

Wetland Indicator Status

The U. S. Army Corps of Engineers has divided the country into a number of regions for use with the National Wetlands Plant List. In New Jersey, *Rhododendron groenlandicum* is an obligate wetland species, meaning that it almost always occurs in wetlands. In some other parts of the country *R. groenlandicum* can occur in both wetlands and nonwetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2023b)

LEGR

Coefficient of Conservatism (Walz et al. 2018)

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

Rhododendron groenlandicum is native to the northern United States, Canada, and Greenland. The species is introduced in Germany, Great Britain, and Japan (POWO 2023). The map in Figure 1 depicts the extent of *R. groenlandicum* in North America.

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

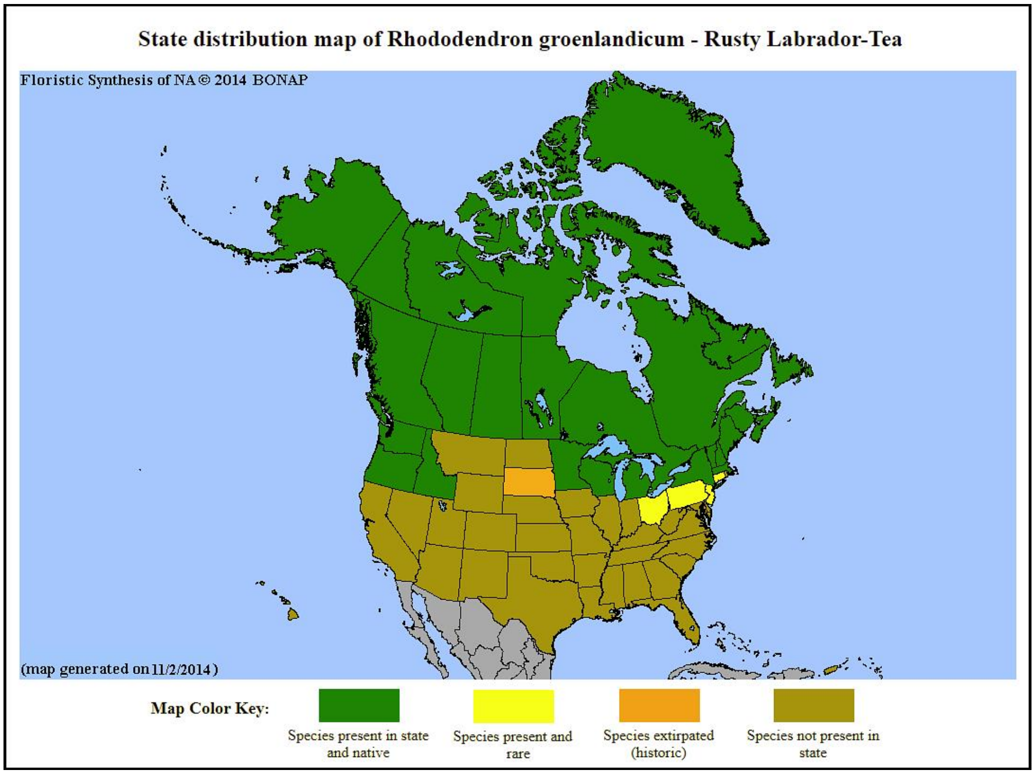


Figure 1. Distribution of R. groenlandicum in North America, adapted from BONAP (Kartesz 2015).

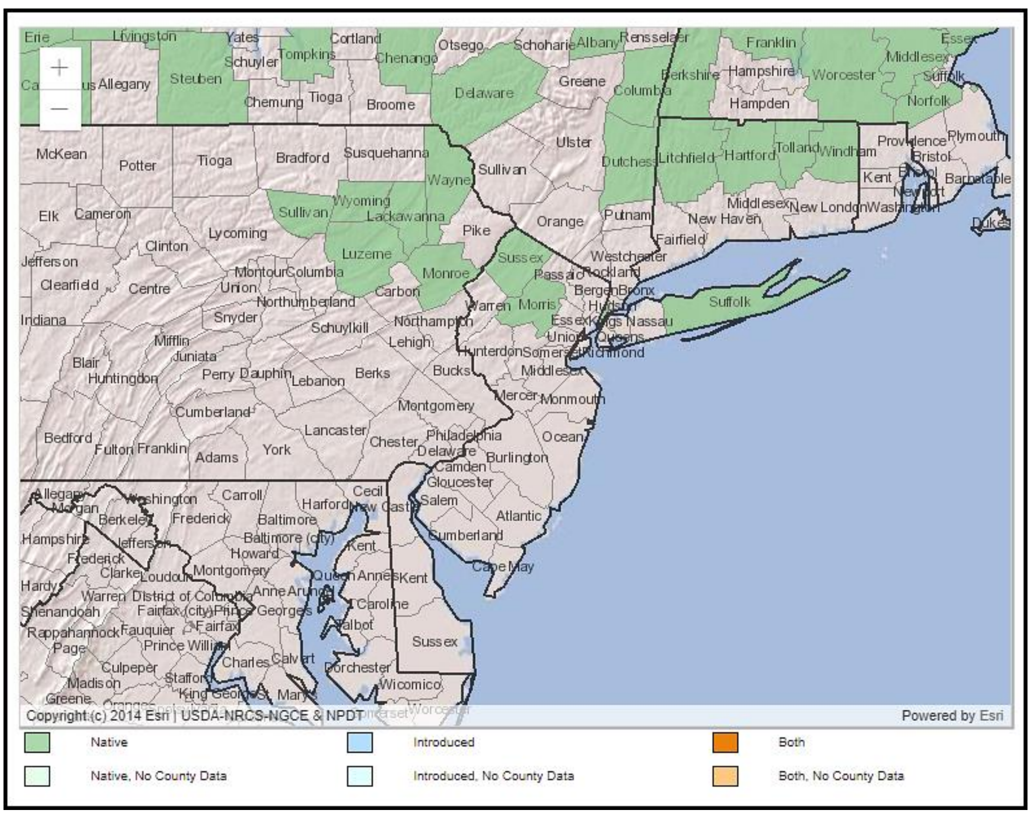


Figure 2. County records of R. groenlandicum in New Jersey and vicinity (USDA NRCS 2023b).

Conservation Status

Rhododendron groenlandicum 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 *R. groenlandicum* throughout its range. Labrador Tea is secure or apparently so throughout most of its range, but it is at risk at a number of locations along its southern border. The species is vulnerable (moderate risk of extinction) in Pennsylvania, imperiled (high risk of extinction) in Connecticut, critically imperiled (very high risk of extinction) in New Jersey, possibly extirpated in Ohio, and likely extirpated in South Dakota.

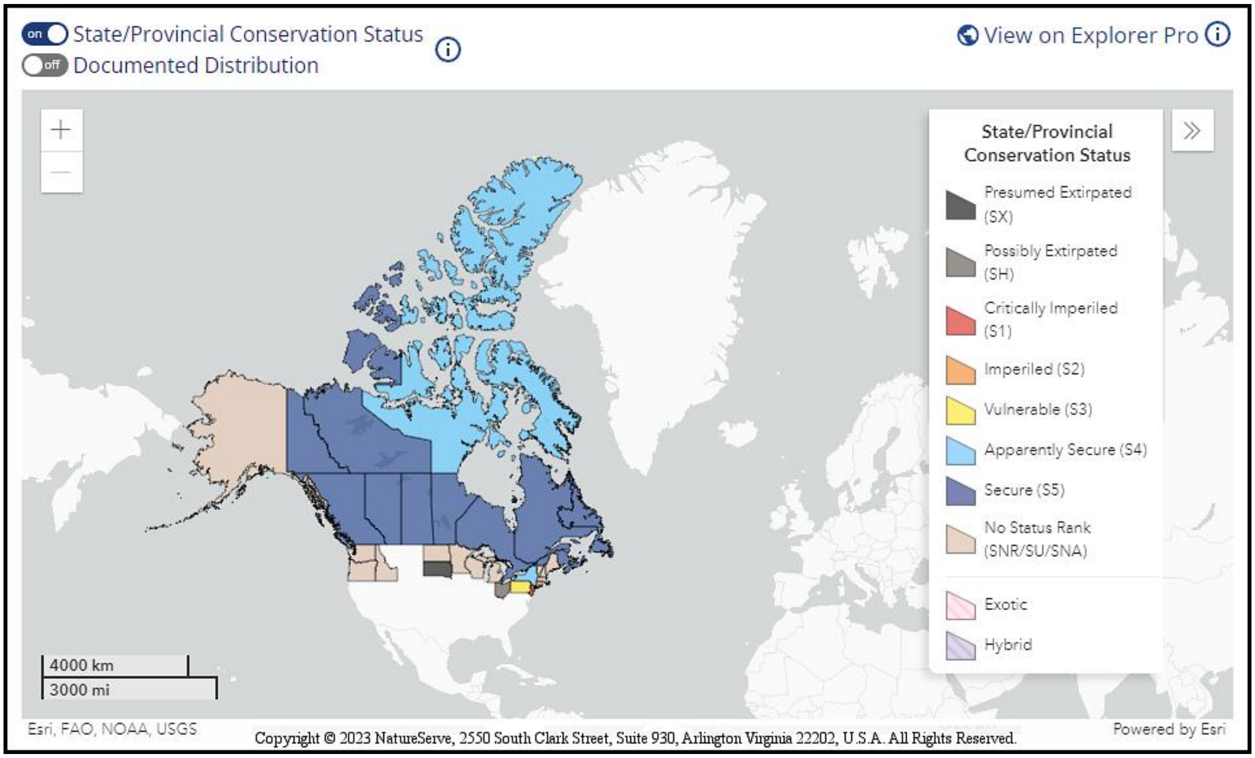


Figure 3. Conservation status of R. groenlandicum in North America (NatureServe 2023).

The critically imperiled (S1) status of *Rhododendron groenlandicum* in New Jersey 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. groenlandicum* 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 plant 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, 2022).

The source of the earliest report of *Rhododendron groenlandicum* in New Jersey remains uncertain. Taylor (1915) said that there was anecdotal evidence of the species in Sussex County but it was not definitely known to occur in the state. The first confirmed state record of *R. groenlandicum* was made by Kenneth Mackenzie, who tentatively identified the plant based on a verbal description and then confirmed it with a visit to a Morris County bog (Mackenzie 1918). For the next half-century that remained the only known population in New Jersey (Fables 1956, Fairbrothers and Hough 1973) but in the 1970s the site was destroyed by the construction of a large regional shopping mall and *R. groenlandicum* was listed as an extirpated species in the state (NJONLM 1992, Breden et al. 2006). In 2000, Glenn (2001) discovered a new population of Labrador Tea in New Jersey and that one was located in Sussex County—perhaps at the same site that had sparked the unsubstantiated reports nearly a century earlier.

Threats

After the North American continent was colonized many bogs were drained and cleared (Transeau 1903). The original New Jersey population of *Rhododendron groenlandicum* was similarly lost to development, although it would likely have been spared by wetlands regulations that were implemented within a decade of its demise. Despite improved protection for its more typical habitats, *R. groenlandicum* can still be affected by human activities. At logged sites the shrubs are sometimes damaged by harvesting equipment (Harper et al. 2004), and a number of the plants in New Jersey's remaining population were cut down for trail maintenance (NJNHP 2022).

Rhododendron groenlandicum may be threatened by changes in water quality. The species is sensitive to herbicides (Hébert and Thiffault 2011) and does not benefit from fertilization (Bubier et al. 2011, Wang et al. 2013). In fact, Thormann and Bayley (1997) found that net primary production in *R. groenlandicum* significantly decreased when nutrients were added to the soil. Even in protected habitats, harmful elements can be introduced via runoff from adjacent land. Enrichment of a bog with fertilizers from nearby lawns or farm fields is likely to facilitate the establishment of generalist species to the detriment of plants like *R. groenlandicum* that thrive in nutrient-poor habitats (Bubier et al. 2011).

In 2019, extensive mortality was observed in New Jersey's *Rhododendron groenlandicum* population, and the cause appeared to be some kind of pathogen (NJNHP 2022). Labrador Tea is susceptible to a number of rust fungi that usually alternate between coniferous and ericaceous hosts but can sometimes proliferate on *Rhododendron* without returning to a conifer. Much of the time the reported damage is primarily cosmetic, limited to spotting or discoloration of the leaves (Crane 2001, Anderson 2011, Hébert and Thiffault 2011), and the overall effects on ericaceous hosts are generally negligible (Šafránková 2008). However, severe cases can result in defoliation (PNE 2023). Plants that are already stressed by other factors may be more vulnerable to acute infections, or the New Jersey shrubs may have succumbed to a completely different disease.

The leaves of *Rhododendron groenlandicum* are fragrant when crushed and they were used by indigenous people and early settlers to brew tea, resulting in the common name Labrador Tea.

Some sources described the flavor as "pleasant" although Walcott (1925) found the beverage "rather too much like turpentine to be palatable." Tea should only be made by steeping the leaves because boiling them can release harmful alkaloids (Ryan 1995). *R. groenlandicum* was also historically utilized as a food source and, since it produces many secondary compounds, it has been employed for a wide variety of medicinal purposes (Anderson 2011, Hébert and Thiffault 2011, Les 2017). Recent population growth in cultures that still utilize the plants and an increase in investigation of botanical sources for commercial medicines have raised concerns about overharvesting. A study by Tendland et al. (2012) demonstrated that uniform removal of all leaves was detrimental but when only older leaves were harvested the plants' growth, foliage production, and survival were not significantly reduced. Despite the species' popularity with humans the large quantities of essential oils in *R. groenlandicum* leaves are thought to serve as a chemical deterrent to herbivory, and one secondary compound isolated from the plant was confirmed to be unpalatable to snowshoe hares when tested by Reichardt et al. (1990). Some mammals, including moose and caribou, may browse on twigs or leaves (Anderson 2011) but *R. groenlandicum* does not appear to be favored by deer. Pellerin et al. (2006) did not find a big difference in cover of the shrub between sites with and without deer and several studies cited by Gucker (2006) also suggested that deer browse on the species is minimal.

New Jersey's population of *Rhododendron groenlandicum* is situated at the extreme southeastern end of the species' North American range and the vulnerability of the occurrence is likely to increase as the climate continues to warm. The species is adapted to cool northern climates (Gucker 2006), and Larsen (1971) found a positive correlation between the range of *R. groenlandicum* and the distribution of arctic air masses. As the global climate changes, temperatures are rising faster in New Jersey than elsewhere else in the northeast and shifting precipitation patterns are resulting in more frequent and prolonged droughts (Hill et al. 2020). Formal investigations of climactic tolerance in Labrador Tea have mainly focused on the species' responses to extreme cold (eg. Reader 1979), but the death of *R. groenlandicum* plants at one site was attributed to desiccation (Lewis and Dowding 1926) and Karlin (1976) reported that young plants exhibited signs of stress following an accidental exposure to high temperatures (40^{o}C). Seedling survival could also be compromised by increasingly arid conditions because the mosses that tolerate dryer habitats grow faster and would be likely to overtake the young plants (Karlin 1976). During a 2010 study in northern Quebec unusually high temperatures, a low water table, and a lengthy drought might have contributed to an observed deterioration in Labrador Tea plants (Tendland et al. 2012). Nevertheless, *R. groenlandicum* may have some capacity to adapt as the climate changes. Smith and Hadley (1974) found that the plants could become acclimated to both cooler and warmer temperatures. *R. groenlandicum* plants that grow in alpine sites have developed smaller leaves, a prostrate habit, and a more rapid photosynthetic rate, which also suggests that the species may be able to slowly adjust to changing conditions (Riebesell 1981).

Management Summary and Recommendations

The New Jersey population of *Rhododendron groenlandicum* may be particularly important due to its location on the southern boundary of the species' range. Range-edge populations can be better-adapted to extreme conditions, so the New Jersey plants may be more resilient in response to climactic warming than plants in other places where the species occurs (Rehm et al. 2015).

Every effort should be made to protect the extant habitat and limit damage to the shrubs. The remaining *R. groenlandicum* plants should be closely monitored for further signs of disease so that the cause can be determined and possible remedies can be investigated.

Rhododendron groenlandicum is currently secure throughout most of its range but management may also be needed in some other states along its southern boundary. The use of buffers around wetlands where the species grows has been recommended to maintain natural hydrologic conditions for populations in Pennsylvania (PANHP 2019), and buffers can also help to limit the introduction of nutrients and harmful chemicals. In some locations, fire could be used as a tool to maintain open habitat and to stimulate both vegetative and sexual reproduction in *R. groenlandicum*.

Synonyms

The accepted botanical name of the species is *Ledum groenlandicum* Oeder. Orthographic variants, synonyms, and common names are listed below (ITIS 2023, POWO 2023, USDA NRCS 2023b). Kron and Judd (1990) reclassified *Ledum* as a subgenus of *Rhododendron* so the first synonym listed below is now widely used.

Botanical Synonyms

Rhododendron groenlandicum (Oeder) Kron & Judd
Ledum canadense G. Lodd.
Ledum groenlandicum var. *aridiphilum* D. Löve
Ledum groenlandicum var. *compactum* (Bean) Rehder
Ledum groenlandicum f. *compactum* (Bean) Rehder
Ledum latifolium Jacq.
Ledum latifolium var. *canadense* (G. Lodd.) DC.
Ledum latifolium var. *compactum* Bean
Ledum latifolium var. *palustre* Alph. Wood
Ledum pacificum Small
Ledum palustre var. *groenlandicum* (Oeder) Rosenv.
Ledum palustre ssp. *groenlandicum* (Oeder) Hultén
Ledum palustre var. *latifolium* (Jacq.) Michx.

Common Names

Labrador Tea
Bog Labrador Tea
Rusty Labrador-tea

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