

Ludwigia hirtella

Hairy Primrose-willow

Onagraceae



Ludwigia hirtella courtesy Carolyn Fannon, Lady Bird Johnson Wildflower Center

***Ludwigia hirtella* Rare Plant Profile**

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

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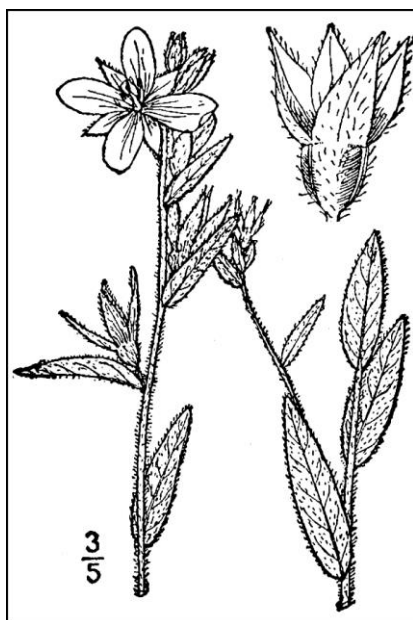
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Life History

Ludwigia hirtella (Hairy Primrose-willow) is a perennial forb in the evening primrose family. *Ludwigia* is a large and variable genus that has been divided into multiple sections. *L. hirtella* was placed in section *Ludwigia* along with three other species: *L. alternifolia* also occurs in New Jersey while *L. maritima* and *L. virgata* are southeastern plants (Raven 1963, Hoch 2022). The species in section *Ludwigia* differ from other members of the genus in a number of ways. They have fusiform, tuberous roots that may have some kind of adaptive function in wet habitats (Hoch 2022). Staminal development in the group is unlike that of any other section, and the fruits are somewhat cuboid capsules that release the seeds through an apical pore (Eyde 1977, 1978). All of the species in section *Ludwigia* have 4 sepals and 4 stamens (Raven 1963) and they are all diploid species. *L. hirtella* is most closely related to *L. alternifolia* (Liu et al. 2020).

Ludwigia hirtella is typically 0.3–1.0 meters tall but some plants can exceed a meter in height. The stems may be simple or branch near the top. The lance-shaped leaves are alternate, stalkless, and 1.4–5.5 cm long. The stem and leaves are usually noticeably hairy, as are the sepals and fruits. The inflorescence is a leafy raceme of bright yellow flowers with four somewhat heart-shaped petals that are up to 14 mm long. Small bracts (2.5–7 mm) are present at the base of the floral pedicels. The sepals are relatively narrow (2.2–4.5 mm) and shorter than the petals; they remain attached as the fruits develop. The fruits are 4-angled subcubic capsules measuring 4–6 mm x 4–5 mm. (See Britton and Brown 1913, Taylor 1915, Munz 1944, Fernald 1950, Gleason and Cronquist 1991, Hoch 2022). The upright, hairy plants and boxy fruits make *Ludwigia hirtella* readily distinguishable from other members of the genus with which it co-occurs (Stone 1911, Wright undated). However *L. hirtella* plants may occasionally lack hairs and *L. alternifolia*—which is typically glabrous—can sometimes be pubescent. *L. alternifolia* also differs in having smaller floral bracts (1–2.5 mm), broader sepals (4–6.5 mm) and short petioles at the base of the leaves (Duke 1955, Hoch 2022).



Left: Britton and Brown 1913, courtesy USDA NRCS 2024a. Right: Courtesy Alan Cressler, Lady Bird Johnson Wildflower Center.

Throughout its range *Ludwigia hirtella* flowers and fruits from June through September (Jones, 1974, Ellis and Urbatsch 1979, Weakley et al. 2024). Blooming appears to begin earlier in the south. Gaddy (1982) found *L. hirtella* flowering during June in South Carolina. Stone (1911) reported that New Jersey plants flowered from early July to late August and produced fruit from early August through late September. Recent observers noted that *L. hirtella* plants at two different locations in the state were still in bud at the end of June (NJNHP 2024).

Pollinator Dynamics

Two-thirds of the species in *Ludwigia* are principally self-fertilized: As the flowers open the anthers deposit pollen directly on the receptive stigmas. The four species in section *Ludwigia* are all highly self-compatible and they can readily interbreed. *Ludwigia virgata* is more likely to be cross-pollinated because its stigma is positioned above the anthers at anthesis but the other members of the group, including *L. hirtella*, are mainly viewed as self-pollinating (Raven 1979, Raven and Tai 1979, Hoch 2022).

However, the species in section *Ludwigia* also have prominent nectaries on the summit of their ovaries (Eyde 1981). Various insects—including a wide array of bees as well as some wasps, gnats, and small butterflies—are attracted to *L. alternifolia* flowers for nectar and/or pollen (Robertson 1929, Hilty 2020). Raven (1979) noted that the primary pollinators of outcrossing *Ludwigia* species were bees, while flower flies and butterflies were of secondary importance. Estes and Thorp (1974) observed that syrphid flies and skippers were ineffective pollinators of *L. peploides* and that the species was mainly bee-pollinated. Large bees (*Apis mellifera*, *Xylocopa virginica*, and *Bombus pensylvanicus*) were identified as the most important pollinators of *L. alternifolia* (Ott 1991). It seems likely that *Ludwigia hirtella* is mainly self-fertilized but also capable of outcrossing under some circumstances, although no pollination studies focusing on the species were found.

Seed Dispersal

Ludwigia hirtella produces numerous seeds in each fruit: They are light brown, 0.6–0.7 mm long, and 0.3–0.4 mm wide. The seeds develop in rows but eventually move freely within the mature capsules (Raven 1963, Hoch 2022). *L. hirtella* seeds have no specialized structures to facilitate dispersal: Myers (2010) inferred that they were mainly gravity-dispersed based on their morphology. Wind probably plays a role in shaking the seeds free of the capsules, which open at the top when ripe. Ott (1991) observed that *L. alternifolia* capsules could remain on the plants and continue dispersing propagules for up to a year.

The majority of *Ludwigia hirtella* seeds are viable. Myers (2010) reported an 82% germination rate for *L. hirtella* seeds that were sown in a laboratory. It is not clear whether the species forms a persistent seed bank. During a Florida study, *L. hirtella* was present in the vegetation of a restored pine flatwoods ecosystem but the species was not documented in the seed bank (Sharma et al. 2018). However, *L. hirtella* reappeared at a New Jersey site from which it had been absent for about two decades (Gordon 2013) and in Florida it colonized a site where soils obtained from

natural habitats had been brought in as part of a phosphate mine reclamation project (Miller et al. 1988) so the possibility of long-term seed banking cannot be ruled out. No information was found regarding the germination and establishment requirements of *Ludwigia hirtella*, but *L. alternifolia* seeds apparently need a period of cold stratification prior to germination (Kootenay Local Agricultural Society 2008, Wild Ones 2015).

Habitat

Ludwigia hirtella is usually found in locations that are situated between 0–300 meters above sea level (Hoch 2022) but Appalachian occurrences have been found at higher elevations: Rossell and Losure (2005) reported a population at 600 meters. The substrate is generally wet or moist. Kirkman et al. (1998) studied the vegetation zones of a Georgia wetland and *L. hirtella* was only found in the hydric ecotone, which was approximately 0.33 meter below the hydric soil boundary and had soils with an average moisture content of 28%. The substrate of sites where *L. hirtella* occurs is often described as sandy or peaty. Typical habitats include boggy depressions, wet swales, savannas, hillside seeps, ditches, and the margins of streams, ponds, or lakes (Youse 1901, Duke 1955, Jones 1974, Ellis and Urbatsch 1979, Calazza and Fairbrothers 1980, Hough 1983, Smith 1996, Drew et al. 1998, Belden et al. 2004, Rossell and Losure 2005, Singhurst et al. 2014, Hoch 2022).

The wetland habitats utilized by *L. hirtella* are often situated in pinelands or oak pine woods (Clark 1904, Fernald 1947, Waterfall 1949, Jones 1974, Ellis and Urbatsch 1979, Gaddy 1982, Hough 1983, Smith 1996, Drew et al. 1998, Belden et al. 2004), although one Appalachian population was associated with bottomland hardwood forests (Olson et al. 2004) and *Acer rubrum* was noted as the dominant canopy species at two locations in New Jersey (NJNHP 2024). Within the communities, *Ludwigia hirtella* is most likely to occur in sites that have a relatively open canopy. Using a scale of 1 (shade-loving) to 9 (sun-loving), Weakley et al. (2024) assigned the species a rank of 8, signifying that it has some tolerance for shade but is much more likely to thrive in sunny habitats. New Jersey's extant populations are located in an open savanna, along the edges of forests or thickets, and in a utility right-of-way (NJNHP 2024). Herbaceous associates can vary widely from one site to the next but it is interesting to note that *Ludwigia hirtella* has often been found growing near other members of the genus including *L. alternifolia*, *L. glandulosa*, *L. linearis*, *L. palustris*, *L. polycarpa*, and *L. sphaerocarpa* (Youse 1901, Fernald 1937, Gordon 2013).

Wetland Indicator Status

The U. S. Army Corps of Engineers divided the country into a number of regions for use with the National Wetlands Plant List and portions of New Jersey fall into three different regions (Figure 1). *Ludwigia hirtella* has more than one wetland indicator status within the state. In the Eastern Mountains and Piedmont region, *L. hirtella* is an obligate wetland species, meaning that it almost always occurs in wetlands. On the Atlantic and Gulf Coastal Plain it is a facultative wetland species, meaning that it usually occurs in wetlands but may occur in nonwetlands. *L. hirtella* is not ranked in the Northcentral and Northeast region (U. S. Army Corps of Engineers 2020).

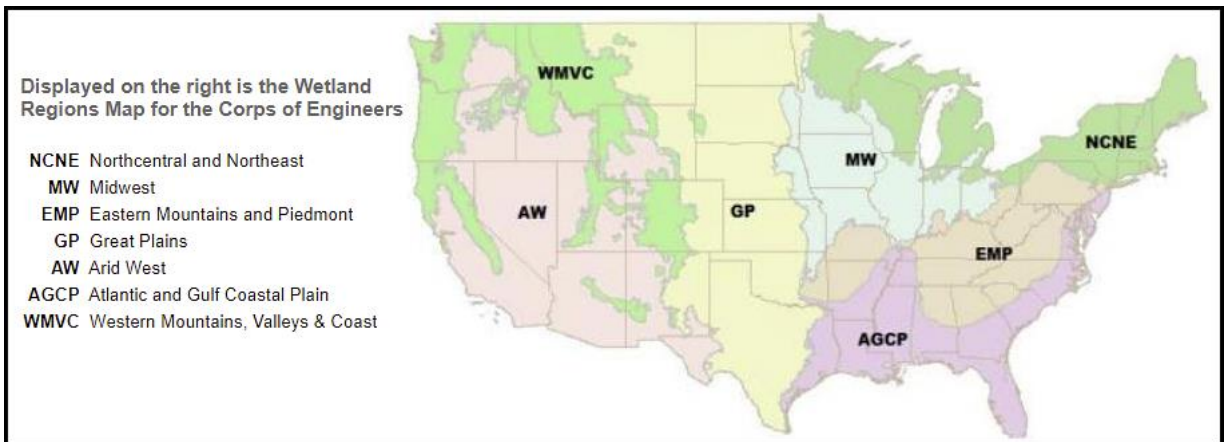


Figure 1. Mainland U. S. wetland regions, adapted from U. S. Army Corps of Engineers (2020).

USDA Plants Code (USDA, NRCS 2024b)

LUHI

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 global range of *Ludwigia hirtella* is restricted to the southeastern and mid-Atlantic regions of the United States (POWO 2024). The map in Figure 2 depicts the extent of the species in North America. Sorrie and Weakley (2001) observed that *L. hirtella* was one of a surprisingly large number of species that mainly occurred on the coastal plain but could also be found in the Eastern Highland Rim and Cumberland Plateau regions in the Appalachian Mountains.

The USDA PLANTS Database (2024b) shows records of *Ludwigia hirtella* in six New Jersey counties: Atlantic, Burlington, Camden, Cape May, Cumberland, and Salem (Figure 3). The data include historic observations and do not reflect the current distribution of the species.

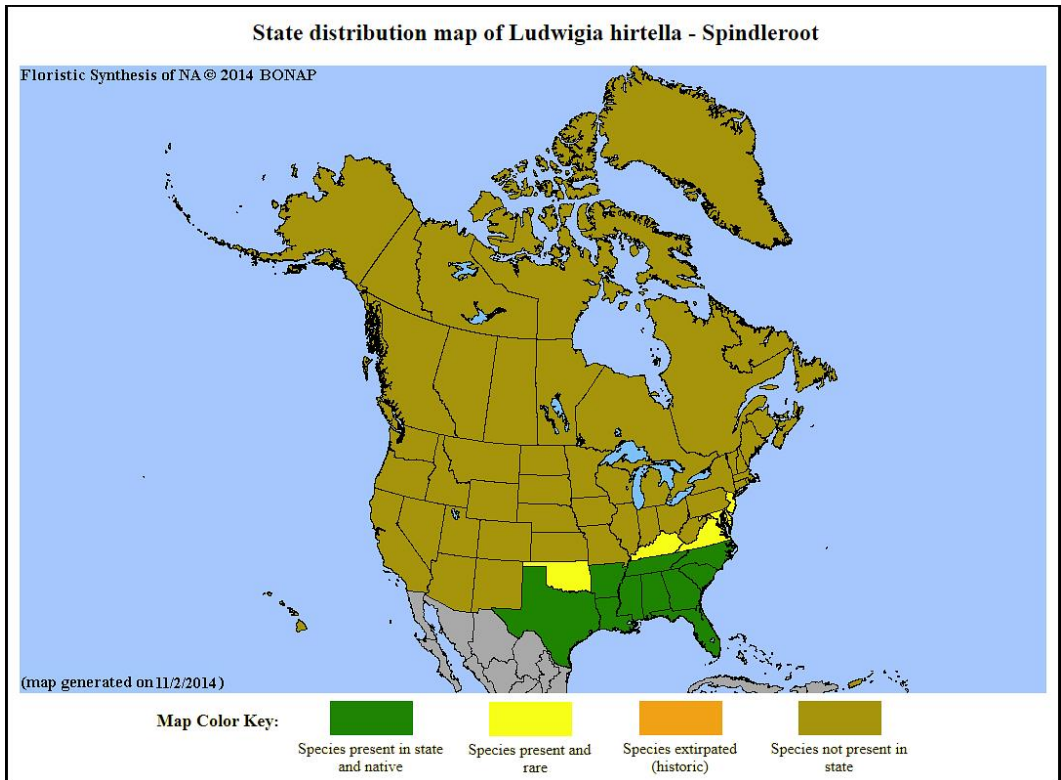


Figure 2. Distribution of *L. hirtella* in North America, adapted from BONAP (Kartesz 2015).

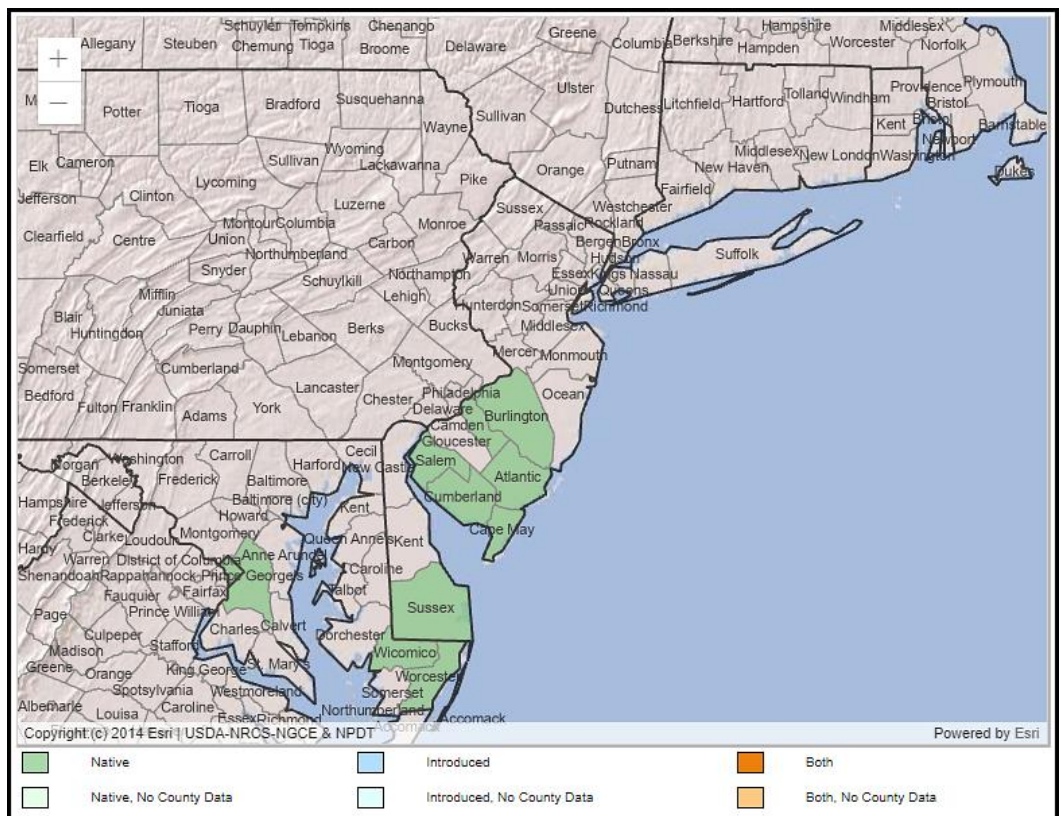


Figure 3. County records of *L. hirtella* in New Jersey and vicinity (USDA NRCS 2024b).

Conservation Status

Ludwigia hirtella 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 2024). The map below (Figure 4) illustrates the conservation status of *L. hirtella* throughout its range. Hairy Primrose-willow is vulnerable (moderate risk of extinction) in one state, imperiled (high risk of extinction) in one state, critically imperiled (very high risk of extinction) in five states, and presumed extirpated in the District of Columbia. *L. hirtella* is secure, apparently secure, or unranked in most of the southern states where it occurs and is mainly rare in the northern part of its range. In the North Atlantic region, which includes four Canadian provinces and twelve U. S. states, it has been identified as a plant species of the highest conservation priority and assigned a rank of R2 (imperiled), signifying a high risk of regional extinction (Frances 2017).

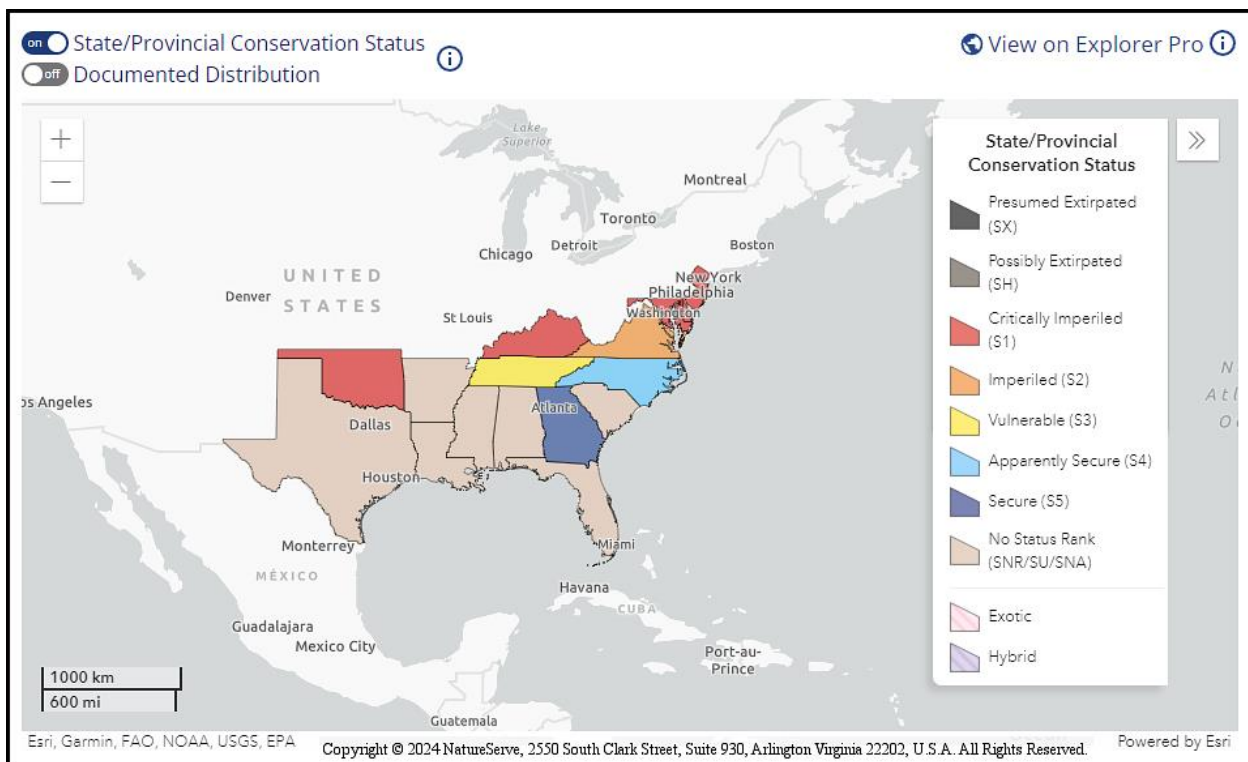


Figure 4. Conservation status of *L. hirtella* in North America (NatureServe 2024).

Ludwigia hirtella is critically imperiled (S1) in New Jersey (NJNHP 2024). The 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. Regional status codes assigned to *L. hirtella* indicate that the species is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

Ludwigia hirtella has never been abundant in New Jersey. Although there were early records of the species from a number of places in the Pine Barrens it was alternately described as sparing in occurrence, rare and local, or very rare (Willis 1874, Britton 1881 & 1889, Stone 1911, Taylor

1915). Calazza and Fairbrothers (1980) initially categorized *Ludwigia hirtella* as threatened and it was one of the 54 plant species protected by the original Comprehensive Management Plan for the Pinelands (NJ Pinelands Commission 1980). Hough (1983) noted that all of the New Jersey records of *L. hirtella* from counties other than Burlington and Cape May predated 1930. Hairy Primrose-willow was assigned an S2 rank in 1992 and remained in that category for around a quarter of a century but was subsequently downgraded to S1 (NJONLM 1992, NJNHP 2016 & 2019). About 80% of the documented occurrences in the state are now considered historical or extirpated and only four are presently thought to be extant (NHNHP 2024).

Threats

The remaining populations of *Ludwigia hirtella* in New Jersey are facing an assortment of threats, many of which are directly attributable to human activities. The habitat of one former occurrence was converted to agricultural fields, and the site of an extant population on privately owned land is likely to be utilized for the expansion of a housing development (Sundue 2006, NJNHP 2024). One population is adjacent to a road where the plants have been run over by vehicles and damaged by roadside maintenance like scraping and mowing. Trampling was identified as a threat to a savanna population which has been subjected to so much foot traffic that trails are beginning to form. All-terrain vehicle activity played a role in the demise of another population, along with an excessive amount of flooding (NHNHP 2024).

Although herbivory was not identified as a threat to New Jersey populations of *Ludwigia hirtella* it is likely to have some effect. A study of White-tailed Deer (*Odocoileus virginianus*) foraging preferences found that *L. hirtella* was heavily browsed during the spring and summer months and also in the fall to a lesser extent (Warren and Hurst 1981). The overpopulation of deer and the consequences on native plant communities in New Jersey are well-documented (Kelly 2019, NJDSR 2019), and plants that are browsed during the growing season cannot complete their reproductive cycle.

Competition from invasive flora, specifically *Lespedeza cuneata* and *Centaurea stoebe*, was noted as a problem at one site (NHNHP 2024). Although natural succession has not been identified as a concern for any particular populations, *Ludwigia hirtella* requires relatively open conditions so some occurrences might decline as the canopy develops. One New Jersey population disappeared for about two decades following canopy closure but reappeared after the site had burned and removed much of the woody cover (Gordon 2013). The effects of fire on *L. hirtella* are unclear. Duke (1955) indicated that the species was often found in "burned-over sandy places." During 2007, the plants in a small New Jersey population appeared to have been directly destroyed by a fire, although the species was subsequently found at the site in 2011 (NHNHP 2024). When Keith and Carrie (2002) studied two Louisiana bogs that had been burned at three-year intervals for about 20 years, *L. hirtella* was present in both bogs and no positive or negative responses to fire were noted for the species.

Climate Change Vulnerability

Information from the references cited in this profile was used to evaluate the vulnerability of New Jersey's *Ludwigia hirtella* populations to climate change. The species was assigned a rank from NatureServe's Climate Change Vulnerability Index using the associated tool (Version 3.02) to estimate its exposure, sensitivity, and adaptive capacity to changing climactic conditions in accordance with the guidelines described by Young et al. (2016) and the state climactic computations by Ring et al. (2013). Based on available data *Ludwigia hirtella* was assessed as Less Vulnerable, meaning that climate change is not expected to have a notable detrimental impact on its extent in New Jersey by 2050. However, the conclusion was reached with only moderate confidence due to gaps in information regarding the species' ecological requirements.

Shifting climactic conditions in New Jersey are resulting in higher temperatures, more frequent and intense precipitation events, and increasing periods of drought (Hill et al. 2020). *Ludwigia hirtella* is fairly abundant in the south so it is likely to tolerate warming in the northern part of its range. Some sensitivity to drought or to shifts in plant community composition can be inferred from the species' habitat preferences but the environmental tolerances of *L. hirtella* have not been studied. Since the species is thought to be capable of self-fertilization in the absence of pollinators, potential phenological shifts in response to the altered temperature regime are not likely to have a significant impact on reproduction. Seedling emergence and growth could potentially be affected by changing temperature patterns but there is no data on the germination and establishment requirements of *L. hirtella*.

Management Summary and Recommendations

Only one of New Jersey's extant populations of *Ludwigia hirtella* is located on protected land and the survival of the remaining occurrences is likely to depend on the establishment of relationships with landowners or managers in order to develop site-specific conservation plans (NJNHP 2024). The most recently discovered population has not been assessed for extent and viability. Few or no *L. hirtella* plants were seen when the other three occurrences were last monitored so management of those sites might require taking a gamble on the species' persistence in the seed bank. Habitat at some of the historical sites is no longer suitable but quite a few of the other records are based on collections that were made more than a century ago so if those locations could be identified and searched additional extant populations might be found. One state locale where *L. hirtella* was first documented in 1867 still supported some plants in 2012 (NJNHP 2024).

Although *Ludwigia hirtella* appears to be secure throughout much of its range, an investment in research is needed to facilitate conservation planning in states where the primrose-willow is imperiled. The factors that determine the northern limits of the species' range are not known. Studies of *L. hirtella* could help to ascertain the extent of self-fertility and the relative importance of pollinators, identify possible mechanisms for long distance dispersal, evaluate seed banking potential, and describe its germination and establishment requirements. A formal assessment of the effects of fire on *L. hirtella*—including consideration of burn frequency, intensity, and timing—is also recommended.

Synonyms

The accepted botanical name of the species is *Ludwigia hirtella* Raf. Orthographic variants, synonyms, and common names are listed below (ITIS 2024, POWO 2024, USDA NRCS 2024b). *Ludwigia* has occasionally been written as *Ludvigia*.

Botanical Synonyms

Ludwigia hirsuta Pursh
Ludwigia permollis W. P. C. Barton
Ludwigia pilosa Elliott
Isnardia hirtella (Raf.) Kuntze
Isnardia hirsuta Hook. & Arn.
Isnardia hirsuta var. *permollis* (W. P. C. Barton) DC.

Common Names

Hairy Primrose-willow
Spindleroot
Hairy Seedbox
Rafinesque's Seedbox

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