

Ludwigia leptocarpa

River Seedbox

Onagraceae



Ludwigia leptocarpa courtesy Stephanie Brundage, Lady Bird Johnson Wildflower Center

***Ludwigia leptocarpa* 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

Ludwigia leptocarpa (River Seedbox) is a semi-aquatic plant in the evening primrose family. *Ludwigia* is a large genus and Raven (1963) recognized 17 divisions within the taxon, placing *L. leptocarpa* in Section *Seminuda*. Twenty-two sections are currently recognized in *Ludwigia* and *L. leptocarpa* remains in the *Seminudae*; it is the only species in that section that occurs in North America (Hoch 2022).

Ludwigia leptocarpa is a morphologically variable plant that can develop as an annual or perennial herb or as a shrub with a woody base (Hoch 2022). The growth form may depend on regional conditions: In South Carolina *L. leptocarpa* behaves as an annual (Dolan 1984) but in Brazil it grows as a shrub and has gelatinous fibers in the stem that provide structural support (Piva et al. 2019). When its base is submerged the plant produces white pneumatophores, aerial roots that facilitate gas exchange (Hoch 2022). The size of plants in a single population can be quite uneven. Hoch (2022) cited a height span of 30–250 cm as typical for the species, and in South Carolina an annual colony of *L. leptocarpa* plants ranged from 10–150 cm at the end of one growing season (Dolan and Sharitz 1984). Raven (1963) indicated that some plants can reach 300 cm in height.



Left: Courtesy R. K. Godfrey, 1972. Right: Courtesy Stephanie Brundage, Lady Bird Johnson Wildflower Center.

The stems of *Ludwigia leptocarpa* are alternately branched and hairy. The leaves are 3.5–18 cm long and lanceolate, narrowing at both ends, and they also are alternate and hairy. The flowers are solitary in the axils of leafy racemes. Each flower may have 4–7 sepals, although 5–6 is most

common, and the flowers have twice as many stamens as sepals. The bright yellow petals are 5–11 mm long and 4–8 mm wide. The petals are deciduous but the sepals remain attached to the fruits, which are long, narrowly cylindrical capsules 1.5–5 cm long and 2.4–4 mm wide. (See Fernald 1950, Raven 1963, Gleason and Cronquist 1991, Hoch 2022).

The life cycle of River Seedbox depends upon its location. In South Carolina seeds germinate in late April and flowering begins in late August, continuing sporadically until the plants die in October (Dolan and Sharitz 1984). In Nigeria *Ludwigia leptocarpa* plants can start producing flowers about two months (67 days) after germination and they continue blooming throughout the year (Oziegbe and Faluyi 2012). Oziegbe and Faluyi observed that the flowers opened at sunrise. In the northeastern United States the plants may bloom from June through September (Gleason and Cronquist 1991) and flowering may extend into October in the southeastern part of the country (Weakley 2015).

Ludwigia leptocarpa produces a number of secondary compounds and in Nigeria infusions made from its leaves have been used in traditional medical treatments. Recent analysis of compounds extracted from plants collected in Cameroon demonstrated that the plants have powerful antibacterial and antioxidant properties, and the species has been deemed worthy of further investigation as a natural therapeutic resource (Mabou et al. 2016).

Pollinator Dynamics

The bright, showy flowers of *Ludwigia leptocarpa* have nectaries that are located on the summit of the ovaries (Eyde 1981), making them attractive to insects. Most of the plants in the genus *Ludwigia* are pollinated by bees, although flower flies and butterflies can also be important pollinators for some species (Raven 1979). In Florida, observed visitors to *L. leptocarpa* flowers included bees and wasps (Coastal Plain Plants 2022). *Ludwigia leptocarpa* is also capable of self-fertilization and is highly self-compatible (Raven 1979, Oziegbe and Faluyi 2012). When the flowers first open, a spatial separation between the anthers and stigmas promotes cross-fertilization (Oziegbe and Faluyi 2012).

Ormond (1978) found that while River Seedbox was capable of both outcrossing and self-pollination, the fertilization mechanism made a significant difference in seed production. Insect-pollinated flowers developed longer fruits and, on average, more than twice as many seeds as those that were self-pollinated. When *L. leptocarpa* flowers were self-fertilized the ovules in the basal part of the ovary did not develop into seeds, resulting in shorter capsules. Fruits that have not been fully fertilized can appear to have long pedicels because the lower part of the capsule has not expanded (Ormond 1978). A high correlation between capsule length and seed number was also observed by Dolan and Sharitz (1984).

Seed Dispersal and Establishment

Ludwigia leptocarpa is mainly reliant on seeds to establish and maintain populations, although vegetative reproduction may occasionally take place: Raven (1979) noted that the detached

floating stems of *Ludwigia* species in section *Seminuda* can establish new plants around lakes or streams. Sexual reproduction in *Ludwigia leptocarpa* is copious, and each of the slender capsules may contain hundreds of seeds (Dolan 1984). Each seed is approximately 0.1 mg in weight and 1–1.2 mm in length (Dolan and Sharitz 1984, Hoch 2022). The seeds are stacked in single rows in each of the capsule's 4–6 locules (compartments). Dolan and Sharitz (1984) found an average of 250 seeds per fruit. Oziegbe and Faluyi (2012) reported an average of 71.5 seeds per locule and 379.6 seeds per capsule. Ormond (1978) specified a mean of 390 seeds per fruit for flowers pollinated by insects and 170 seeds per fruit for self-pollinated flowers.

As soon as the fruits of *Ludwigia leptocarpa* ripen they can become detached from the stems. The seeds typically remain in the capsules for weeks or months before they are released, often while the fruits float on water (Oziegbe et al. 2010). In South Carolina, dehiscence begins during late autumn but the majority of seeds are released in the spring prior to germination (Dolan 1984). Some local dispersal by gravity has been reported (Les 2017). *L. leptocarpa* fruits have a spongy inner zone that helps to maintain their buoyancy (Eyde 1978), and fruits that land in the water can be widely dispersed. Once released the seeds can continue to float or they may be transported even further by animals. *L. leptocarpa* seeds can become attached to the feet or feathers of aquatic birds (Coile 1981) and the buoyancy of the seeds increases the likelihood that they will be consumed by birds or fish (Oziegbe and Faluyi 2012). River Seedbox is considered beneficial to waterfowl because of its abundant seeds (Ringelman 1991), and waterfowl can effectively disperse viable propagules although results vary depending on both plant species and gut retention time (Soons et al. 2008, Wongsriphuek et al. 2008, Farmer et al. 2017). Some *Ludwigia leptocarpa* seeds have been successfully germinated after being eaten by fish (Silveira et al. 2019).

Oziegbe et al. (2010) reported that a short period of dormancy may be beneficial for *Ludwigia leptocarpa*, noting an overall higher germination rate in six month old seeds than in seeds that had been freshly shed. However, their research also showed that fresh seeds could germinate rapidly on moist filter paper in petri dishes, indicating that a dormant period is not absolutely required. South Carolina studies found that the species maintained little to no seed bank: The majority of plants developed from recently released seeds of the previous year's plants (Dolan 1984), and soil sieving experiments showed that few to no viable seeds were present from earlier years (Dolan and Sharitz 1984). Nevertheless some seeds may persist, as viable propagules of *L. leptocarpa* were discovered in the seed bank of a Louisiana coastal marsh (Baldwin et al. 1996).

Dolan and Sharitz (1984) observed that River Seedbox was likely to establish on streambanks, mudflats and other wet substrates where fluctuating water levels provided exposed soil for colonization, and experiments conducted by Baldwin et al. (1996) demonstrated that *Ludwigia leptocarpa* seeds retrieved from the coastal marsh seed bank failed to germinate when subjected to flooding but seedlings emerged when the substrate was not flooded. On the other hand, *L. leptocarpa* seeds have been known to germinate while still floating on the water (Oziegbe and Faluyi 2012).

The effect of seed size on germination, establishment, and growth was studied in an attempt to understand the discrepancies in the size of mature plants in a *Ludwigia leptocarpa* population. Although plant sizes were not linked to the size of seeds, larger seeds did germinate faster and at

a higher percentage. Seedlings from large seeds also showed a competitive advantage against those from smaller seeds (Dolan 1984, Dolan and Sharitz 1984).

Habitat

Ludwigia leptocarpa grows in shallow water or wet soils, usually at elevations of 0–200 meters but occasionally at sites up to 1300 meters above sea level (Hoch 2022). The water may be fresh or brackish and tidal or nontidal (Les 2017). Wetland habitats include bayous, borrow pits, ditches, floodplains, marshes, mudflats, ponds, rice fields, sand bars, seeps, sloughs, and swamps as well as the margins of rivers, lakes, ponds (Weakley 2015, Les 2017, Hoch 2022). Beaver ponds and artificial impoundments such as reservoirs may also be utilized (Ringelman 1991, de Moura et al. 2017). *L. leptocarpa* plants can establish on alluvium, gravel, muck, mud, peat, sand, hummocks, logs, the bases of trees, or floating mats of vegetation (Sasser et al. 1995, Weakley 2015, Les 2017). The pH of the substrate usually ranges from 5.4–7.6 (Les 2017).

Wetland Indicator Status

Ludwigia leptocarpa is an obligate wetland species, meaning that it almost always occurs in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2022)

LULE4

Coefficient of Conservatism (Walz et al. 2018)

CoC = 5. Criteria for a value of 3 to 5: Native with an intermediate range of ecological tolerances and may typify a stable native community, but may also persist under some anthropogenic disturbance (Faber-Langendoen 2018).

Distribution and Range

Ludwigia leptocarpa is native to North America, South America, and Africa and it has also been introduced at several locations in southeast Asia (POWO 2022). The map in Figure 1 depicts the extent of River Seedbox in the United States and Canada. New Jersey is not included on the map because *L. leptocarpa* was just discovered in the state during 2020 (NJNHP 2022). Kartesz (2015) show the species as adventive at the northern end of its range.

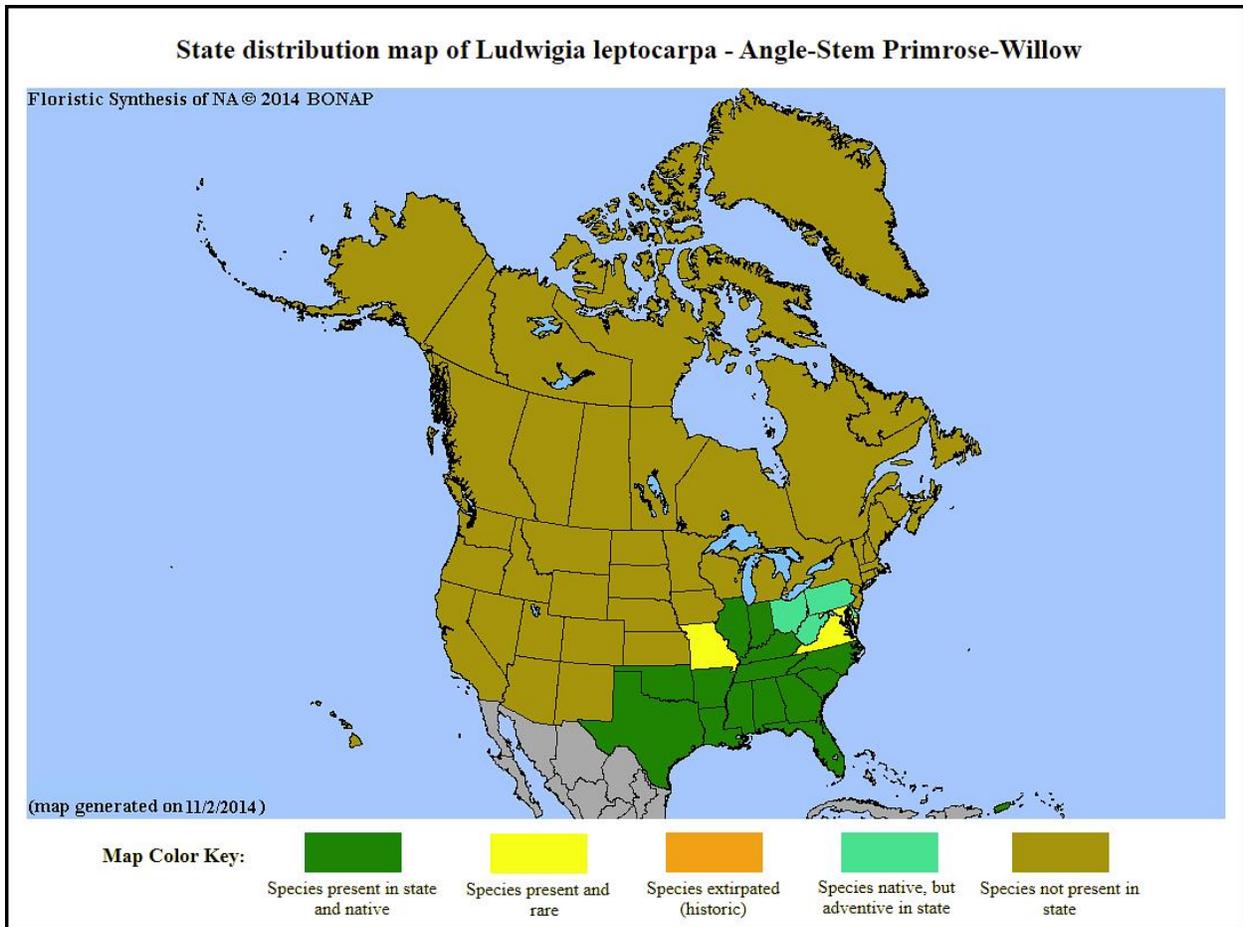


Figure 1. Distribution of *L. leptocarpa* in the United States and Canada, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2022) does not include any New Jersey county records for the species because, as noted above, *L. leptocarpa* is a very recent addition to the state's flora (Figure 2, below). The sole known occurrence from Pennsylvania, shown in the figure, is the northernmost record of the species (Kartesz 2015, USDA 2022, POWO 2022). The eastern Pennsylvania record dates back to 1865 when *L. leptocarpa* was found growing on ballast ground in Philadelphia (Mid-Atlantic Herbaria 2022). That occurrence was deemed an introduction, and the species was not included in the recent state flora by Rhoads and Block (2007). Consequently, New Jersey's newly documented population in Gloucester County appears to be the northernmost natural occurrence of *Ludwigia leptocarpa*.

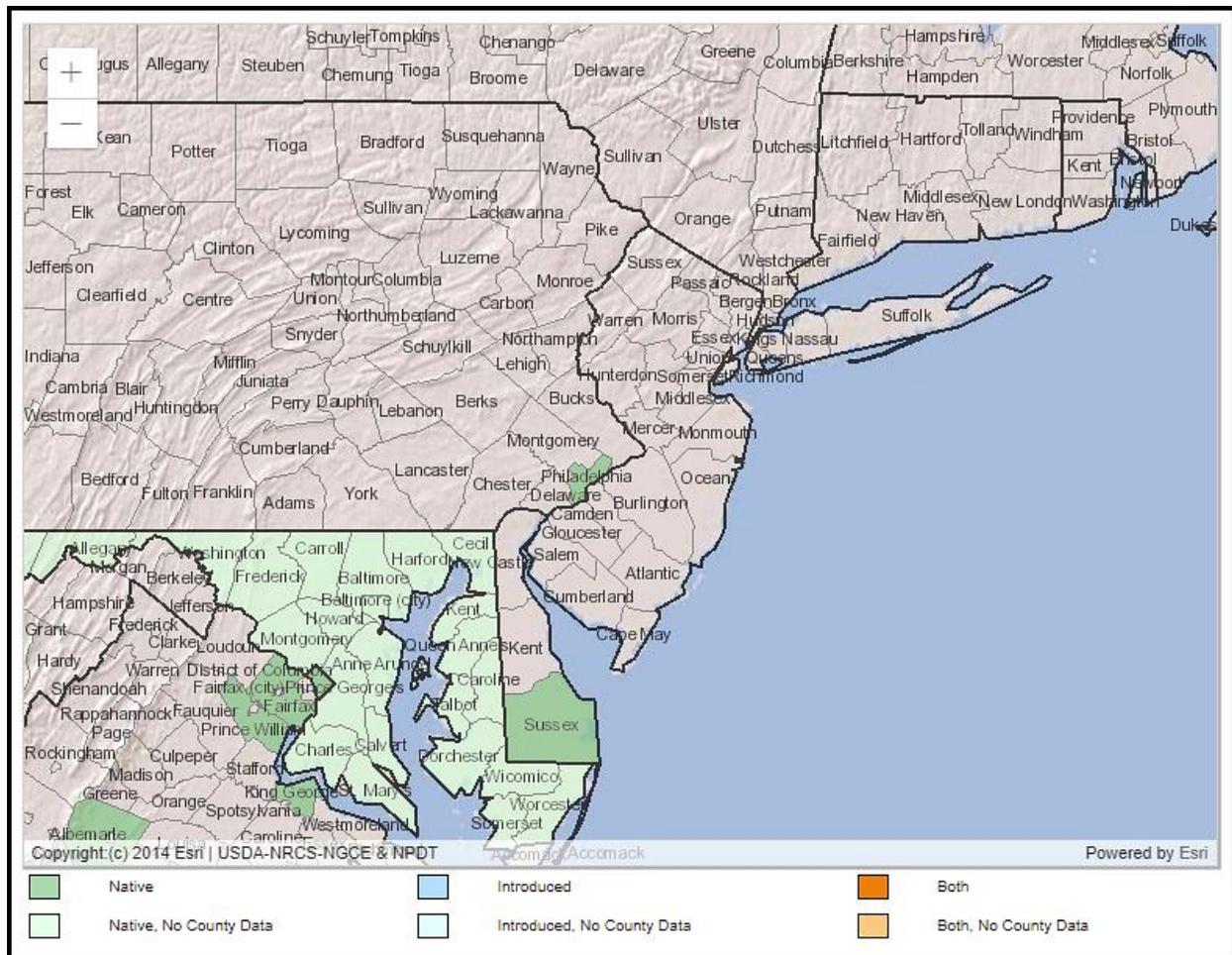


Figure 2. County records of *L. leptocarpa* in the vicinity of New Jersey (USDA NRCS 2022).

Conservation Status

Ludwigia leptocarpa 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 2022). *L. leptocarpa* has been identified as a troublesome weed in rice paddies and other cultivated wetlands in a number of west African nations including Sierra Leone, Nigeria, The Gambia, and Ghana (Oziegbe and Faluyi 2012).

The map below (Figure 3) illustrates the conservation status of *L. leptocarpa* throughout the United States. River Seedbox is critically imperiled (very high risk of extinction) in one state, imperiled (high risk of extinction) in two states, and vulnerable (moderate risk of extinction) in two states. The species is ranked as secure or apparently so in two states and is unranked in the majority of states where it occurs. *Ludwigia leptocarpa* is depicted as an exotic species in Delaware, where the single occurrence is reported as a monoculture occupying an area of about 50 acres (McAvoy 2005).

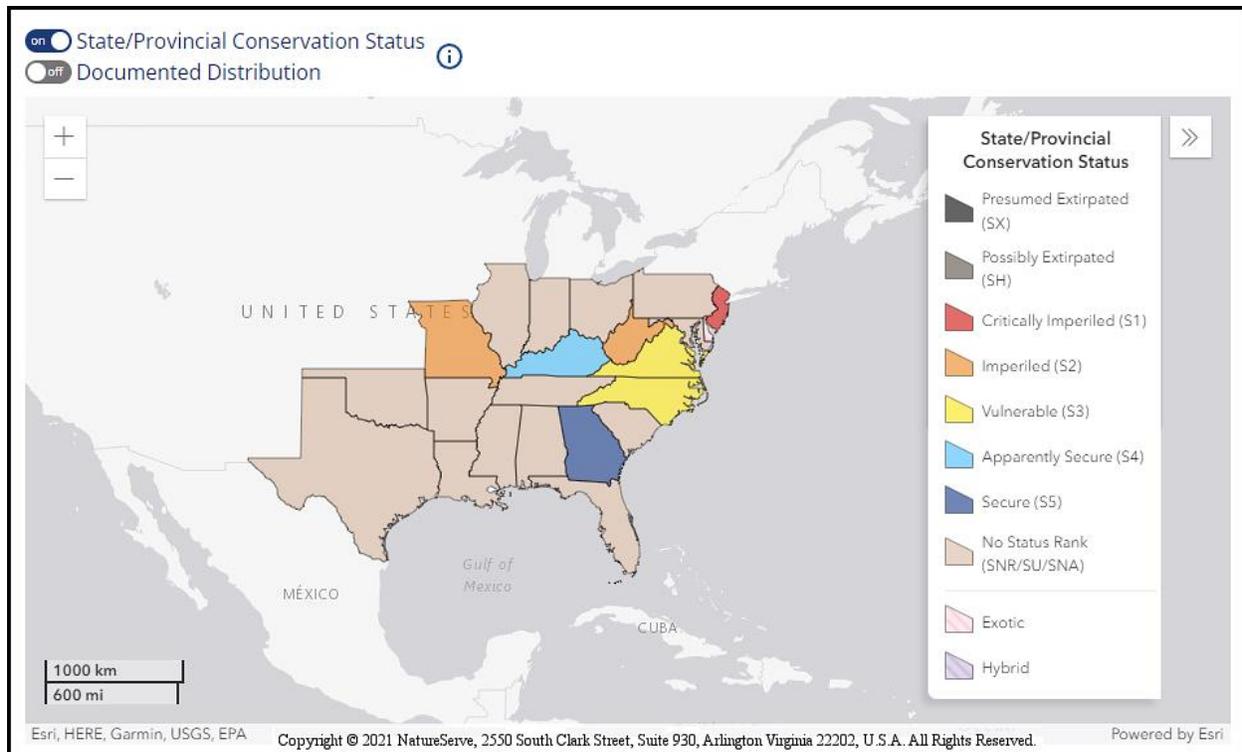


Figure 3. Conservation status of *L. leptocarpa* in the United States (NatureServe 2022).

Ludwigia leptocarpa is ranked S1.1 in New Jersey (NJNHP 2022), meaning that it is critically imperiled due to extreme rarity. A species with an S1.1 rank has only ever been documented at a single location in the state. *L. leptocarpa* is also eligible for protection in the portion of the state that falls within the Highlands Preservation Area (HL) (NJNHP 2010). New Jersey's sole population of River Seedbox was first observed during 2020, and the population had significantly increased in size by 2021 when it was observed to be "aggressively filling in much of the wetland" (NJNHP 2022).

Threats

Few significant threats have been identified for *Ludwigia leptocarpa*. The species may be inadvertently harmed by the use of biological controls that target exotic *Ludwigia* species (e.g. Reddy et al. 2021). A study in South Carolina by Scott and Haskins (1987) found that herbivory on *L. leptocarpa* by flea beetles (*Alticia* spp.) can remove a substantial amount of plant tissue. Scott and Haskins observed that both adults and larvae fed on the plants and noted that damage was particularly heavy early in the season. Subsequent leaf senescence compounded the problem and nearly a quarter of *L. leptocarpa* biomass had been lost by late August. Potential impacts on reproductive capacity were not investigated.

Climate change could be either harmful or beneficial to *Ludwigia leptocarpa* in different parts of the United States. In coastal regions, increasing salinity levels may make some habitats unsuitable for the plants, and higher water levels may limit seedling establishment at certain locations (Baldwin et al. 1996). However, *L. leptocarpa* may benefit from rising temperatures.

Research at sites where water temperatures were increased by the effluent from nuclear reactors demonstrated that *L. leptocarpa* plants flowered earlier, grew larger, and produced more fruits and seeds in response to warmer water. Nutrient uptake may have been enhanced at the sites where water temperatures were higher (Christy and Sharitz 1980, Gibbons and Sharitz 1981).

Management Summary and Recommendations

Recent observations indicated that New Jersey's population of *Ludwigia leptocarpa* was vigorous and no management needs were identified (NJNHP 2022). In the southeastern part of the U.S. where the species is well established, no significant threats or management needs have been reported. However, the status of *L. leptocarpa* near the northern end of its range is less clear and the plant is regarded as rare in some states and adventive in others (Figure 4).

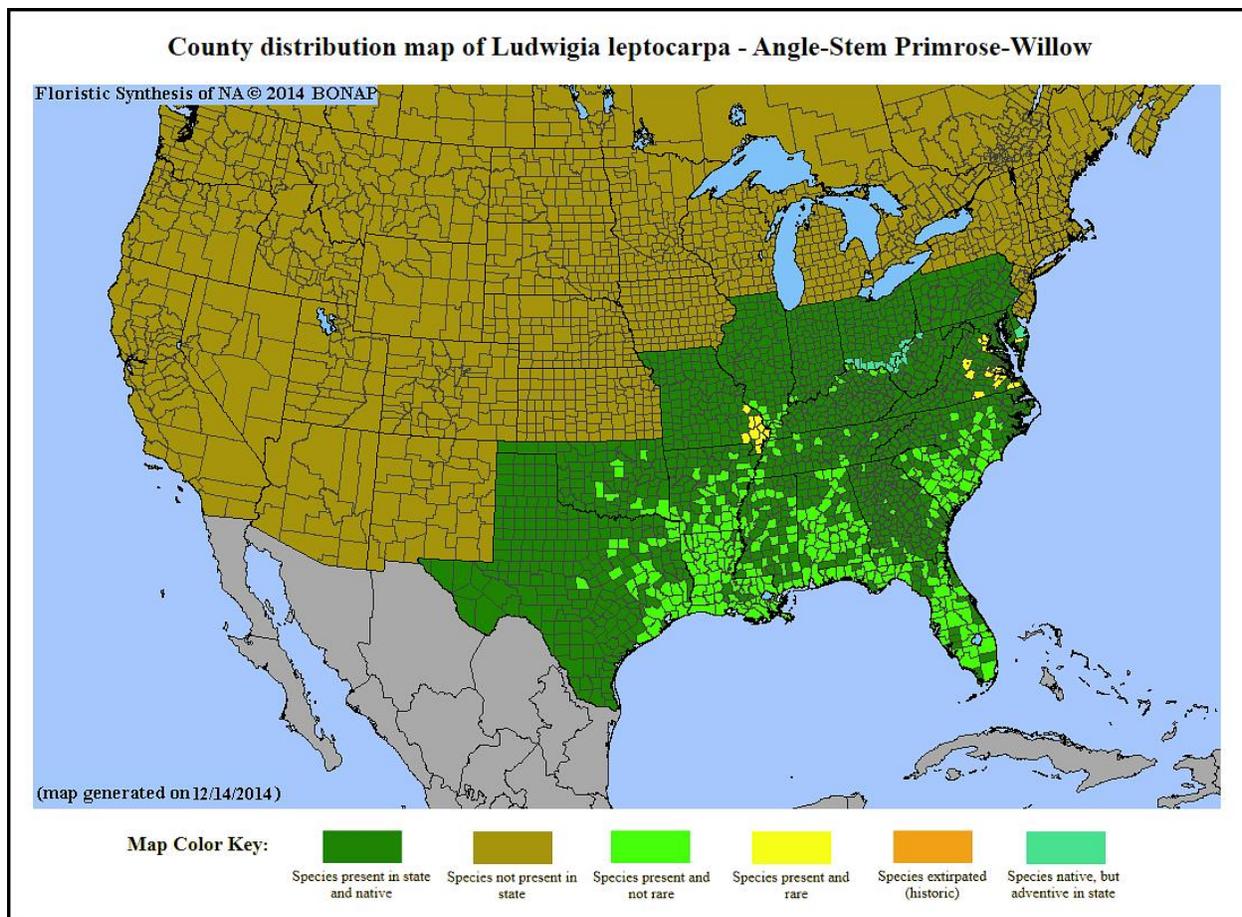


Figure 4. County level distribution of *L. leptocarpa* in the United States, adapted from BONAP (Kartesz 2015).

It looks as if *Ludwigia leptocarpa* is slowly expanding its range in a northerly direction, particularly in coastal areas and in the vicinity of major waterways such as the Mississippi and Ohio Rivers. Fernald (1950) described River Seedbox as a southern species but remarked that the plant was "reported in our range while this is in press." No herbarium specimens from Ohio

were found that predate the 1970s, and the Delaware population was documented in 2005 (Mid-Atlantic Herbaria 2022). Because *L. leptocarpa* appears to thrive at higher temperatures, the northward movement of the species could accelerate as the climate continues to become warmer.

Synonyms

The accepted botanical name of the species is *Ludwigia leptocarpa* (Nutt.) H. Hara. Orthographic variants, synonyms, and common names are listed below (Weakley 2015, Hoch 2022, ITIS 2022, POWO 2022, USDA NRCS 2022). A named subspecies, *Ludwigia leptocarpa* ssp. *foliosa* (C. Wright ex Griseb.) Borhidi, is only found in Cuba (POWO 2022).

Botanical Synonyms

Common Names

<i>Ludwigia leptocarpa</i> var. <i>angustissima</i> (Helwig) Alain	River Seedbox
<i>Ludwigia leptocarpa</i> var. <i>meyeriana</i> (Kuntze) Alain	Anglestem Primrose-willow
<i>Jussiaea biacuminata</i> Rusby	Anglestem Waterprimrose
<i>Jussiaea foliosa</i> C. Wright ex Grisebach	Water Buttercup
<i>Jussiaea leptocarpa</i> Nutt.	Water Willow
<i>Jussiaea leptocarpa</i> ssp. <i>angustissima</i> (Helwig) Acevedo-Rodriguez	
<i>Jussiaea leptocarpa</i> var. <i>angustissima</i> Helwig	
<i>Jussiaea leptocarpa</i> var. <i>genuina</i> Munz, (not validly publ.)	
<i>Jussiaea pilosa</i> var. <i>glabra</i> Hoehne	
<i>Jussiaea leptocarpa</i> var. <i>meyeriana</i> (Kuntze) Munz	
<i>Jussiaea pilosa</i> Kunth	
<i>Jussiaea pilosa</i> var. <i>robustior</i> Donnell Smith	
<i>Jussiaea schottii</i> Micheli	
<i>Jussiaea surinamensis</i> Miquel	
<i>Jussiaea variabilis</i> G. Meyer	
<i>Jussiaea variabilis</i> var. <i>meyeriana</i> Kuntze	
<i>Jussiaea variabilis</i> var. <i>pilosa</i> (Kunth) Kuntze	

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