Seedbox (*Ludwigia hyssopifolia*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, April 2022
Revised, May 2022
Web Version, 8/9/2022

Organism Type: Plant
Overall Risk Assessment Category: Uncertain

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1 Native Range and Status in the United States

Native Range

From CABI (2021):

"It occurs in South-East Asia, and in S. Asia from Kerala and Sri Lanka to Assam and Bhutan. It was noted by Chandrasena (1987) as the most widespread and abundant rice weed in Sri Lankan low country rice fields. *L. hyssopifolia* is found in Upper Myanmar, Laos, Cambodia, Hong

Kong, south to northern Australia, the Caroline Islands (Ponape and the Yap group), Guam, Fiji (Viti Levu), Samoa and Christmas Island. […] It also occurs in a number of countries in Central and S. America where it is assumed to be native."

CABI (2021) lists *Ludwigia hyssopifolia* as native to Angola, Benin, Burkina Faso, Cabo Verde, Cameroon, Central African Republic, Chad, Democratic Republic of the Congo, Egypt, Gabon, Gambia, Ghana, Liberia, Nigeria, São Tomé and Príncipe, Senegal, Sierra Leone, Togo, Bangladesh, Bhutan, Brunei, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Taiwan, Vietnam, Costa Rica, Cuba, Dominica, Grenada, Guadeloupe, Martinique, Mexico, Nicaragua, Panama, Trinidad and Tobago, Australia, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, and Venezuela.

CABI (2021) additionally lists *L. hyssopifolia* as present in the following countries but does not comment on the native or introduced status: Republic of the Congo, Guinea, Buinea-Bissau, Mali, Sudan, Hong Kong, Iraq, Thailand, Honduras, American Samoa, Christmas Island, French Polynesia, Guam, Marshall Islands, New Zealand, Northern Mariana Islands, Palau, Papua New Guinea, and Soloman Islands.

Diop and Rehel (2020) consider *L. hyssopifolia* native to Africa and Central and South America. In addition to many of the countries listed by CABI (2021), Diop and Rehel (2020) list *L. hyssopifolia* as native to Antigua and Barbuda, Côte d'Ivoire, El Salvador, Equatorial Guinea, Guatamala, Guinea, Guinea-Bissau, Honduras, Mali, Mauritania, Niger, Saint Kitts and Nevis, Saint Lucia, Saint Martin, Saint Vincent and the Grenadines, Seychelles, South Sudan, Virgin Islands (British and U.S.).

Status in the United States

No records of *Ludwigia hyssopifolia* found in the wild or in trade in the United States.

Means of Introductions in the United States

No records of *Ludwigia hyssopifolia* found in the United States.

Remarks

According to World Online Flora (2022), synonyms for include *Fissendocarpa linifolia* (Vahl) Bennet*, Jussiaea fissendocarpa* Haines*, Jussiaea hyssopifolia* G.Don*, Jussiaea linifolia, Jussiaea weddellii* Micheli*, and Ludwigia linifolia* (Vahl) R.S.Rao.

From CABI (2021):

"There has been some nomenclatural confusion due to the *L. hyssopifolia* synonym, *Jussiaea linifolia* Vahl, resulting in occasional assumption that this also equates with *Ludwigia linifolia* Poir. However, *L. linifolia* Poir.is a quite distinct species in a different section of the genus. The common name 'water primrose' is a general term for *Ludwigia* spp."

"It is in some of these Pacific Isalnds [sic] that there is serious doubt whether it is native or introduced, conflicting opinions being expressed by different authors (see HEAR, 2012)."

"It [*Ludwigia hyssopifolia*] is so widespread that it is difficult to say where it may have originated."

"*L. hyssopifolia* is an extremely widespread weed of rice and wetlands across three continents. Holm et al. (1979) record it as a 'serious' or 'principal' weed in Indonesia, Borneo, Thailand, Malaysia, Nigeria and Trinidad, and common in Colombia and the Philippines. More recent publications confirm its importance in Malaysia (Begum et al., 2008) and in Sri Lanka (Chandrasena, 1987)."

"*L. hyssopifolia* is primarily a weed of rice, across a wide range of cultural types. In South and South-East Asia (Moody, 1989), it is present in: lowland rice (Bangladesh, Cambodia, Laos); transplanted rice (India, Indonesia, Malaysia, Philippines, Thailand, Vietnam); dry-seeded rice (Indonesia, Malaysia, Thailand); tidal swamp rice (Indonesia); wet-seeded rice (Malaysia, Philippines, Thailand, Sri Lanka); upland rice (Philippines); and direct-seeded rice (Sri Lanka). It has been recorded as a major rice weed on both clay-loam and clay soils (e.g. in South Andaman by Singh and Gangwar, 1987). Waterhouse (1993) records L. hyssopifolia as an important weed of rice in Myanmar, Malaysia and Thailand which also affects cotton, tobacco and vegetables."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to World Flora Online (2022), *Ludwigia hyssopifolia* (G.Don) Exell is the accepted name for this species.

From ITIS (2022):

Kingdom Plantae
Subkingdom Viridiplantae
Infrakingdom Streptophyta
Superdivision Embryophyta
Division Tracheophyta
Subdivision Spermatophytina
Class Magnoliopsida
Superorder Rosanae
Order Myrtales
Family Onagraceae
Genus *Ludwigia*
Species *Ludwigia hyssopifolia* (G. Don) Exell

Size, Weight, and Age Range

From World Flora Online (2022):

"Stems 50-300 cm tall, […]"

From CABI (2021):

"Leaves alternate, lanceolate, up to 10 cm long, 1-2 cm wide, […]"

"Longevity in the soil was at least 3½ years in the Philippines (Juliano, 1940)."

Environment

From CABI (2021):

"*L. hyssopifolia* is a plant of wet places in the tropical zone, usually in standing water, rice paddies, and the edges of streams and swamps, but it also occurs along wet roadsides and in moist grassland. It has been recorded as a major rice weed on both clay-loam and clay soils (e.g. in South Andaman by Singh and Gangwar, 1987). It may be abundant in natural wetlands, as in peat-lands in Selangor, Malaysia (Baki et al. 1997), and in wetlands in Venezuela (Gordon and Valk, 2003)."

Climate

From CABI (2021):

"*L. hyssopifolia* is a pantropical weed of wet places at low elevations."

"It occurs mainly in the tropical belt up to 20°N and S of the equator, but up to 25-28°N in China and Mexico. Holm et al. (1979) record it in Iraq, at least 30° N but this is not confirmed by other sources. Its naturalization in Spain (39°N) appears anomalous, but may suggest that it has sufficient plasticity to spread well beyond its current native distribution."

"*L. hyssopifolia* requires warm, moist to wet conditions and is largely restricted to the moist tropics, though it may thrive in wetlands in less wet climates. The lack of spread much outside the tropics suggests a minimum temperature requirement but this is not well documented. It is presumed to be sensitive to frost."

"Germination can occur between 10 and 40°C, with optimum temperatures being 15 to 35°C (Sauerborn et al., 1988)."

Distribution Outside the United States

Native

From CABI (2021):

"It occurs in South-East Asia, and in S. Asia from Kerala and Sri Lanka to Assam and Bhutan. It was noted by Chandrasena (1987) as the most widespread and abundant rice weed in Sri Lankan low country rice fields. *L. hyssopifolia* is found in Upper Myanmar, Laos, Cambodia, Hong Kong, south to northern Australia, the Caroline Islands (Ponape and the Yap group), Guam, Fiji (Viti Levu), Samoa and Christmas Island. […] It also occurs in a number of countries in Central and S. America where it is assumed to be native."

CABI (2021) lists *Ludwigia hyssopifolia* as native to Angola, Benin, Burkina Faso, Cabo Verde, Cameroon, Central African Republic, Chad, Democratic Republic of the Congo, Egypt, Gabon, Gambia, Ghana, Liberia, Nigeria, São Tomé and Príncipe, Senegal, Sierra Leone, Togo, Bangladesh, Bhutan, Brunei, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Taiwan, Vietnam, Costa Rica, Cuba, Dominica, Grenada, Guadeloupe, Martinique, Mexico, Nicaragua, Panama, Trinidad and Tobago, Australia, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, and Venezuela.

CABI (2021) additionally lists *L. hyssopifolia* as present in the following countries but does not comment on the native or introduced status: Republic of the Congo, Guinea, Buinea-Bissau, Mali, Sudan, Hong Kong, Iraq, Thailand, Honduras, Christmas Island, French Polynesia, Guam, Marshall Islands, New Zealand, Northern Mariana Islands, Palau, Papua New Guinea, and Soloman Islands.

Diop and Rehel (2020) consider *L. hyssopifolia* native to Africa and Central and South America. In addition to many of the countries listed by CABI (2021), Diop and Rehel (2020) list *L. hyssopifolia* as native to Antigua and Barbuda, Côte d'Ivoire, El Salvador, Equatorial Guinea, Guatamala, Guinea, Guinea-Bissau, Honduras, Mali, Mauritania, Niger, Saint Kitts and Nevis, Saint Lucia, Saint Martin, Saint Vincent and the Grenadines, Seychelles, South Sudan, Virgin Islands (British).

Introduced

From CABI (2021):

"Although there is some uncertainty over its native distribution, it is recorded as introduced and invasive on several Pacific islands, including Fiji, Kosrae, Pohnpei, Upolu (Western Samoa) and Christmas Island (HEAR, 2012). […] It has recently been identified as a 'new invader' in Spain (Ferrer and Laguna, 2009; Ferrer et al., 2009). Although this may be a slight exaggeration of its status there it does apparently have the ability to naturalise well north of its current distribution."

"It is found in Africa from the vicinity of Dakar (Senegal) to Lake Chad, southern Sudan and south to Zaire; it also occurs on the Cape Verde Islands and Sâo Tomé. The fact that in Africa it is relatively local and confined to the west suggests that it may have been introduced there (but it was found on Sâo Tomé as early as 1822; Raven, 1963)."

"Holm et al. (1979) record it in Iraq, at least 30° N but this is not confirmed by other sources. Its naturalization in Spain (39°N) appears anomalous, but may suggest that it has sufficient plasticity to spread well beyond its current native distribution."

CABI (2021) lists *Ludwigia hyssopifolia* as introduced and invasive in Spain. Additionally, it lists *L. hyssopifolia* as invasive in the Federated States of Micronesia and Fiji but does not comment on the introduced or native status in those countries.

From Diop and Rehel (2020):

"It has probably been introduced to Asia and Pacific Ocean islands."

Diop and Rehel (2020) consider the following to have introduced, extant, populations of *L. hysspifolia*: Bangladesh, Bhutan, Cambodia, China, Christmas Island, Fiji, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Papua New Guinea, Philippines, Sri Lanka, Taiwan, Thailand, and Vietnam. Some of these areas are considered part of the native range by other authors.

Nayak et al. (2020) list *Ludwigia hyssopifolia* as introduced in India.

Means of Introduction Outside the United States

From CABI (2021):

"In the case of introduction to Spain, Ferrer et al. (2009) hypopthesise that this species could have been introduced in contaminated coconut fibre used as a substrate for plant culture."

Short Description

From World Flora Online (2022):

From CABI (2021):

"*L. hyssopifolia* is an erect aquatic or semi-aquatic annual herb, up to 2 or even 3 m high, stem base spongy and swollen with aerenchyma, sometimes becoming woody, upper stem ribbed. Often with aerenchymatous roots. Young growth minutely hairy; otherwise foliage glabrous. Leaves alternate, lanceolate, up to 10 cm long, 1-2 cm wide, base decurrent to a short petiole. Flowers solitary in leaf axils, sessile or nearly so, usually four-partite, sometimes five-partite. Calyx lobes 3–4 mm. Petals bright yellow or white fading to orange-yellow, 2-4 mm long. Stamens normally 8, 1-2 mm long. Inferior ovary four- to five-celled, style club-shaped. Capsule pubescent, more-or-less cylindrical or swollen towards the apex, up to 30 mm long with many brown oblong seeds about 0.5 mm long, free, in the upper part of the capsule, mostly larger 0.8 mm and embedded in corky endocarp below (Kostermans et al., 1987; Grierson and Long, 1991). *L. hyssopifolia* was among five *Ludwigia* species whose pollen morphology was described by Edeoga et al. (1996). They were triporate, and circular or triangular in general outline. Those of *L. hyssopifolia* were relatively large, 62 micron in diameter."

Biology

According to CABI (2021), *Ludwigia hyssopifolia* is described as annual, herbaceous, and seed propagated.

From CABI (2021):

"In *L. hyssopifolia* which possesses both non-endocarp and endocarp seeds, non-endocarp seeds are first dispersed at ripening of fruit while endocarp seeds remain on the parent plant for several weeks and months before they are eventually dispersed into water (Oziegbe et al., 2010). Total seed production can be 75,000 seeds per plant (Pancho, 1964), […]."

"Seeds of *L. hyssopifolia* require light for germination, and burial in soil, even to 1 cm depth, greatly reduces germination (Pons, 1985; Chauhan and Johnson, 2009). The same authors confirm germination is also reduced under flooding to just 2 cm depth, though Sahid and Hossain (1995) obtained some germination down to a water depth of 4 cm. When delayed to 21 days after sowing, however, flooding to a depth of 10 cm did not significantly suppress growth (Chauhan and Johnson, 2009).

In a study in Nigeria, germination of fresh seed on filter paper was high, but slow. Seeds placed on the surface of different soil types was very low < 10%) on loamy and clay soils and moderate (37%) on sandy soil. After 6 months storage germination was high and rapid on all surfaces. It is unclear how the soils influenced germination even when the seeds were placed on the surface, but the results suggest there is some degree of dormancy in freshly shed seeds (Oziegbe et al., 2010)."

"*L. hyssopifolia* has no specialized dispersal mechanism, but seeds may float for long enough to be dispersed by flowing water."

Human Uses

From CABI (2021):

"A methanol extract showed significant anti-diarrhoeal properties (Mohammad Shaphiullah et al., 2003), but it is not known if there is any economic use from this."

From Banibrata et al. (2007):

"*Ludwigia hyssopifolia* Linn. (synonym *Jussiaea linifolia* Vahl. or *Jussiaea hyssopifolia* Linn., Family-Onagraceae; Bengali Name- Lalbunlonga) is extensively grown in Bangladesh, in all parts of India and Ceylon (Hooker, 1973; Huq, 1986). The plant is considered as astringent, anthelmintic, carminative and diuretic. A decoction is used in diarrhoea and dysentery, flatulence, leucorrhoea, and spitting of blood. The leaves are used for poulticing in orchitis and glands in the neck. A decoction is also used as a vermifuge and purgative (Ambasta, 1986; Ghani, 1990)."

From Praneetha et al. (2018):

"*Ludwigia hyssopifolia* of family *Onagraceae* is traditionally used in the treatment of jaundice."

From Mangao et al. (2019):

"*L. hyssopifolia* aqueous leaf extract showed significant inhibition of shoot growth and biomass accumulation of weeds (*Amaranthus spinosus* L., *Dactyloctenium aegyptium* L., *Cyperus iria* L.) while maintaining less adverse effects on rice (crop) compared to other aqueous extracts of roots and stem."

From Diop and Rehel (2020):

"It is used in making composting and in manuring."

Diseases

From CABI (2021):

"Huang et al. (2006) record infection of *L. hyssopifolia* by Alternanthera yellow vein virus and a distinct begomovirus, for which the name *Ludwigia* yellow vein virus (LuYVV) is proposed."

Threat to Humans

No information found on threat to humans.

3 Impacts of Introductions

The native range of *Ludwigia hyssopifolia* is not well understood. The information below may come from areas where it had been introduced, however, some authors included these areas in the native range. The introduction to Spain is the only introduction completely outside any description of the native range. No information on impacts from the introduction in Spain was found.

From CABI (2021):

"It is thus an aggressive weed of rice and of wetlands that poses a real threat to these ecologies [Pacific islands]."

"Holm et al. (1997) note that it occurs in […] and taro in Samoa."

4 History of Invasiveness

Ludwigia hyssopifolia is established in many continents throughout the world. Its range is widespread and there is disagreement regarding the native range of the species. There is consensus that it is native to Central and South America but varying opinions on its status in Africa, Asia, and Pacific Islands. *L. hyssopifolia* has been documented as introduced in Spain, however there is limited information available in English regarding the introduction. Throughout Africa and Asia, *L. hyssopifolia* is reported as a major weed of crops, primarily rice. Not having any certainty as to the native or introduced status of the species in those areas precludes considering that information as an impact of introduction. This species is not in the ornamental trade but is cultivated and used in traditional medicine. Mainly due to the uncertainty in understanding the native range, the History of Invasiveness is classified as Data Deficient.

5 Global Distribution

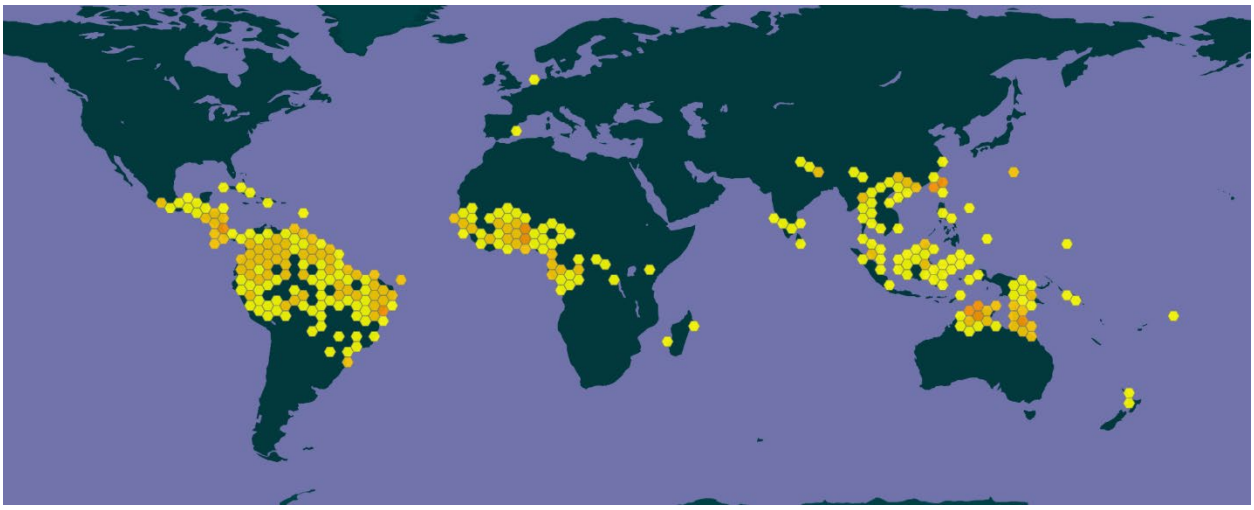

Figure 1. Known global distribution of *Ludwigia hyssopifolia*. Observations are in Central America, South America, Africa, South-East Asia, Australia, and Indonesia. Map from GBIF Secretariat (2022). The observations in the Netherlands were not used in the climate match; record information indicated that they may have been from captive populations.

6 Distribution Within the United States

No records of *Ludwigia hyssopifolia* in the wild in the United States were found.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Ludwigia hyssopifolia* was generally medium for the contiguous United States with some areas of high and low climate match. Areas of high match were found in peninsular Florida as well as along the Gulf and southern Atlantic coasts. Small areas of high match were found in the desert Southwest and in the Rocky Mountains. Areas of low match were found in northern New England, northern Great Plains, coastal Pacific Northwest, and in small areas of the Rocky Mountains. The overall Climate 6 score (Sanders et al. 2021; 16 climate variables; Euclidean distance) was 0.258, High (Scores of 0.103 and greater are classified as high). About half the States had high individual Climate 6 scores. California, Colorado, Connecticut, Idaho, Kansas, Maine, Montana, Nevada, New Hampshire, New York, and Washington had medium individual scores. Iowa, Illinois, Indiana, Michigan, Minnesota, Nebraska, New Jersey, North Dakota, Ohio, Pennsylvania, South Dakota, Vermont, Wisconsin, and Wyoming had low individual scores.

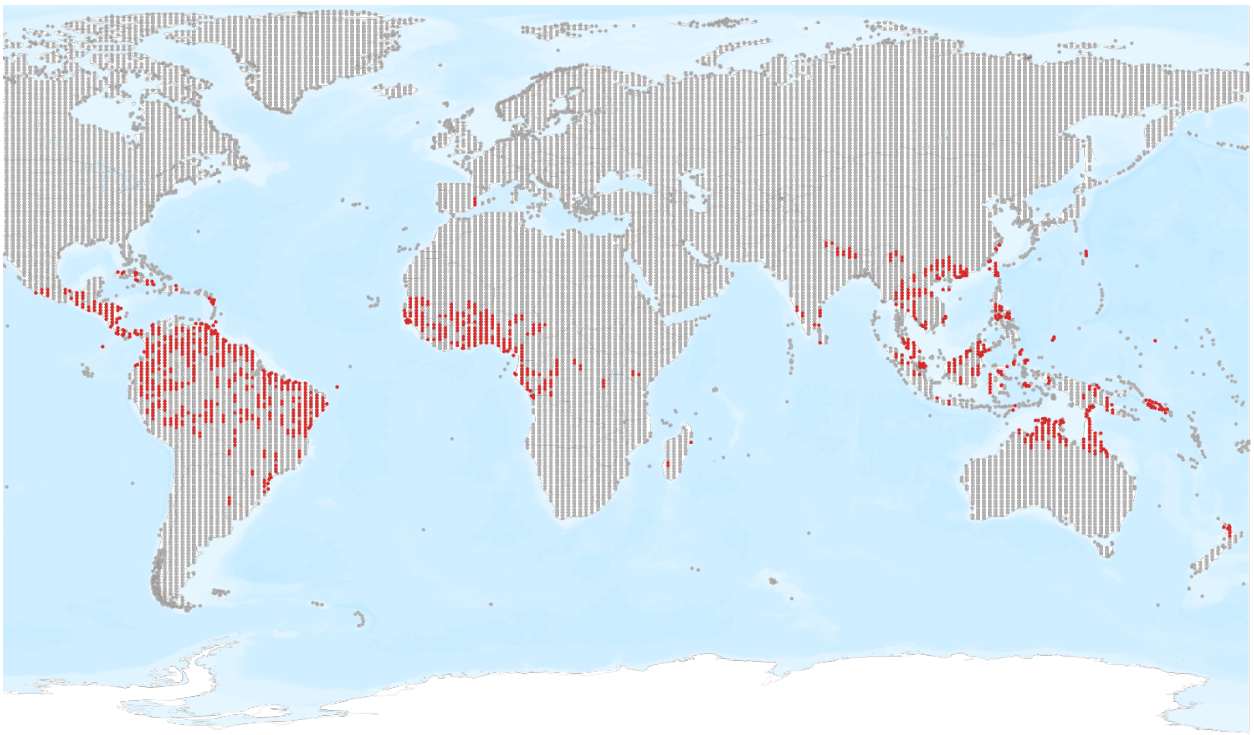

Figure 2. RAMP (Sanders et al. 2021) source map showing weather stations in Central America, South America, Africa, Southeast Asia, Australia, and Indonesia selected as source locations (red) and non-source locations (gray) for *Ludwigia hyssopifolia* climate matching. Source locations from GBIF Secretariat (2022). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

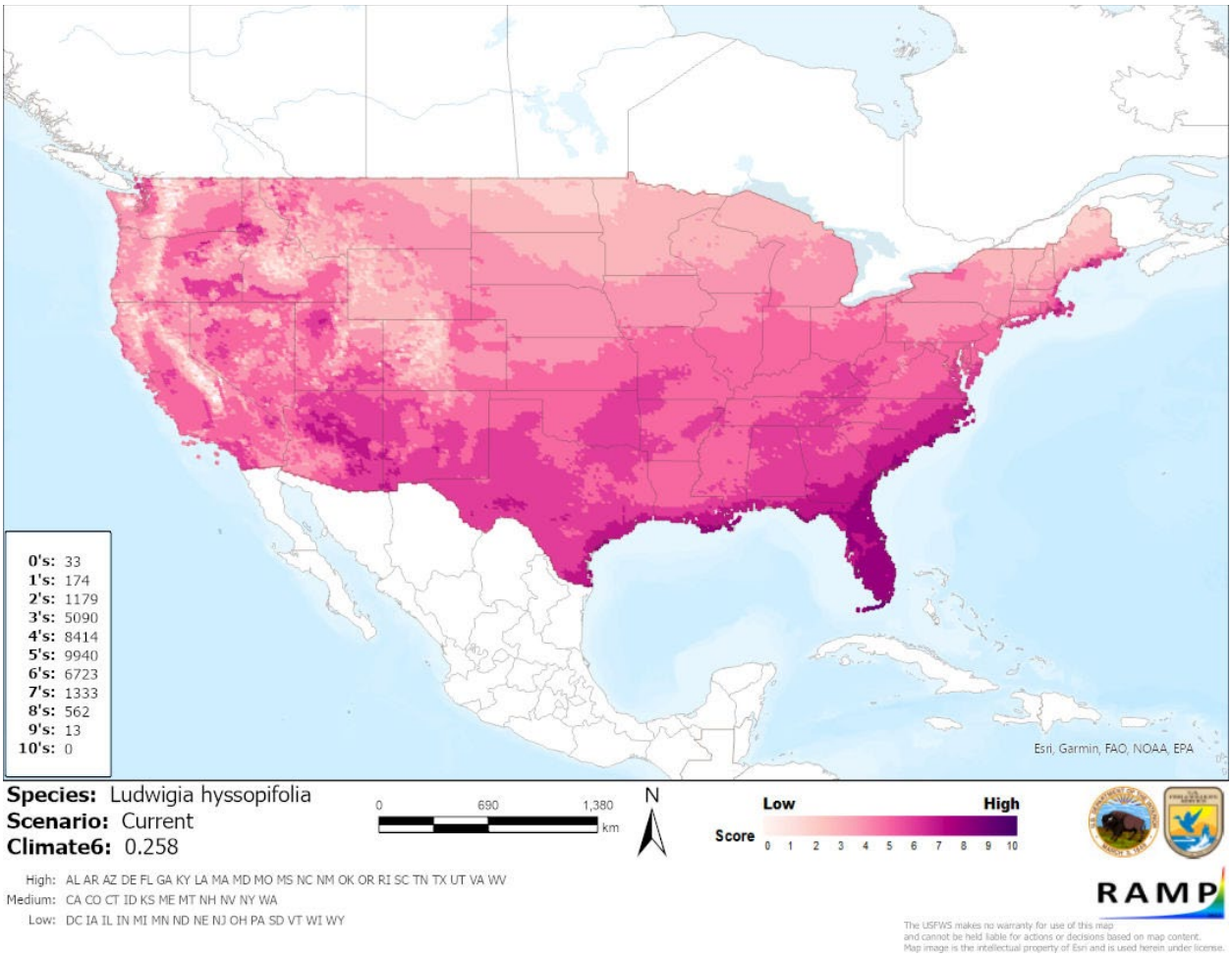

Figure 3. Map of RAMP (Sanders et al. 2021) climate match for *Ludwigia hyssopifolia* in the contiguous United Stated based on source locations from GBIF Secretariat (2022). Counts of climate match scores are tabulated on the left. 0/Light Pink = Lowest match, 10/Dark Purple = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: (Count of target points with climate scores 6-10)/ (Count of all target points)	Overall Climate Match Category
0.000≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

8 Certainty of Assessment

There is information available about the biology and ecology of *Ludwigia hyssopifolia.* There is much confusion regarding the native and introduced ranges of *L. hyssopifolia*. One unambiguous record of introduction resulting in a established population was found. No information about impacts of introductions were found. Due to the lack of clarity regarding the native range of the

species and lack of information regarding impacts of introduction, the certainty of assessment is low.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Ludwigia hyssopifolia, the Seedbox, is an erect annual herb that can be found in wetlands. It has been cultivated and used in traditional medicine. It is widely distributed across Central and South America, Africa, Southeast Asia, India, Australia, and several pacific islands. There is consensus that it is native to Central and South America but disagreement on if it is native or introduced in the other parts of its range. It has been introduced to Spain and become established. In Africa and Asia, it is a major agricultural pest, however, there is no impact information available for the introduction in Spain. The history of invasiveness is classified as Data Deficient. The overall climate match for the contiguous United States was High. Areas of high match were found along the Gulf and southern Atlantic coasts. The certainty of assessment is Low due to the conflicting information regarding the species' native range and a lack of information on impacts from introductions. The overall risk assessment category is Uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 4): Data Deficient**
- **Overall Climate Match Category (Sec. 7): High**
- **Certainty of Assessment (Sec. 8): Low**
- **Remarks, Important additional information: None**
- **Overall Risk Assessment Category: Uncertain**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 11.

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11 Literature Cited in Quoted Material

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

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