

Variableleaf Water Hyacinth (*Eichhornia diversifolia*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, March 2021

Revised, June 2021

Web Version, 8/24/2021

Organism Type: Plant

Overall Risk Assessment Category: Uncertain

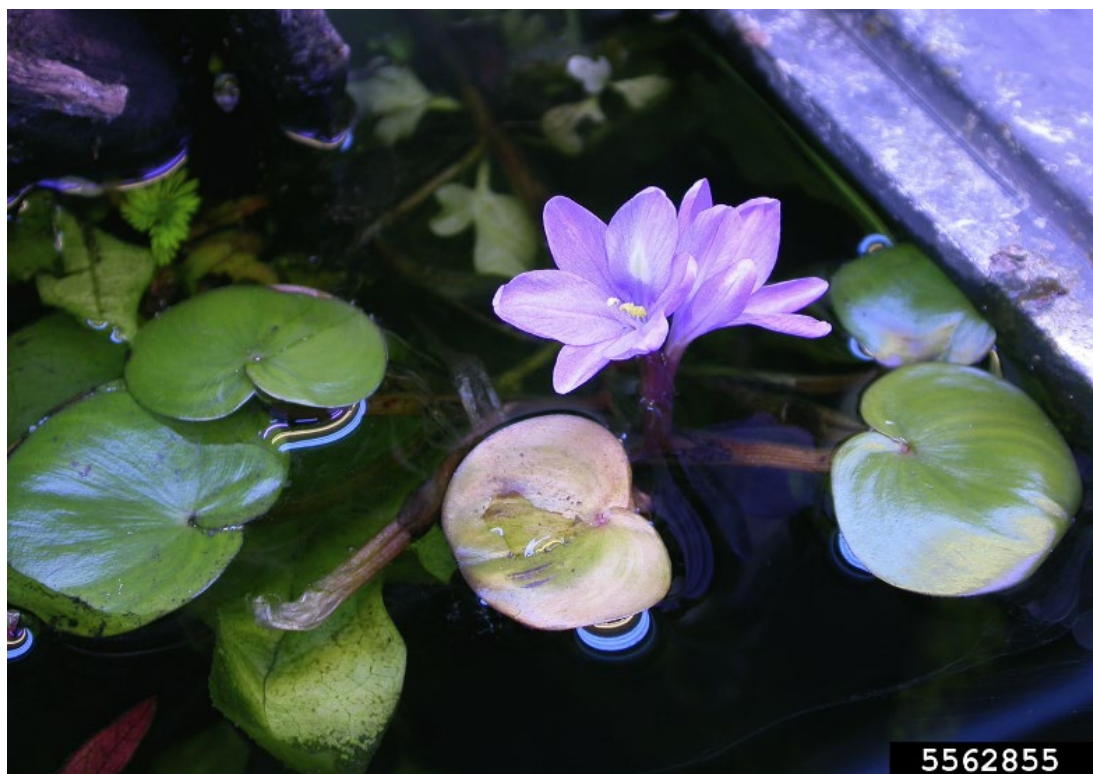


Photo: Shaun Winterton, Aquarium and Pond Plants of the World, Edition 3. Licensed under Creative Commons Attribution-Noncommercial 3.0 License. Available: <https://www.invasive.org/browse/detail.cfm?imgnum=5562855> (March 2021)

1 Native Range and Status in the United States

Native Range

From Mota de Oliveira and Hamann (2021):

“Central America (south from Nicaragua) and South America (Colombia, Ecuador, Venezuela, the Guianas and Brazil to 15° S); [...]”

From Diop (2010), under the synonym *E. natans*:

“Over the rest of tropical Africa, and in central and south tropics. It is widespread in Sub-Saharan Africa. Also found in Cuba and tropical South America.”

“In Africa it is widespread throughout Western and Central Africa, from Senegal to Kenya, and down to Mozambique, including Zambia and Angola. It is also present in Sudan and Ethiopia.”

Status in the United States

According to USDA, NRCS (2021), *Eichhornia diversifolia* is introduced in Puerto Rico. It is listed as ‘presumed extirpated’ by Gann et al. (2015-2020).

From Winterton et al. (2018):

“*Eichhornia paniculata*, *E. diversifolia* and *E. azurea* have historical records in Texas and Florida, but apparently no extant populations have been substantiated recently in the United States.”

The genus *Eichhornia* is listed as a Prohibited Aquatic Plant, Class 1, by the State of Florida (United States Department of Agriculture, 2021).

E. diversifolia is found in the aquarium trade in the United States.

From Aquatic Plant Central (2009):

“Although it is difficult to find in stores, *E. diversifolia* is quite easy to obtain via other hobbyists. Aquatic plant nurseries Oriental Aquariums and Tropica both offer this plant.”

Means of Introductions in the United States

No information regarding means of introduction were found.

Remarks

Eichhornia spp. are very similar and commonly combined when discussed in the literature and on websites.

From World Flora Online (2021):

“Synonyms

Eichhornia natans (P.Beauv.) Solms

Eichhornia natans var. *pauciflora* (Seub.) Solms

Eichhornia pauciflora Seub.

Heteranthera cordata Vahl

Heteranthera diversifolia Vahl

Heteranthera grandiflora Klotzsch

Leptosomus natans (P.Beauv.) Schltdl.
Piaropus diversifolius (Vahl) P.Wilson
Pontederia natans P.Beauv.”

POWO (2019) considers the name *Pontederia diversifolia* to be the valid name for this species with *E. diversifolia* the synonym.

From Pellegrini et al. (2018):

“The African *E. natans* (\equiv *P. [Pontederia] natans*) is currently treated as a synonym of the Neotropical *Eichhornia diversifolia* (\equiv *P. diversifolia*) by all online databases (i.e. eMonocot 2010; The Plant List 2013; Govaerts 2018; Tropicos.org 2018). Nonetheless, as indicated in our identification key [...], both species can be easily differentiated based on the number of flowers per inflorescence, floral diameter, presence or absence of a nectar guide, pubescence of the filaments and capsule dehiscence. Thus, *P. natans* is here re-established.”

Although the synonymy of *E. natans* with *E. diversifolia* is under debate in the scientific literature, this ERSS follows World Flora Online (2021) in treating *E. natans* as a synonym of *E. diversifolia*. This synonym and all others listed in this section were used in searching for information on this species.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to World Flora Online (2021), *Eichhornia diversifolia* is the accepted scientific name for this species.

From ITIS (2019):

Kingdom Plantae
Subkingdom Viridiplantae
Infrakingdom Streptophyta
Superdivision Embryophyta
Division Tracheophyta
Subdivision Spermatophytina
Class Magnoliopsida
Superorder Lilianae
Order Commelinales
Family Pontederiaceae
Genus *Eichhornia*
Species *Eichhornia diversifolia* (Vahl) Urb.

Size, Weight, and Age Range

From Bleher (2021):

“Plant size in the aquarium – up to the surface, in Nature up to 200 cm”

Environment

From Barrett (1988):

“*Eichhornia diversifolia* is most commonly found in seasonal ponds that experience large water-level fluctuations. During the vegetative growth period it is often in water 1-2 m deep, [...]”

From Hyde et al (2021), under the synonym *E. natans*:

“In shallow, still or slow-moving water in rivers, lagoons and swamps.”

“Altitude range: 400 – 1400 m”

Climate

From Bleher (2021):

“tropical”

Distribution Outside the United States

Native

From Mota de Oliveira and Hamann (2021):

“Central America (south from Nicaragua) and South America (Colombia, Ecuador, Venezuela, the Guianas and Brazil to 15° S); [...]”

From Diop (2010), under the synonym *E. natans*:

“Over the rest of tropical Africa, and in central and south tropics. It is widespread in Sub-Saharan Africa. Also found in Cuba and tropical South America.”

“In Africa it is widespread throughout Western and Central Africa, from Senegal to Kenya, and down to Mozambique, including Zambia and Angola. It is also present in Sudan and Ethiopia.”

Introduced

CABI (2019) lists *Eichhornia diversifolia* as present in the United Kingdom. There were no further details indicating if this was due to trade or a wild introduction.

From Al-Helli et al. (2019):

“It [the survey at two sampling locations in southern Iraq] also observed several types of aquatic plants, such as *Phragmites australis*, *Ceratophyllum demersum*, *Eichhornia diversifolia* and *Vallisneria spiralis*.”

According to Lukács et al. (2016), *E. diversifolia* was observed in Hungary in 2005.

According to POWO (2019), *E. diversifolia* (under the synonym *Pontederia diversifolia*) has been introduced to Cuba, Dominican Republic, India, and Taiwan.

No further information was available for any of the above introductions, including establishment status.

Means of Introduction Outside the United States

No information available.

Short Description

From Mota de Oliveira and Hamann (2021):

“Annual, rooted in mud. Vegetative stem elongate, developing to and growing at the water surface; flowering stem glabrous, 1.5-3 cm long. Sessile leaves alternate, linear, acuminate at apex, 3.5-7 cm long; petiolate leaves floating, blade rounded to cordate, 1.3-3.2 cm long, 0.6-4 cm wide with an obtuse to acute apex and a cordate base; petiole 2.5-5 cm long. Inflorescence a spike with 2-4 flowers, all opening the same day; peduncle glabrous, 0.9-1.9 cm long; spathe linear 1.3-1.9 cm long. Flowers blue, tube 8-15 mm long, tepals obtuse to acute at apex, 4-10 mm long, the central upper tepal dark toward base with a yellow spot above; upper stamens 2.5-6 mm long, lower stamens 5.1-7.6 mm long, anthers 0.7-1.3 mm long; ovary 1-3 mm long, stigma capitate, pilose; homostylous. Capsule 6-10 mm long; seeds 0.4-1 mm long, 0.2-0.5 mm wide with [sic] 9-12 longitudinal [sic] wings”

From Hyde et al (2021), under the synonym *E. natans*:

“Flowers single, purple, white or mauve; tubecylindric; lobes obovate, subequal.”

Biology

From Barrett (1988):

“The flowers of *Eichhornia* [the genus] are usually mauve- blue and showy and are pollinated primarily by bees and butterflies. They display a broad range of morphological specializations associated with their pollination mechanisms and breeding systems. The variation ranges from large multicolored tristylous flowers adapted to outcrossing to small uniformly colored self-fertilizing homostylous flowers.”

Human Uses

From Winterton et al. (2018):

“*Eichhornia* contains six species, of which five are presently cultivated for aquaria or ponds, and one, *E. paniculata*, is often a research subject in flower structure genetics.”

From Aquatic Plant Central (2009):

“Although it is difficult to find in stores, *E. diversifolia* is quite easy to obtain via other hobbyists. Aquatic plant nurseries Oriental Aquariums and Tropica both offer this plant.”

Diseases

No information on diseases was found.

Threat to Humans

No information on threats to humans was found.

3 Impacts of Introductions

There are multiple reports of introductions of *Eichhornia diversifolia* but no information regarding impacts of introduction were found.

4 History of Invasiveness

There are records of introductions of *Eichhornia diversifolia* to Cuba, Dominican Republic, Hungary, India, Iraq, Puerto Rico, Taiwan, and the United Kingdom. There are also historical records of the species in Texas and Florida. It is a prohibited species in Florida. In Puerto Rico it is presumed to be extirpated. No information regarding the establishment status of the remaining introductions was found. No information regarding any impacts of introduction were found. This species is reportedly in trade, but information on actual trade volume or duration was not available. The history of invasiveness is classified as No Known Nonnative Population.

5 Global Distribution

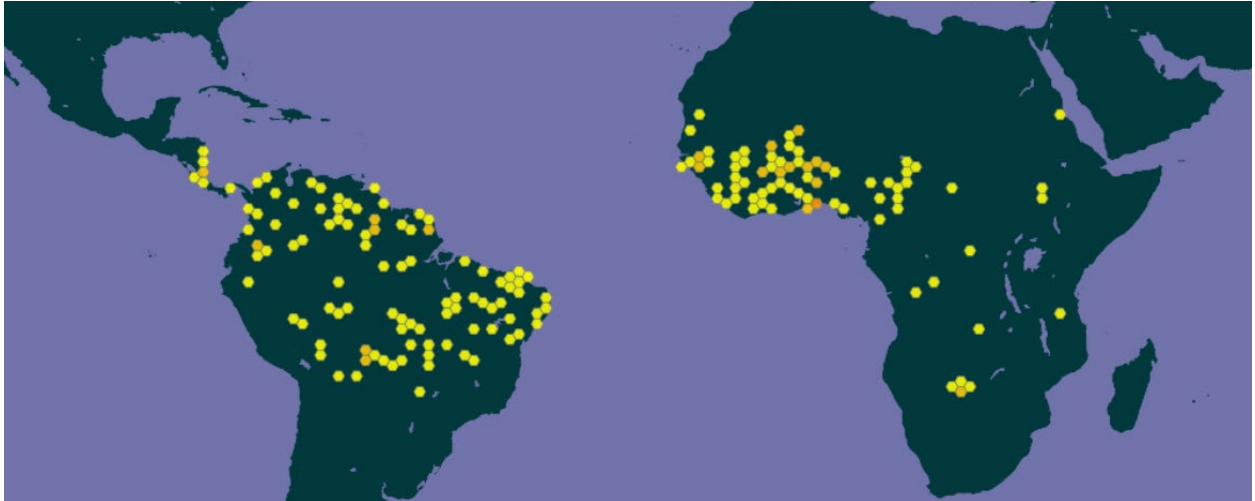


Figure 1. Known global distribution of *E. diversifolia*. Observations are reported from Central America, South America, and Africa. Map from GBIF Secretariat (2021). The introductions reported in the United Kingdom and Iraq were not used to select source points as it was unknown if they represent established populations.

6 Distribution Within the United States

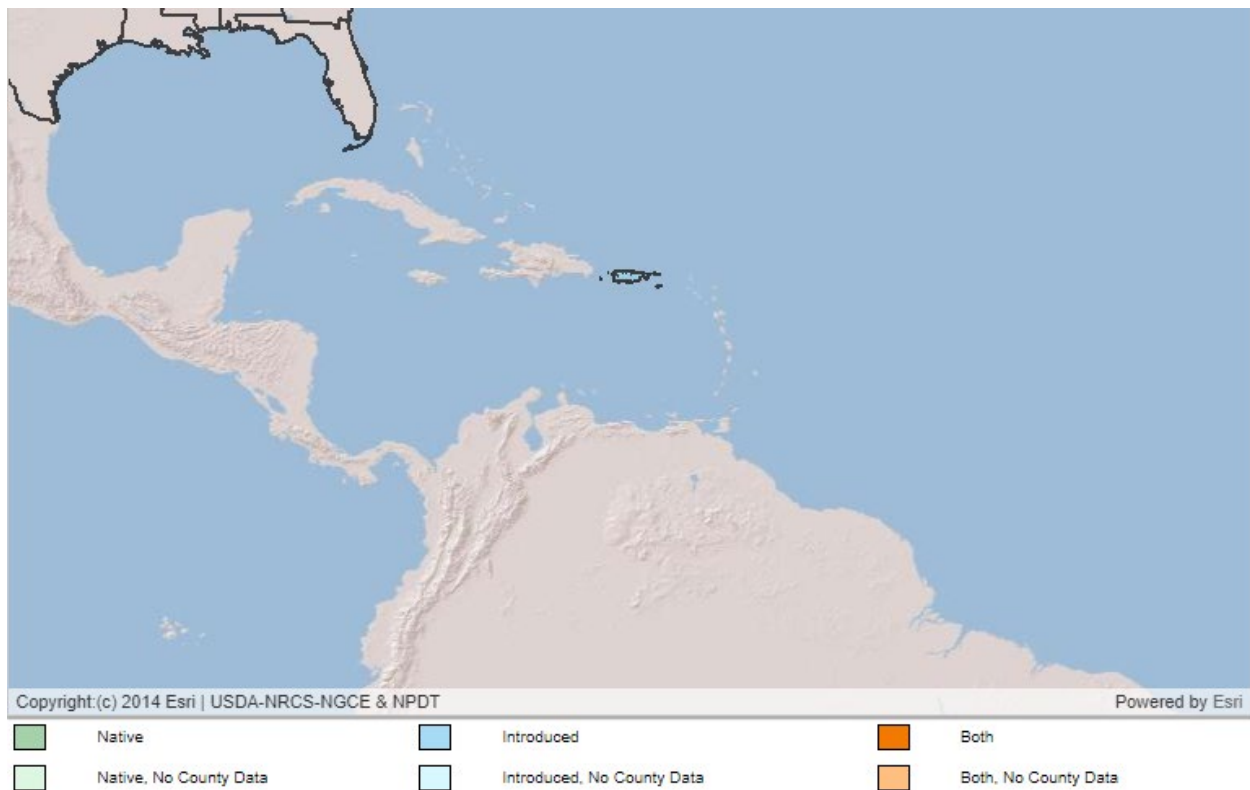


Figure 2. Map of the known range of *Eichhornia diversifolia* in the United States. The light blue shading indicates that the species is introduced but there is no county level observation data. Map from USDA, NRCS (2021). *E. diversifolia* is introduced in Puerto Rico but no finer distribution information was available. *E. diversifolia* is presumed to be extirpated in Puerto Rico and no source points representing Puerto Rico were used in the climate match.

7 Climate Matching

Summary of Climate Matching Analysis

Most of the contiguous United States had a low climate match. Areas along the southern border with Mexico had a medium match. Medium match was also found in patches along the Gulf Coast, northern Florida, and the southern Atlantic Coast. Southern Florida had a high match; there were also small areas of high match in southern Texas and Arizona. The overall Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.017, medium. (Scores between 0.005 and 0.103, exclusive, are categorized as medium.) Most States had a low individual Climate 6 score. Florida had a high individual score and Arizona and Texas had medium individual scores.

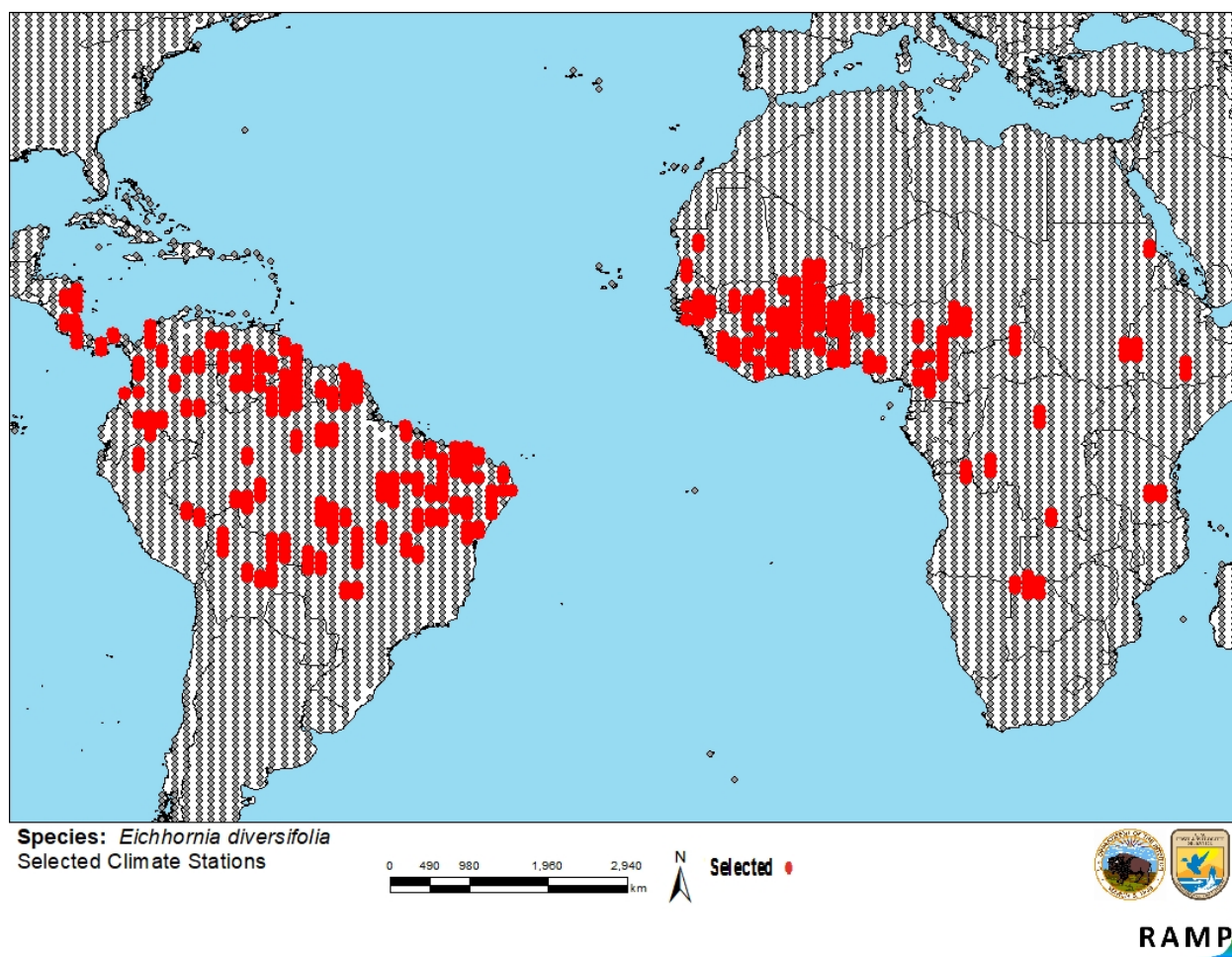


Figure 3. RAMP source map showing weather stations in Central America, northern South America and Africa selected as source locations (red; Nicaragua, Costa Rica, Panama, Columbia, Peru, Bolivia, Brazil, Venezuela, Guyana, Suriname, Ecuador, Mauritania, Senegal, Mali, Guinea, Sierra Leone, Liberia, Ivory Coast, Gambia, Guinea-Bissau, Ghana, Togo, Benin, Nigeria, Chad, Cameroon, Central African Republic, Democratic Republic of the Congo, South Sudan, Uganda, Ethiopia, Sudan, Tanzania, Namibia, Botswana) and non-source locations (gray) for *Eichhornia diversifolia* climate matching. Source locations from GBIF Secretariat (2021). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

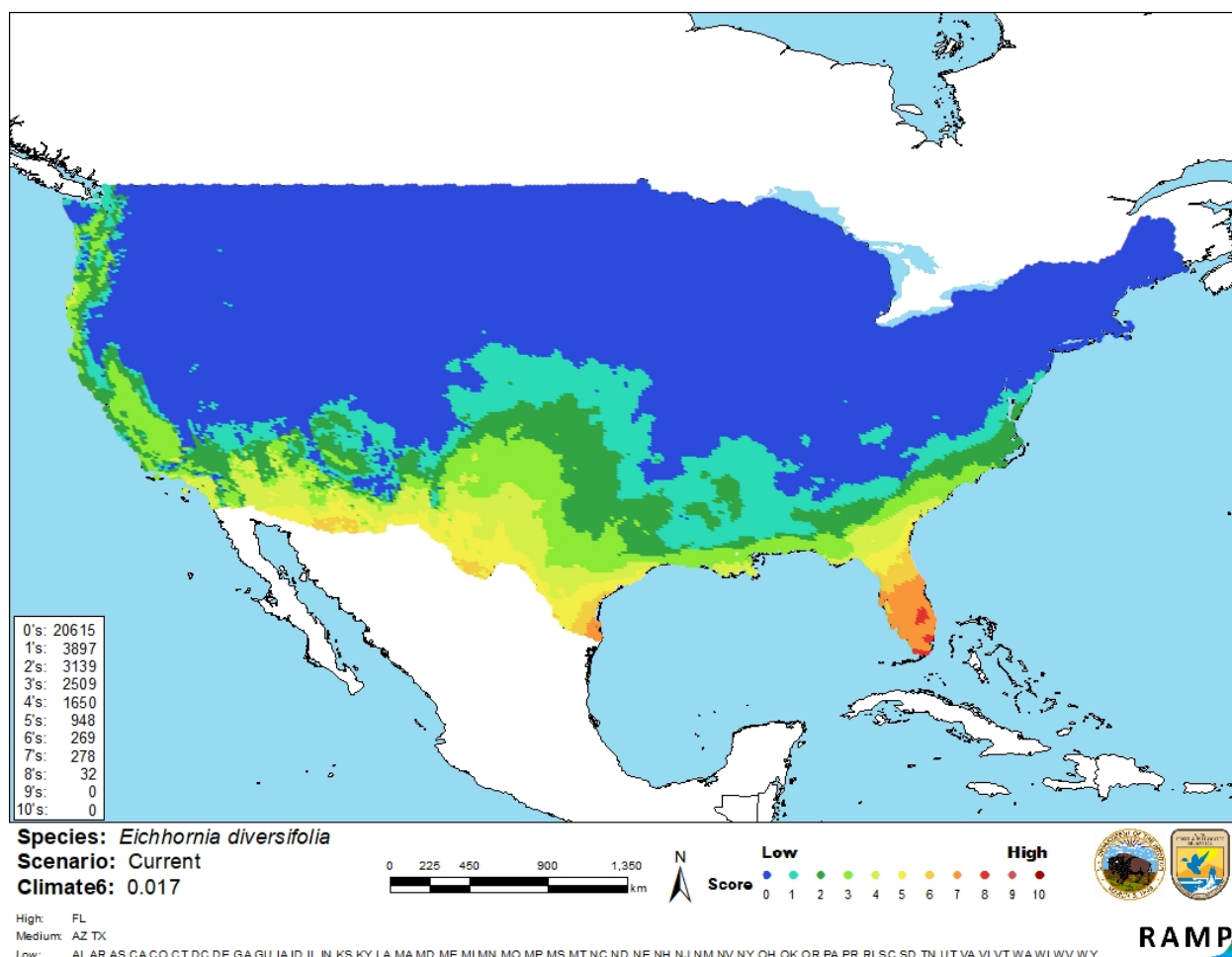


Figure 4. Map of RAMP (Sanders et al. 2018) climate matches for *Eichhornia diversifolia* in the contiguous United States based on source locations reported by GBIF Secretariat (2021). Counts of climate match scores are tabulated on the left. 0/Blue = Lowest match, 10/Red = Highest match.

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
$0.000 \leq X \leq 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

8 Certainty of Assessment

The certainty of assessment for *E. diversifolia* is low. Most reports of introductions did not include information on establishment status, and no information was found on impacts of introductions. The species' distribution is well documented but may be overestimated given taxonomic disagreements over the status of *E. natans*.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Variableleaf water hyacinth (*Eichhornia diversifolia*) is an aquatic flowering plant with floating leaves that is native to Central and South America, and sub-Saharan Africa. The populations in Africa are recorded under the synonym *E. natans*. Some taxonomists treat *E. natans* as separate species. *E. diversifolia* is reportedly widely available in the aquarium and garden trade. The history of invasiveness is No Known Nonnative Population. *E. diversifolia* has been introduced to Puerto Rico but is now considered extirpated. It is listed as a prohibited species in Florida. It has also been introduced to Cuba, Dominican Republic, Hungary, India, Iraq, Taiwan, and the United Kingdom. There are historical records of *E. diversifolia* in Florida and Texas, but no information was available regarding the status of the species in those locations. No information regarding status of the introductions or impacts was available. The overall climate match for the contiguous United States is Medium. Areas of Florida had a high match while areas from the southwest east to the southern Atlantic Coast had medium matches. The certainty of assessment is Low due to a lack of information. The overall risk assessment category for *E. diversifolia* is Uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 4): No Known Nonnative Population**
- **Overall Climate Match Category (Sec. 7): Medium**
- **Certainty of Assessment (Sec. 8): Low**
- **Remarks/Important additional information:** This ERSS includes information on *E. natans*, considered a synonym by WFO, but a separate species by some taxonomists.
- **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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