Yellow Velvetleaf (*Limnocharis flava*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, March 2012
Revised, March 2018
Web Version, 2/1/2019

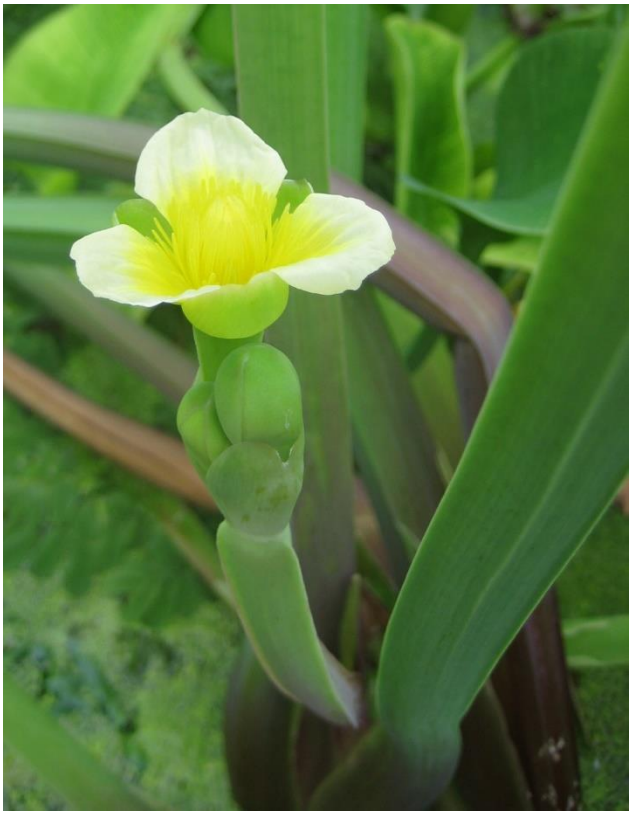

Photo: Michael Wolf (2009). Licensed under Creative Commons (CC-BY-SA-3.0, 2.5, 2.0, 1.0). Available: https://commons.wikimedia.org/wiki/File:Limnocharis_flava_03.jpg. (March 2018).

1 Native Range and Status in the United States

Native Range

From CABI (2018):

"*L. flava* is native to tropical and subtropical America (i.e. northwestern Mexico, Nicaragua, Costa Rica, Panama, Cuba, Haiti, Dominican Republic, Windward Islands, Colombia, Venezuela, Ecuador, West Indies, Peru and Brazil) […]"

Status in the United States

The USDA Natural Resources Conservation Science (2018) website lists *Limnocharis flava* a "Prohibited aquatic plant, Class 1" Florida state-listed noxious weed. Current status in natural settings is unclear, but CABI (2018) does mention it "was introduced to the USA for use in water gardens." The only geographic coordinates within the contiguous United States included in the GBIF Secretariat (2018) dataset for the species is for the Missouri Botanical Gardens.

Means of Introductions in the United States

From CABI (2018):

"*L. flava* often serves as an ornamental plant in ponds and was introduced to the USA for use in water gardens."

Remarks

From CABI (2018):

"*L. flavus* produces large numbers of seeds, with a single plant capable of producing over 1,000,000 seeds a year. The fruitlets are carried by water, floating to new locations and dispersing seeds along the way. Seeds are also carried with the mud sticking to the feet of birds, by man and agricultural implements (Kotalawala, 1976), or with cereals from an infested field transported to an uninfected area."

GISD (2018) lists *Alisma flava, Limnocharis plumieri, Damasonium flavum, Limnocharis laforesti, Limnocharis mattogrossensis, and Limnocharis emarginata* as synonyms for *Limnocharis flava*.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2018):

"Kingdom Plantae
Subkingdom Viridiplantae
Infrakingdom Streptophyta
Superdivision Embryophyta
Division Tracheophyta
Subdivision Spermatophytina
Class Magnoliopsida
Superorder Lilianae
Order Alismatales
Family Alismataceae
Genus *Limnocharis*
Species *Limnocharis flava* (L.) Buchenau – yellow velvetleaf"

"Taxonomic status: accepted"

Size, Weight, and Age Range
From CABI (2018):

"[…] 20-100 cm tall […]"

Environment
From GISD (2018):

"*L. flava* inhabits shallow swamps, ditches, pools and wet rice fields, occurring usually in stagnant fresh water (Abhilash [personal communication], 2004)."

Climate/Range
From CABI (2018):

"*L. flava* is native to tropical and subtropical America […]"

Distribution Outside the United States
Native
From CABI (2018):

"*L. flava* is native to tropical and subtropical America (i.e. northwestern Mexico, Nicaragua, Costa Rica, Panama, Cuba, Haiti, Dominican Republic, Windward Islands, Colombia, Venezuela, Ecuador, West Indies, Peru and Brazil) […]"

Introduced
GISD (2018) lists Australia, Bangladesh, India, Indonesia, Malaysia, Myanmar, Papua New Guinea, Singapore, Sri Lanka, and Thailand as countries with distribution records for *L. flava*. Further, GISD (2018) designates the plant is established in all of these countries, except for the uncertain designation given to Papua New Guinea.

Means of Introduction Outside the United States
From GISD (2018):

"It is thought that the introduction of *L. flava* into India may have been due to contaminated imports of rice from rice paddies in South East Asia infested with the weed (Abhilash [personal communication], 2004). As well as unintentional spread of the seed via agricultural imports its use and cultivation as a food source may result in intentional spread of the plant into new countries. The latter is thought to be the cause of its spread from Java to Papua (Waterhouse, 2003).The plant was introduced into Singapore for ornamental purposes (Corlett, 1988). […] Movement of *L. flava* from Irian Jaya (Papua) to Papua New Guinea as a source of food is inevitable (if it isnt there already). This is also thought to be the reason for its introduction into Papua from Java (Waterhouse, 2003)."

From CABI (2018):

"*L. flavus* produces large numbers of seeds, with a single plant capable of producing over 1,000,000 seeds a year. The fruitlets are carried by water, floating to new locations and dispersing seeds along the way. Seeds are also carried with the mud sticking to the feet of birds, by man and agricultural implements (Kotalawala, 1976), or with cereals from an infested field transported to an uninfected area."

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Short Description

From GISD (2018):

"*L. flava* has triangular-shaped leaf and flower stalks and produces 'octopus-like' inflorescences consisting of up to 15 three-lobed yellow flowers. Its fruits are spherical and made up of cresent shaped segments that eventually split off, carried by water currents to disperse seeds to new locations (CRC for Australian Weed Management, 2003)."

Biology

From GISD (2018):

"Flowering and fruiting takes place throughout the year, with a single fruit producing about 1000 seeds, and a single plant producing about 1000 fruits per year (Senartana, 1940). The flowers open in the morning and close by mid-day, after which the stamens and petals disintegrate into a mucilaginous mass (van Steenis, 1954). There are no known pollinators for the plant in either South America or South east Asia. Spherical shaped fruit develops and ripens, opening along the adaxial (inner) wall; this is due to the thick curving abaxial (outer) wall. Each fruit consists of individual cresent shaped segments, known as fruitlets; the fruit and fruitlets may float for several days, scattering the numerous tiny seeds as they float downstream. The plant may also propagate clonally. A vegetative plantlet, known as a ramet, develops in the centre of an inflorescence. After the fruit has fallen, the penduncle (stalk of the inflorescence) bends over and the ramet eventually reaches the surface of the water. It then sends out its own rhizome and roots, which take root in the mud below. Alternatively, ramets may break off and float away, forming new infestations downstream (Abhilash [personal communication], 2004; CRC for Australian Weed Management, 2003)."

Human Uses

From GISD (2018):

"*L. flava* is valued as an ornamental plant in some countries and cultivated in botanic gardens or private homes. […] In some South-East Asian countries *L. flava* is used as a source of food. […]

It is also reported to be used as pig or cattle fodder (in Sumatra), and as green crop manure for fertilising paddies (Abhilash [personal communication], 2004)."

Diseases

Ingold (1995) reports the presence of a smut fungus, *Doassansiopsis limnocharidis* on *L. flava* in Costa Rica.

Threat to Humans

From GISD (2018):

"Clumps of the weed provide congenial breeding sites for disease-vectors, including mosquitoes, which encourages the spread of diseases such as Japan fever and dengue fever (Abhilash [personal communication], 2004)."

3 Impacts of Introductions

From GISD (2018):

"If allowed to grow unchecked, *L. flava* may become a very invasive environmental weed of streams and wetlands. It has become a serious weed in rice fields, irrigation canals and wetlands in South-East Asia (Waterhouse, 2003). Clumps of the weed provide congenial breeding sites for disease-vectors, including mosquitoes, which encourages the spread of diseases such as Japan fever and dengue fever (Abhilash [personal communication], 2004)."

From CABI (2018):

"L. flava chokes irrigation and drainage channels, promotes silting, and reduces water discharge capacity (Kotalawala, 1976). The effectiveness of drainage ditches and irrigation channels can be reduced through siltation caused by blockage of water flow by *L. flava* leaves and root systems. In some situations, infestations of the weed are so severe that they have forced the abandonment of ricefields."

"If allowed to grow unchecked, *L. flava* may become a very invasive weed of streams and wetlands. *L. flava* colonizes shallow wetlands and the margins of deeper waterways, where it can quickly grow to dominate native aquatic plants. The natural ecological balance may thus be altered to seriously impact native water-dwelling creatures."

"In the USA, *L. flava* is a threat to the biodiversity of a number of unique wetland areas including the Florida everglades. It could have similar impacts on Australia's wetlands, and has the potential to rapidly establish in suitable habitats."

4 Global Distribution

Figure 1. Known distribution of *Limnocharis flava* in the Eastern Hemisphere. Map by GBIF Secretariat (2018).

Figure 2. Known distribution of *Limnocharis flava* in the Western Hemisphere. Map by GBIF Secretariat (2018). Location point for Missouri Botanical Gardens was excluded because it does not represent an introduction in a wild setting.

5 Distribution Within the United States

The USDA Natural Resources Conservation Science (2018) website lists *Limnocharis flava* a "Prohibited aquatic plant, Class 1" Florida state-listed noxious weed. Current status in natural settings is unclear, but CABI (2018) does mention it "was introduced to the USA for use in water gardens." The only geographic coordinates for *L. flava* within the contiguous United States included in the GBIF Secretariat (2018) dataset is for Missouri Botanical Gardens.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean Distance) for *Limnocharis flava* within the contiguous United States is medium overall. The Climate6 proportion for this species is 0.054. The range of proportions classified as medium match is 0.005 to $\leq$0.103. Locally, Florida, Georgia, South Carolina, and Texas all showed high climate matches, which indicates areas most likely to support to establishment of *L. flava*. The medium climate match of Alabama, Louisiana, and Arizona also indicate favorable climates for the species, while the rest of the contiguous United States received low climate match scores.

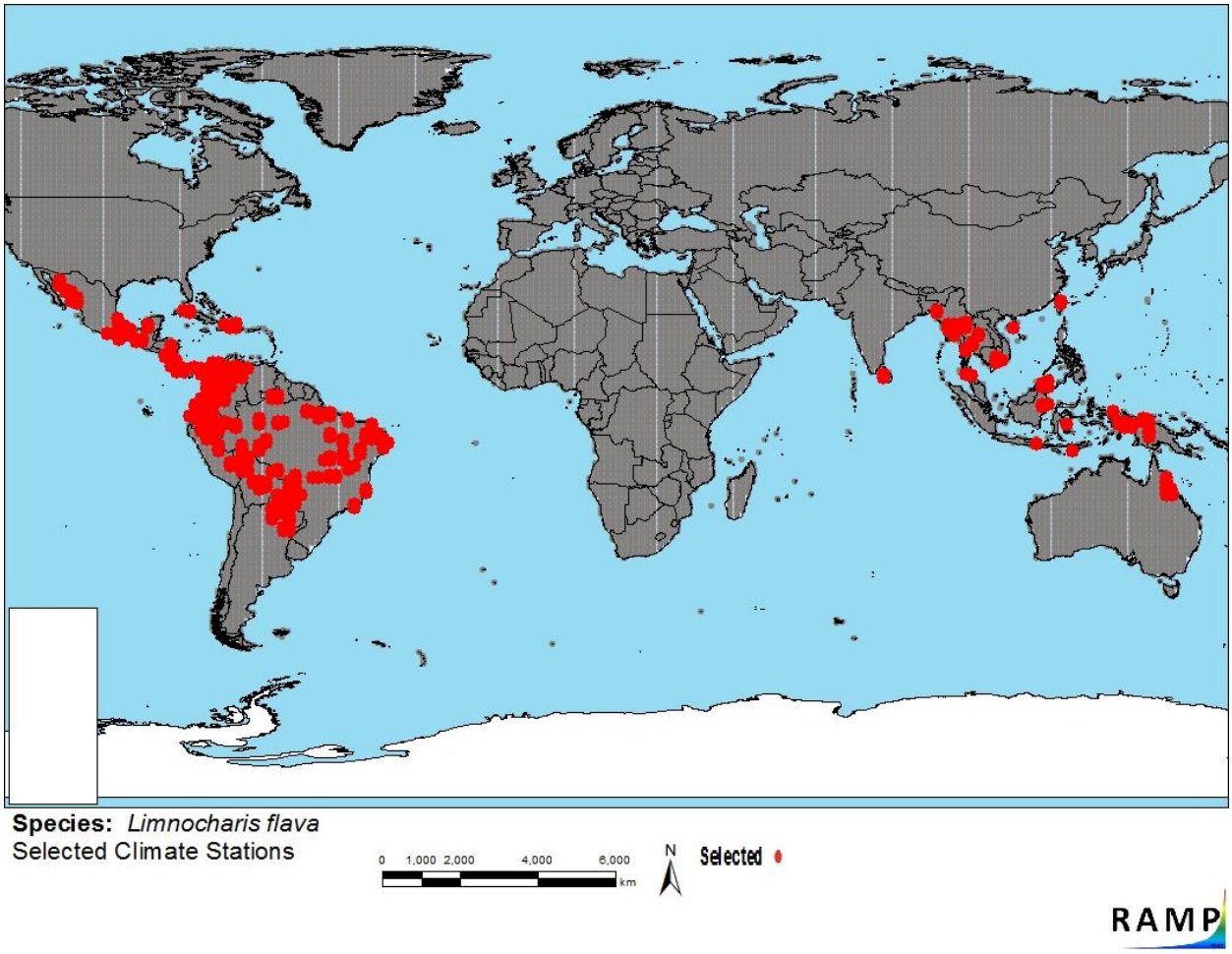

Figure 3. RAMP (Sanders et al. 2014) global source map showing weather stations selected as source locations (red; Central and South America, Southeast Asia, Sri, Lanka, and northeastern Australia) and non-source locations (gray) for *Limnocharis flava* climate matching. Source locations from GBIF Secretariat (2018).

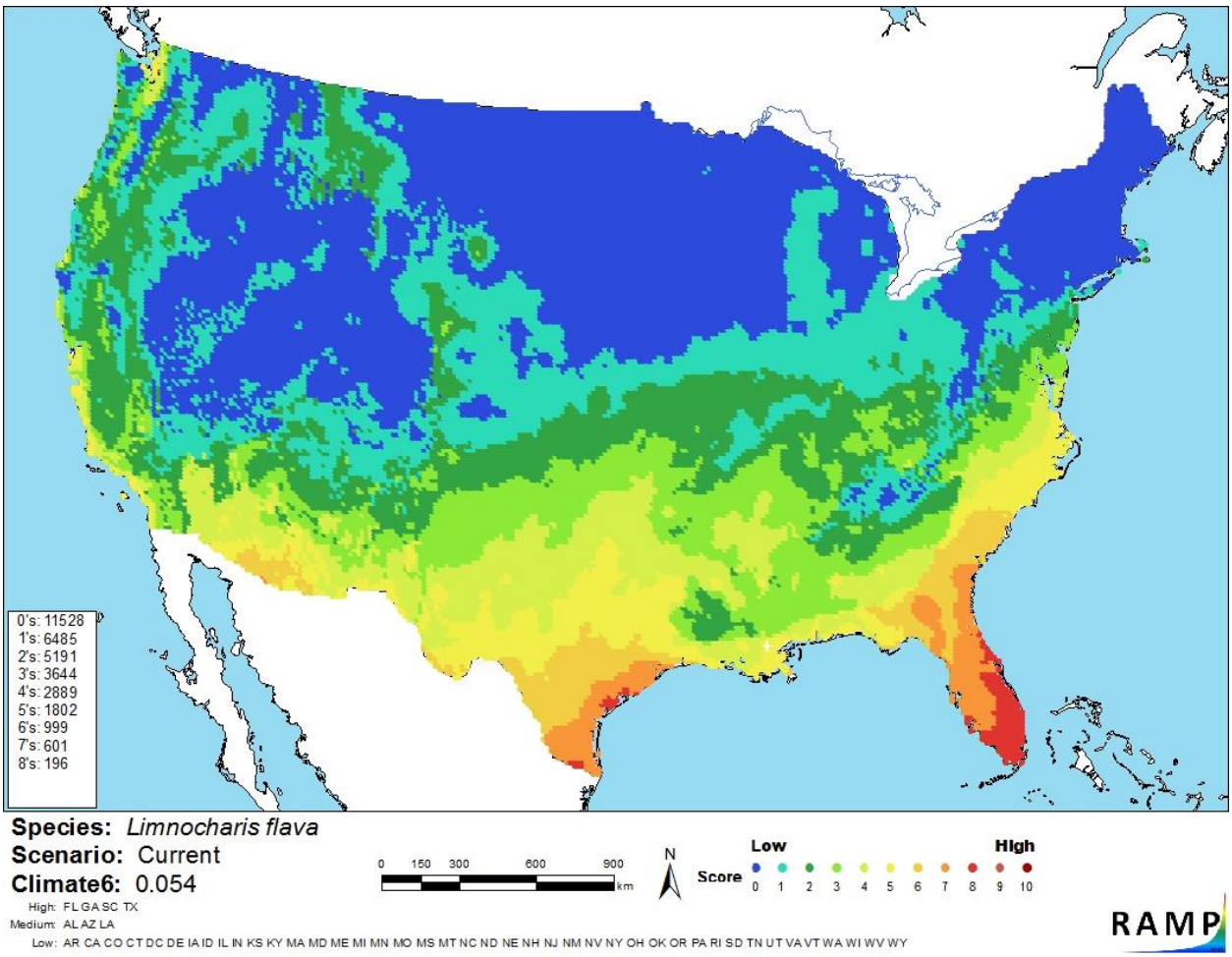

Figure 4. Map of RAMP (Sanders et al. 2014) climate matches for *Limnocharis flava* in the contiguous United States based on source locations reported by GBIF Secretariat (2018). Counts of climate match scores are tabulated on the left. 0=Lowest match, 10=Highest match.

The "High", "Medium", and "Low" climate match categories are based on the following table:

Climate 6: Proportion of (Sum of Climate Scores 6-10) / (Sum of total Climate Scores)	Climate Match Category
$0.000 \leq X \leq 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

7 Certainty of Assessment

A fair amount of information on the biology, ecology, distribution, and impacts of introduction currently exist for *Limnochromis flava*. Scientific research addresses positive (e.g., filtration, food source, etc.) and negative (e.g., promotes siltation, water flow blockage, breeding site for disease vectors, etc) impacts from introduction. However, distribution of the species is uncertain. Some reported introductions provide only limited information and current status in these, and

other, areas is unknown. More distribution information is needed to fully assess *L. flava*, but existing information does support a medium certainty of assessment.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Limnocharis flava is a prolific plant native to tropical and subtropical America, with a far-reaching range of northwestern Mexico to Brazil and includes several Caribbean nations. The plant shows a preference for shallow swamps, ditches, pools, wet rice fields, and stagnant fresh water. *L. flava* offers a wide range of human uses including forage for wildlife, ornamental, food for humans, manure, medicinal and research. One or more of these benefits led to introductions in many countries throughout Southeast Asia. However, these introductions have also led to negative biological and economic impacts. For example, in some areas infestations became so severe that they forced abandonment of rice fields and created blockage of water flow in other areas. Infestations can also provide unwanted breeding grounds for disease-vectors and restrict wetland habitat for native aquatic plants and animals. A single plant produces over one million seeds a year that can easily spread by water, birds, man, or with infested crops such as rice. While distribution within the contiguous United States is unclear, the species has been reported as an ornamental plant in private ponds and has been cultivated by Missouri Botanical Gardens. It was listed as a noxious weed in Florida in 2002, designated as a "Prohibited aquatic plant, Class 1." Climate match within the contiguous United States is medium, with Florida, Georgia, South Carolina, and Texas providing high matches. Given its high history of invasiveness, medium climate match, and documented negative impacts of introduction, the overall risk of *Limnocharis flava* within the United States is high.

Assessment Elements

- **History of Invasiveness (Sec. 3): High**
- **Climate Match (Sec. 6): Medium**
- **Certainty of Assessment (Sec. 7): Medium**
- **Important additional information: Can serve as breeding sites for disease vectors such as mosquitoes.**
- **Overall Risk Assessment Category: High**

9 References

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

CABI. 2018. *Limnocharis flava* [original text by A. Man]. *In*: Invasive Species Compendium. Wallingford, UK: CAB International. Available: www.cabi.org/isc. (March 2018).

GBIF Secretariat. 2018. GBIF backbone taxonomy *Limnocharis flava* Buchenau. Global Biodiversity Information Facility, Copenhagen. Available: https://www.gbif.org/species/5328736. (March 2018).

GISD (Global Invasive Species Database). 2018. Species profile: *Limnocharis flava*. Available: http://www.iucngisd.org/gisd/speciesname/Limnocharis+flava on 21-03-2018. (March 2018).

Ingold, C. T. 1995. An unusual smut fungus: *Doassansiopsis limnocharidis*. Mycologist 9(2):58-59.

ITIS (Integrated Taxonomic Information System). 2018. *Limnocharis flava* Buchenau. Integrated Taxonomic Information System, Reston, Virginia. Available: https://itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=503462#null. (March 2018).

Sanders, S., C. Castiglione, and M. H. Hoff. 2014. Risk Assessment Mapping Program: RAMP. U.S. Fish and Wildlife Service.

USDA Natural Resources Conservation Science. 2018. Plant profile: *Limnocharis flava* (L.) Buchenau [excluded]. Available: https://plants.usda.gov/core/profile?symbol=LIFL5. (March 2018).

10 References Quoted But Not Accessed

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.

CRC (Cooperative Research Centre) for Australian Weed Management. 2003. Weed of the month: *Limnocharis flava*. Waite Campus, University of Adelaide, Australia.

Corlett, R. T. 1988. The naturalized flora of Singapore. Journal of Biogeography 15(4):657-663.

Kotalawala, J. 1976. Noxious water vegetation in Sri Lanka: the extent and impact of existing infestations. Pages 51-58 *in* Aquatic Weeds in SE Asia. W. Junk, The Hague, Netherlands.

van Steenis, C. G. G. J. 1954. Flora Malesiana 1(5):118-120.

Waterhouse, B. M. 2003. Know your enemy: recent records of potentially serious weeds in northern Australia, Papua New Guinea and Papua (Indonesia). Telopea 10(1):477-485.