

Family: *Pontederiaceae*

Taxon: *Heteranthera reniformis*

Synonym: *Buchozia aquatica* Vell.

Common Name: kidneyleaf mudplantain

Heteranthera acuta Willd.

Heteranthera pubescens Vahl

Heteranthera virginicus Steud. [Invalid]

Leptanthus peruvianus Pers.

Phrynium reniforme (Ruiz & Pav.) Kuntze

Schollera reniformis (Ruiz & Pav.) Kuntze

Questionnaire :	current 20090513	Assessor:	Assessor	Designation:	H(HPWRA)
Status:	Assessor Approved	Data Entry Person:	Assessor	WRA Score 26	
101	Is the species highly domesticated?		y=-3, n=0		n
102	Has the species become naturalized where grown?		y=1, n=-1		
103	Does the species have weedy races?		y=1, n=-1		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"		(0-low; 1-intermediate; 2-high) (See Appendix 2)		High
202	Quality of climate match data		(0-low; 1-intermediate; 2-high) (See Appendix 2)		High
203	Broad climate suitability (environmental versatility)		y=1, n=0		y
204	Native or naturalized in regions with tropical or subtropical climates		y=1, n=0		y
205	Does the species have a history of repeated introductions outside its natural range?		y=-2, ?=-1, n=0		y
301	Naturalized beyond native range		y = 1*multiplier (see Appendix 2), n= question 205		y
302	Garden/amenity/disturbance weed		n=0, y = 1*multiplier (see Appendix 2)		
303	Agricultural/forestry/horticultural weed		n=0, y = 2*multiplier (see Appendix 2)		y
304	Environmental weed		n=0, y = 2*multiplier (see Appendix 2)		
305	Congeneric weed		n=0, y = 1*multiplier (see Appendix 2)		y
401	Produces spines, thorns or burrs		y=1, n=0		n
402	Allelopathic		y=1, n=0		
403	Parasitic		y=1, n=0		n
404	Unpalatable to grazing animals		y=1, n=-1		
405	Toxic to animals		y=1, n=0		n
406	Host for recognized pests and pathogens		y=1, n=0		n
407	Causes allergies or is otherwise toxic to humans		y=1, n=0		n
408	Creates a fire hazard in natural ecosystems		y=1, n=0		n

409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	n
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	y
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally	y=1, n=-1	
604	Self-compatible or apomictic	y=1, n=-1	
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	y
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)	y=1, n=-1	
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	

Designation: H(HPWRA)

WRA Score 26

Supporting Data:

101	2003. Horn, C.F.. Pontederiaceae. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. Vol. 26. Flora of North America Association, New York and Oxford	[Is the species highly domesticated? No] No evidence
102	2013. WRA Specialist. Personal Communication.	NA
103	2013. WRA Specialist. Personal Communication.	NA
201	2003. Horn, C.F.. Pontederiaceae. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. Vol. 26. Flora of North America Association, New York and Oxford	[Species suited to tropical or subtropical climate(s) 2-High] "0--2600 m; Ala., Conn., Del., Fla., Ga., Ill., Ind., Ky., La., Md., Miss., Mo., N.J., N.Y., N.C., Ohio, Pa., S.C., Tenn., Tex., Va., W.Va.; Mexico; throughout Central America; scattered in South America (Argentina, Brazil, Paraguay); naturalized in Italy."
202	2003. Horn, C.F.. Pontederiaceae. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. Vol. 26. Flora of North America Association, New York and Oxford	[Quality of climate match data 2-High]
203	2003. Horn, C.F.. Pontederiaceae. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. Vol. 26. Flora of North America Association, New York and Oxford	[Broad climate suitability (environmental versatility)? Yes] "Roadside ditches, edges of streams and ponds, freshwater tidal mudflats; 0--2600 m; Ala., Conn., Del., Fla., Ga., Ill., Ind., Ky., La., Md., Miss., Mo., N.J., N.Y., N.C., Ohio, Pa., S.C., Tenn., Tex., Va., W.Va.; Mexico; throughout Central America; scattered in South America (Argentina, Brazil, Paraguay); naturalized in Italy." [Elevation range exceeds 1000 m. Also has a broad native distribution]
203	2008. Gargiullo, M.B./Magnuson, B.L./Kimball, L.D.. A Field Guide to Plants of Costa Rica. Oxford University Press US, New York, NY	[Broad climate suitability (environmental versatility)? Yes] "Altitude: Sea level to 1300 m or more." [Elevation range exceeds 1000 m. Also has a broad native distribution]
204	2005. Acevedo-Rodríguez, P./Strong, M.T.. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium. 52: 1-415.	[Native or naturalized in regions with tropical or subtropical climates? Yes] "General distribution: Eastern United States, Mexico, Central America; scattered in South America (Argentina, Brazil, Paraguay); naturalized in Italy."
205	2010. Waterkeyn, A. et al.. Unintentional dispersal of aquatic invertebrates via footwear and motor vehicles in a Mediterranean wetland area. Aquatic conservation: Marine and freshwater ecosystems. 20(5): 580-587.	[Does the species have a history of repeated introductions outside its natural range? Yes] "In the Camargue, at least 11 invasive aquatic plant species are encountered frequently, including, for example, the water primroses <i>Ludwigia peploides</i> and <i>Ludwigia grandiflora</i> , and the mudplantains <i>Heteranthera reniformis</i> and <i>Heteranthera limosa</i> . Most of them were voluntarily introduced from the American continent for aesthetic or agricultural reasons; others were accidentally imported along with agricultural seeds."
205	2012. Hussner, A.. Alien aquatic plant species in European countries. Weed Research. 52(4): 297-306.	[Does the species have a history of repeated introductions outside its natural range? Yes] "Table 1 List of all non-indigenous aquatic plants species, which have been reported as introduced from at least one European" [<i>Heteranthera reniformis</i> - 14 = France; 16 = Greece; 19 = Italy; 31 = Portugal]
205	2013. NSW Department of Primary Industries. Weed alert: <i>Heteranthera</i> . http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles/heteranthera [Accessed 16 Aug 2013]	[Does the species have a history of repeated introductions outside its natural range? Yes] " <i>Heteranthera</i> was introduced to Australia as an ornamental pond plant and has been actively promoted on a number of Australian websites. In February 2006, a naturalised population was found in northern Sydney. Then in late 2007, another population was located in coastal South East Queensland. Soon after, more than 20 additional sites were found in South East Queensland."
301	2001. Dana, E.D./Sanz-Elorza, M./Sobrinho, E.. Plant invaders in Spain [check-list]. 'The Unwanted Citizens'. http://www.marz-kreations.com/WildPlants/ASTR/Docs/ASTSQ/Spain_Checklist.pdf	[Naturalized beyond native range? Yes] "Naturalised Species Showing a Potential Threat to Spanish Ecosystems" [List includes <i>Heteranthera reniformis</i>]
301	2006. Domingues de Almeida, J./Freitas, H.. Exotic naturalized flora of continental Portugal – A reassessment. <i>Botanica Complutensis</i> . 30: 117-130.	[Naturalized beyond native range? Yes] "Exotic vascular plant species (invasive, potentially invasive or more or less naturalized) in continental Portugal." [<i>Heteranthera reniformis</i> - Year of first reported naturalization of exotic species = 1994]

301	2013. NSW Department of Primary Industries. Weed alert: <i>Heteranthera</i> . http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles/heteranthera [Accessed 16 Aug 2013]	[Naturalized beyond native range? Yes] "In February 2006, a naturalised population was found in northern Sydney. Then in late 2007, another population was located in coastal South East Queensland. Soon after, more than 20 additional sites were found in South East Queensland." ... "It has naturalised in Italy, Spain and areas of the USA that are outside of its native range. <i>Heteranthera</i> is a weed of rice crops in a number of European countries; particularly in Italy where rice yields have been drastically reduced by the presence of this weed."
302	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Garden/amenity/disturbance weed? Disturbance adapted with negative impacts on agriculture] "Because it is a poor competitor with many sedges, rushes and other wetland species, <i>H. reniformis</i> is easily crowded out of wetlands. It is, however, able to take advantage of favourable situations quickly, such as recently inundated areas (e.g. following flooding, beaver dams or human activity) and areas where competition has been destroyed or otherwise removed"
303	1996. Ferrero, A.. Prediction of <i>Heteranthera reniformis</i> competition with flooded rice using day-degrees. <i>Weed Research</i> . 36: 197–201.	[Agricultural/forestry/horticultural weed? Yes] "In field studies carried out in 1992 and 1993, several durations of growth of <i>Heteranthera reniformis</i> Ruitz et Pavon were established in flooded rice (<i>Oryza sativa</i> L.) to evaluate weed influence on crop yield using day degree predictive models for weed growth. <i>H. reniformis</i> was allowed to emerge at 7 day intervals from rice emergence until 49 days later. Weeds that emerged with the rice accumulated 403 day-degrees during the first 49 days. Weeds allowed to utilize 308 day degrees had a dry weight reduction of 20% compared with plants that emerged with the rice. With the loss of all 403 day-degrees dry weight was reduced by about 95%. Maximum leaf area index (LAI) was 2.8, reached at 308 day-degrees. Weed density ranged from 48 to 5 plants m ⁻² when all 403 day-degrees were accumulated or lost by the plant respectively. When the weed lost only 95 day-degrees out of the possible 403 (1 week's delay in emergence) rice yield was 34% and 39% lower in 1992 and 1993 respectively. When the weed was allowed to accumulate all 403 day degrees yield reduction reached 62% in 1992 and 68% in 1993, very similar to the control plot, which were maintained weedy throughout (64% and 70.5%). After an accumulation of 403 day degrees the weed reduced the number of rice panicles by 45% in 1992 and 38% in 1993."
303	1999. Vasconcelos, T./Tavares, M./Gaspar, N.. Aquatic plants in the rice fields of the Tagus Valley, Portugal. <i>Hydrobiologia</i> . 415: 59-65.	[Agricultural/forestry/horticultural weed? Yes] "The recently introduced neophytes <i>Heteranthera limosa</i> and <i>Heteranthera reniformis</i> and the increasing presence of red rice (<i>Oryza sativa</i>), represent a potential danger to rice culture."
303	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Agricultural/forestry/horticultural weed? Yes] "In Italy, <i>H. reniformis</i> is a weed of flooded rice and can reduce yields by up to 70%."
303	2013. Beachy, J.R.. O'ahu Army Natural Resources Program. Pers. Comm. 29 July 2013.	[Agricultural/forestry/horticultural weed? Yes] Becoming a problematic weed for taro farmers in in Waihe'e, Oahu
303	2013. Frohlich, D.. Oahu Early Detection Botanist. Pers. Comm. 02 Aug 2013.	[Agricultural/forestry/horticultural weed? Yes] "On Oahu, it has already proven to be a problematic species in taro lo'i (patches). Over the course of a year, the population has spread to four patches, despite efforts by the farmers to control this plant by hand-pulling and draining the lo'i repeatedly. "
303	2013. NSW Department of Primary Industries. Weed alert: <i>Heteranthera</i> . http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles/heteranthera [Accessed 16 Aug 2013]	[Agricultural/forestry/horticultural weed? Yes] " <i>Heteranthera</i> is a weed of rice crops in a number of European countries; particularly in Italy where rice yields have been drastically reduced by the presence of this weed." ... " <i>Heteranthera</i> is a Class 1 State Prohibited Weed across NSW under the Noxious Weeds Act 1993. It must be eradicated and land must be kept free of the plant. As a notifiable weed, all outbreaks must be reported to the local council within 24 hours, and the plant is prohibited from sale in NSW."
304	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Environmental weed? Potentially] "Based on the evidence collected in this study, it seems reasonable to conclude that <i>H. reniformis</i> has long-term potential to become an abundant and troublesome pest in Queensland, mainly in highly disturbed, shallow freshwater wetland habitats. It is expected to be less of a problem in wetlands where taller vegetation is still intact and provides shade."
304	2013. NSW Department of Primary Industries. Weed alert: <i>Heteranthera</i> . http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles/heteranthera [Accessed 16 Aug 2013]	[Environmental weed? Potentially] " <i>Heteranthera</i> also known as kidneyleaf mud plantain, is a sprawling annual or perennial aquatic plant. It is able to form dense mats and colonise open shallow water, such as disturbed wetlands and flooded rice production. Such characteristics make this weed a potential threat to native vegetation and freshwater aquatic habitats."

305	2006. Sanz-Elorza, M./Dana, E.D./Sobrinho, E.. Invasibility of an inland area in NE Spain by alien plants. <i>Acta Oecologica</i> . 29(1): 114-122.	[Congeneric weed? Yes] "The high amount of invasive species (50%) is caused by the great number of alien weeds among established crops. For instance, almost the entire suite of species appearing in rice fields <i>Lindernia dubia</i> (Scrophulariaceae), <i>Ammannia robusta</i> , <i>Ammannia coccinea</i> (Lythraceae), <i>Heteranthera reniformis</i> , <i>Heteranthera limosa</i> , <i>Heteranthera rotundifolia</i> (Pontederiaceae), <i>Azolla filiculoides</i> (Azollaceae), <i>Echinochloa hispidula</i> , <i>Echinochloa oryzoides</i> , <i>Echinochloa oryzicola</i> , (Gramineae) are alien plants that were introduced with this crop (Conesa and Sanz-Elorza, 1998)."
305	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Congeneric weed? Yes] <i>Heteranthera viscidiflora</i> , <i>Heteranthera callifolia</i> , <i>Heteranthera dubia</i> , <i>Heteranthera limosa</i> , <i>Heteranthera peduncularis</i> , <i>Heteranthera rotundifolia</i> , <i>Heteranthera zosteraefolia</i> [Species listed as naturalized and/or weeds]
401	2003. Horn, C.F.. Pontederiaceae. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. Vol. 26. Flora of North America Association, New York and Oxford	[Produces spines, thorns or burrs? No] "Plants annual or facultatively perennial. Vegetative stems submersed with elongate internodes, or emersed and procumbent. Flowering stems 1–9 cm, distal internode 0.5–4 cm. Sessile leaves forming basal rosette, blade linear to oblanceolate, thin, 2.4–3.7 cm × 3–8 mm. Petiolate leaves floating or emersed; stipule 1–5 cm; petiole 2–13 cm; blade reniform, 1–4 × 1–5 cm, length equal to or less than width, apex obtuse. Inflorescences spicate, 2–8-flowered, elongating in 1 day, usually shorter than spathes, terminal flower sometimes extending beyond spathe apex; spathes 0.8–5.5 cm, glabrous; peduncle 0.5–4.2 cm, glabrous."
402	2013. WRA Specialist. Personal Communication.	[Allelopathic? Unknown]
403	2003. Horn, C.F.. Pontederiaceae. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. Vol. 26. Flora of North America Association, New York and Oxford	[Parasitic? No] "Plants annual or facultatively perennial." [Pontederiaceae]
404	2013. WRA Specialist. Personal Communication.	[Unpalatable to grazing animals? Unknown]
405	2008. Wagstaff, D.J.. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	[Toxic to animals? No] No evidence in genus
406	2007. Lupi, D./Sparacino, A.C./Ranghino, F./Colombo, M.. Weeds as hosts of the rice water weevil (<i>Lissorhoptrus oryzophilus</i> Kuschel) in Italy. Pp. 308-309 in Proceedings of the fourth international temperate rice conference, Novara, Italy.	[Host for recognized pests and pathogens? No] "The rice water weevil (<i>RWW</i>) <i>Lissorhoptrus oryzophilus</i> Kuschel, recently detected in Italy, lives and develops, in both the larval and adult stages, on rice and some spontaneous weeds." ... "Neither larvae nor pupae were detected on <i>A. geniculatus</i> , <i>H. reniformis</i> , and <i>S. mucronatus</i> ."
407	2008. Wagstaff, D.J.. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	[Causes allergies or is otherwise toxic to humans? No] No evidence in genus
408	2003. Horn, C.F.. Pontederiaceae. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. Vol. 26. Flora of North America Association, New York and Oxford	[Creates a fire hazard in natural ecosystems? No] "Roadside ditches, edges of streams and ponds, freshwater tidal mudflats" [Occurs in or near to aquatic habitats]
409	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Is a shade tolerant plant at some stage of its life cycle? No] "It is readily outcompeted and replaced by taller vegetation and does not thrive under shade."
409	2013. NSW Department of Primary Industries. Weed alert: <i>Heteranthera</i> . http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles/heteranthera [Accessed 16 Aug 2013]	[Is a shade tolerant plant at some stage of its life cycle? No] " <i>Heteranthera</i> will quickly colonise open sunny areas but does not grow well in shaded areas, or amongst taller growing vegetation such as sedges and tall grasses."
410	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Tolerates a wide range of soil conditions? No] "...adapted to open, sunny sites with nutrient rich soil and shallow water (less than 15 cm deep) (NatureServe 2007)."
411	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Climbing or smothering growth habit? No] " <i>H. reniformis</i> also forms dense mats within its native range." ... " <i>H. reniformis</i> has successfully naturalised at several sites in south-east Queensland, where it appears to form dense mats, albeit at a localised scale."
412	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Forms dense thickets? Yes] " <i>H. reniformis</i> also forms dense mats within its native range." ... " <i>H. reniformis</i> has successfully naturalised at several sites in south-east Queensland, where it appears to form dense mats, albeit at a localised scale."

501	2005. Acevedo-Rodríguez, P./Strong, M.T.. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium. 52: 1-415.	[Aquatic? Yes] "Plant annual or facultatively perennial, trailing and rooting at the nodes in mud or floating in shallow water."
502	2003. Horn, C.F.. Pontederiaceae. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. Vol. 26. Flora of North America Association, New York and Oxford	[Grass? No] Pontederiaceae
503	2003. Horn, C.F.. Pontederiaceae. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. Vol. 26. Flora of North America Association, New York and Oxford	[Nitrogen fixing woody plant? No] Pontederiaceae
504	2003. Horn, C.F.. Pontederiaceae. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. Vol. 26. Flora of North America Association, New York and Oxford	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "Plants annual or facultatively perennial. Vegetative stems submersed with elongate internodes, or emersed and procumbent."
601	2003. Horn, C.F.. Pontederiaceae. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. Vol. 26. Flora of North America Association, New York and Oxford	[Evidence of substantial reproductive failure in native habitat? No, although may be endangered within parts of its broad native range]
601	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Evidence of substantial reproductive failure in native habitat? No] "While, <i>H. reniformis</i> is listed as 'endangered' at certain locations at the periphery of its native range in the United States, it appears to have increased in abundance elsewhere, perhaps due to disturbance and the creation of suitable habitat."
602	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Produces viable seed? Yes] "The fruit is a capsule with 8–14 winged seeds, 0.5–0.9 mm × 0.3–0.5 mm." ... "Soil seed-banks are thought to exist for many years" ... "Optimum conditions for seed germination may include daily fluctuations in temperature. These fluctuations naturally raise and lower soluble oxygen levels and may act as a trigger for germination"
603	2013. WRA Specialist. Personal Communication.	[Hybridizes naturally? Unknown]
604	2013. WRA Specialist. Personal Communication.	[Self-compatible or apomictic? Unknown]
605	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Requires specialist pollinators? No] "Flowers are white to pale blue and open about three hours after sunrise and wilt by early afternoon; salverform, tube 5–10 mm, limbs zygomorphic, lobes narrowly elliptic, 3–6.5 mm, distal central lobe with yellow or green region at base, sometimes with distal brown spot; stamens unequal, lateral stamens 0.9–2.2 mm, filaments linear, pubescent with white multicellular hairs toward apex; central stamen 2.2–4.7 mm, filament sparsely pubescent with multicellular hairs; style pubescent with multicellular hairs."
605	2013. Encyclopedia of Life. <i>Heteranthera reniformis</i> . http://eol.org/pages/1117867/details [Accessed 16 Aug 2013]	[Requires specialist pollinators? No] "Pollination: The flowers lack nectaries. Pollen collecting bees visit the conspicuous yellow anthers of the shorter stamens and pick up pollen from the pale blue or greenish anther of the long central stamen (Rosatti 1987 quoting from another publication: Lovell, The Flower and the Bee). The cleistogamously fertilized ovules develop into normal-sized fruits (Horn 1985)"
606	2008. Gargiullo, M.B./Magnuson, B.L./Kimball, L.D.. A Field Guide to Plants of Costa Rica. Oxford University Press US, New York, NY	[Reproduction by vegetative fragmentation? Yes] "Small floating or rooted aquatic herb, colonial from root sprouts, rooting at nodes, stems long, creeping."
606	2013. NSW Department of Primary Industries. Weed alert: <i>Heteranthera</i> . http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles/heteranthera [Accessed 16 Aug 2013]	[Reproduction by vegetative fragmentation? Yes] " <i>Heteranthera</i> 's main method of dispersal is through vegetative reproduction. Any stem fragment containing one or more nodes is capable of producing a new plant."
607	2005. Acevedo-Rodríguez, P./Strong, M.T.. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium. 52: 1-415.	[Minimum generative time (years)? 1+] "Plant annual or facultatively perennial..."
701	1999. Vasconcelos, T./Tavares, M./Gaspar, N.. Aquatic plants in the rice fields of the Tagus Valley, Portugal. <i>Hydrobiologia</i> . 415: 59-65.	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? Yes] "Water, birds and mechanical means aided the spread of <i>H. limosa</i> and <i>H. reniformis</i> , which became the 4th and 6th most important weeds in rice in Italy (Sgattoni et al., 1989)."

701	2013. NSW Department of Primary Industries. Weed alert: <i>Heteranthera</i> . http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles/heteranthera [Accessed 16 Aug 2013]	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? Yes] "Plant fragments can be washed downstream or moved to a new location in mud stuck to animals or vehicles."
702	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Propagules dispersed intentionally by people? Yes] " <i>H. reniformis</i> is a popular ornamental pond plant and is actively promoted on internet sites for its attractive foliage. Like most other invasive plants, ornamental use and trade has no doubt resulted in its escape, naturalisation and dispersal."
703	1999. Vasconcelos, T./Tavares, M./Gaspar, N.. Aquatic plants in the rice fields of the Tagus Valley, Portugal. <i>Hydrobiologia</i> . 415: 59-65.	[Propagules likely to disperse as a produce contaminant? Potentially Yes] " <i>H. limosa</i> was common in 1994, in the region of Alcácer do Sal (LIS). Desfayes (1996) refers to the presence of <i>Heteranthera rotundifolia</i> (Kunth) Griseb in one rice field in Coruche. This species was imported from South America into Italy in 1968–1969 together with the seeds of commercial varieties of rice." [Related species a contaminant of rice, and <i>H. reniformis</i> is becoming an important weed of rice crops in Italy and perhaps elsewhere]
704	2013. NSW Department of Primary Industries. Weed alert: <i>Heteranthera</i> . http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles/heteranthera [Accessed 16 Aug 2013]	[Propagules adapted to wind dispersal? Yes] "Seeds are winged and small, allowing them to be dispersed by wind and water."
705	2000. Nadkarni, N.M./Wheelwright, N.T.. Monteverde: Ecology and Conservation of a Tropical Cloud Forest. Oxford University Press, New York	[Propagules water dispersed? Yes] "Water-dispersed seeds generally have the ability to float for an extended period, due either to the high surface area-to-volume ratio of minute seeds... The only known native Monteverde example is <i>Heteranthera reniformis</i> (Pontederiaceae)."
705	2005. Acevedo-Rodríguez, P./Strong, M.T.. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium. 52: 1-415.	[Propagules water dispersed? Yes] "Distribution in Puerto Rico and the Virgin Islands: Wet mud of streams and roadside ditches. Widely distributed, although seldom collected."
705	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Propagules water dispersed? Yes] "Since the stems of <i>H. reniformis</i> produce roots at each node, it is expected that any broken fragments of stems, with one or more nodes intact, could be washed downstream to infest new areas. A single flood-event is likely to disperse stem fragments over a considerable distance."
706	2009. Brochet, A.-L./Guillemain, M./Fritz, H./Gauthier-Clerc, M./Green, A. J.. The role of migratory ducks in the long-distance dispersal of native plants and the spread of exotic plants in Europe. <i>Ecography</i> . 32: 919–928.	[Propagules bird dispersed? Yes] "Table 2. Hardness and size of the seed species in teal guts, together with their abundance (data pooled for all teal examined, n=42)." [Includes <i>Heteranthera reniformis</i>]
707	2013. NSW Department of Primary Industries. Weed alert: <i>Heteranthera</i> . http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles/heteranthera [Accessed 16 Aug 2013]	[Propagules dispersed by other animals (externally)? Yes] "Plant fragments can be washed downstream or moved to a new location in mud stuck to animals or vehicles."
708	2009. Brochet, A.-L./Guillemain, M./Fritz, H./Gauthier-Clerc, M./Green, A. J.. The role of migratory ducks in the long-distance dispersal of native plants and the spread of exotic plants in Europe. <i>Ecography</i> . 32: 919–928.	[Propagules survive passage through the gut? Yes] "Table 2. Hardness and size of the seed species in teal guts, together with their abundance (data pooled for all teal examined, n=42)." [Includes <i>Heteranthera reniformis</i>]
708	2010. Brochet, A.L./Guillemain, M./Fritz, H./Gauthier-Clerc, M./Green, A.J.. Plant dispersal by teal (<i>Anas crecca</i>) in the Camargue: duck guts are more important than their feet. <i>Freshwater Biology</i> . 55(6): 1262-1273.	[Propagules survive passage through the gut? Yes] "We identified 21 plant taxa in the teal rectum, including the exotic species <i>Ludwigia peploides</i> , <i>Paspalum distichum</i> , <i>Heteranthera reniformis</i> and <i>H. limosa</i> . These species are not native to Europe and were introduced into the Camargue as ricefield weeds (Marnotte et al., 2006). Our results thus suggest that teal are important vectors of exotic species (see also Brochet et al., 2009)."
801	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Prolific seed production (>1000/m ²)? Unknown] "Each fruit on <i>H. reniformis</i> contains 8–14 winged seeds."
802	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] "Soil seed-banks are thought to exist for many years; as a result, populations show up unexpectedly when conditions improve. This could explain populations that appear unexpectedly when rice fields are flooded." ... "Seed banks may exist in the soil for many years (NatureServe 2007). Optimum conditions for seed germination may include daily fluctuations in temperature. These fluctuations naturally raise and lower soluble oxygen levels and may act as a trigger for germination (NatureServe 2007)."

802	2013. NSW Department of Primary Industries. Weed alert: <i>Heteranthera</i> . http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles/heteranthera [Accessed 16 Aug 2013]	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] "Seeds are capable of existing in the soil for many years."
803	2008. Csurhes, S.. Plant pest risk assessment: kidneyleaf mudplantain, <i>Heteranthera reniformis</i> . Biosecurity Queensland, Brisbane, Qld	[Well controlled by herbicides? Yes] "This study was unable to find detailed information on the control of <i>H. reniformis</i> . However, experiments to control common <i>Heteranthera</i> species within flooded rice in Italy found that cinosulfuron (sulfonylurea) showed the highest effectiveness and selectivity, even when applied in very low amounts (Sparacino et al. 1996)."
803	2011. Ensbey, R.. Noxious and environmental weed control handbook. A guide to weed control in non-crop, aquatic and bushland situations. 5th Edition. Department of Primary Industries, NSW	[Well controlled by herbicides? Yes] "Kidney-leaf mud plantain – <i>Heteranthera reniformis</i> " ... "Glyphosate 360 g/L. 200ml per 10 L of water. Foliar application"
804	2013. North Coast Weeds Advisory Committee. Kidney leaf mud plantain - <i>Heteranthera reniformis</i> . http://www.northcoastweeds.org.au/weed/kidney-leaf-mud-plantain/ [Accessed 16 Aug 2013]	[Tolerates, or benefits from, mutilation, cultivation, or fire? Unknown] "The shallow growing depth suggests that KLMP may allow mechanical removal, however, as the plant can reproduce vegetatively, this may lead to further spread through fragmentation."
805	2013. WRA Specialist. Personal Communication.	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Unknown]

Summary of Risk Traits

High Risk / Undesirable Traits

- Broad native distribution and able to thrive in tropical climates
- Elevation range may exceed 1000 m
- Naturalized in France, Greece, Italy; Portugal, Australia, Oahu (Hawaiian Islands)
- A disturbance adapted weed
- An agricultural weed in rice and taro
- Potential environmental weed
- Other *Heteranthera* species have become invasive
- Forms dense mats
- Spreads vegetatively & by seeds
- Can reproduce and spread from single pieces of stem or root fragments
- Seeds and plant fragments can be spread by water, birds, or stuck to machinery
- Can form a persistent seed bank

Low Risk Traits

- Unarmed (no spines, thorns or burrs)
- Readily outcompeted and replaced by taller vegetation
- Does not thrive under shade
- Certain herbicides may provide effective control