

<b>Taxon:</b> <i>Begonia nelumbiifolia</i> Schltdl. & Cham.	<b>Family:</b> Begoniaceae
<b>Common Name(s):</b> lilypad begonia lotus leaved begonia water lily begonia	<b>Synonym(s):</b> <i>Begonia caudilimba</i> C.DC. <i>Begonia derycxiana</i> Lem. <i>Gireoudia nelumbiifolia</i> (Cham. & Cham.)

<b>Assessor:</b> Chuck Chimera	<b>Status:</b> Assessor Approved	<b>End Date:</b> 24 Jul 2017
<b>WRA Score:</b> 10.0	<b>Designation:</b> H(HPWRA)	<b>Rating:</b> High Risk

**Keywords:** Naturalized, Herbaceous, Ornamental, Rhizomatous, Self-Compatible

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
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		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
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		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
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	y

Qsn #	Question	Answer Option	Answer
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		
501	Aquatic	y=5, n=0	n
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	y
604	Self-compatible or apomictic	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)		
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed		
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

**Supporting Data:**

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	"Damp thickets and forests, alt. 1-1,650 meters; Alta Verapaz; Izabal; Santa Rosa. Southern Mexico to Colombia." [No evidence of domestication]

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 20 Jul 2017]	"Native: Northern America Northern Mexico: Mexico - San Luis Potosi Southern Mexico: Mexico - Chiapas, - Federal District, - Hidalgo, - Oaxaca, - Puebla, - Tabasco, - Veracruz Southern America Central America: Belize; Costa Rica; El Salvador; Guatemala; Panama Western South America: Colombia"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 20 Jul 2017]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	"Damp thickets and forests, alt. 1-1,650 meters" [Elevation range exceeds 1000 m in regions with a tropical climate, demonstrating environmental versatility]

Qsn #	Question	Answer
204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 20 Jul 2017]	"Native: Northern America Northern Mexico: Mexico - San Luis Potosi Southern Mexico: Mexico - Chiapas, - Federal District, - Hidalgo, - Oaxaca, - Puebla, - Tabasco, - Veracruz Southern America Central America: Belize; Costa Rica; El Salvador; Guatemala; Panama Western South America: Colombia"

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Dave's Garden. 2017. Lotus Leaved Begonia, Water Lily Begonia - <i>Begonia nelumbiifolia</i> . <a href="http://davesgarden.com/guides/pf/go/49921/">http://davesgarden.com/guides/pf/go/49921/</a> . [Accessed 21 Jul 2017]	"This plant has been said to grow in the following regions: Anniston, Alabama Beverly Hills, California Big Pine Key, Florida Clearwater, Florida De Leon Springs, Florida New Port Richey, Florida Saint Petersburg, Florida Zephyrhills, Florida Kurtistown, Hawaii"

301	Naturalized beyond native range	y
	Source(s)	Notes
	Liogier, A.H. & Martorell, L.F. 2000. Flora of Puerto Rico and adjacent islands: a systematic synopsis. Second Edition Revised. La Editorial, UPR, San Juan, Puerto Rico	"Cultivated and escaped in moist districts at lower to middle elevations, Puerto Rico; a native to Mexico and Colombia, cultivated in the tropics."

Qsn #	Question	Answer
	Parker, J.L. & Parsons, B. 2016. New Plant Records from the Big Island for 2015. Bishop Museum Occasional Papers 118: 17–22	"Originally collected by G. Staples on the Big Island in 2007, this Begonia is distinct with its circular, dinner-plate sized, lotus-shaped leaves, which give it its specific epithet. The material examined from our collection was from a steep hillside in a wet, shady valley in Honomū. Also collected by G. Staples in 2007 was material from O‘ahu and determined to be a new naturalized record. Material examined. HAWAII: South Hilo Distr., Old Māmalahoa Hwy, Honomū Gulch, 2198093N 278941e, leaves over 12” across, white flowers on stalks 3–4 ft tall, 25 Jan 2012, J. Parker & R. Parsons BIED165; boundary between North and South Hilo Distr., roadside on Hwy 19, mauka side of highway, on crumbling lava embankment in heavy shade, damp pockets of humus on steep rock face, first naturalized record for the species on Hawai‘i Island, 15 Apr 2007, G. Staples 1303. O‘AHU: Pali Hwy, windward side, 50 ft uphill from pulloff parking area by hairpin turn, steep rock bank in deep shade, under secondary disturbed vegetation of Psidium cattleianum, Citharexylum caudatum, Fraxinus, Schinus, growing in pockets of humus on rock face, first genuinely naturalized record for this species on O‘ahu, 9 mar 2007, G. Staples 1300."

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[Potential weed. Impacts unspecified] "References: Puerto Rico-CW-261, United States of America-N-101, United States of America-N-1114, Cuba-NI-1505, Global- CD-1611, -I-, Cuba-W-2055, Cuba-W-1977, Global--1324"

303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

304	Environmental weed	n
	Source(s)	Notes
	Knox, G. W., Wilson, S. B., Deng, Z. and Freyre, R. 2013. Alternatives to Invasive Plants Commonly Found in North Florida Landscapes. ENH1206. University of Florida Institute of Food and Agricultural Sciences, Gainesville, FL. <a href="http://edis.ifas.ufl.edu">http://edis.ifas.ufl.edu</a> . [Accessed 21 Jul 2017]	"Table 1. Invasive ornamentals commonly found in north Florida landscapes and commonly available native and non-native, non-invasive substitutes" [Invasive ornamental - <i>Colocasia esculenta</i> . Non-native, non-invasive substitute = <i>Begonia nelumbiifolia</i> , Lotus-leaf begonia]

305	Congeneric weed	y
	Source(s)	Notes
	Fox, A. M., Gordon, D. R., & Stocker, R. K. 2003. Challenges of reaching consensus on assessing which non-native plants are invasive in natural areas. HortScience, 38(1): 11-13	"Conversely, wax begonia ( <i>Begonia cucullata</i> Willd.; Category II) and lantana (Category I) were assigned "Caution" in the north (where they both occur) but lantana received "Do not use" and begonia received "Avoid with risk-benefit analysis" in the central and south zones."

Qsn #	Question	Answer
	Imada, C.T. 2007. New Hawaiian plant records for 2005–2006. Bishop Museum Occasional Papers 96: 34-41	"Previously reported as naturalized on Hawai'i (Wagner et al. 1999), <i>B. foliosa</i> is now recorded from O'ahu in very wet native-dominated habitat at Mount Kaala. This matforming herb is described as having brittle stems, making it difficult to remove. The fragmenting stems probably allow it to spread vegetatively. <i>Begonia foliosa</i> var. <i>miniata</i> , the name originally applied to this taxon in Hawaii (Wagner et al. 1999), has subsequently been determined to be a misapplied name (Staples & Herbst 2005). Material examined. OAHU:Waianae Mts, slopes on SE side of Mt Kaala, 1040 m, wet walls just south of stream and waterfall, localized, 4 Jul 1999, S. Perlman & B. Garnett 16703."
	Tassin, J., Triolo, J., & Lavergne, C. 2007. Ornamental plant invasions in mountain forests of Réunion (Mascarene Archipelago): a status review and management directions. <i>African Journal of Ecology</i> , 45(3): 444-447	"Table 1 List of the ornamental species threatening mountain forests on Reunion. Invasiveness status is evaluated as highly invasive (+++), invasive (++) or potentially invasive but detected only in gardens (+)." [Begonia diadema, Begonia foliosa var. miniata, & Begonia rex listed as invasive (++) and targeted for Early detection and control]

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	[No evidence] "Herbaceous; rhizome repent, short, 15 mm. thick, setose, internodes extremely short; stipules persistent, lanceolate, over 2 cm. long, entire, rather firm, pilose; petioles 15-45 cm. long, 8 mm. thick, sparsely rufous-hirsute, soon glabrous; leaf-blades peltate, obliquely very broadly ovate or subelliptic, 7-9-nerved, evenly rounded except for the abruptly acuminate apex or slightly produced at the ends of the nerves, remotely denticulate, soon glabrous, the margin ciliate and sometimes purple, 17-40 cm. long, 10-28 cm. wide, thin; peduncle usually exceeding the leaves, to 66 cm. long, 6 mm. thick, soon glabrous; cymes regular, much branched, diffuse, 2-5 dm. broad; bracts deciduous, ovate, obtuse; pedicels slender, 9-22 mm. long; staminate tepals 2, suborbicular, 6-8 mm. long, white or pale pink; stamens few, anthers narrowly obovate, equaling or longer than the filaments; pistillate flowers ebracteolate; pistillate tepals 2, like the staminate; ovary 3-celled, placentae bifid, ovuliferous on all sides, styles connate at base, distinctly divided, the stigmatic surface linear, spiral, continuous; capsule erect or somewhat nutant, broadly ovoid, 6-10 mm. long, wings very unequal, the largest ovate or deltoid, obtuse, to 15 mm. wide, seeds ellipsoid, blunt."

402	Allelopathic	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown

Qsn #	Question	Answer
403	<b>Parasitic</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	"Herbaceous; rhizome repent, short, 15 mm. thick, setose, internodes extremely short" [Begoniaceae. No evidence]
404	<b>Unpalatable to grazing animals</b>	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2017. Personal Communication	Unknown. Some Begonia species have edible foliage
405	<b>Toxic to animals</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence
406	<b>Host for recognized pests and pathogens</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Backyard Gardener. 2017. Begonia nelumbiifolia (Lily-pad Begonia). <a href="https://www.backyardgardener.com/plantname/begonia-nelumbiifolia-lily-pad-begonia/">https://www.backyardgardener.com/plantname/begonia-nelumbiifolia-lily-pad-begonia/</a> . [Accessed 24 Jul 2017]	[General, widespread pests] "Problems Diseases : Rhizactonia Root and Stem Rot Pest : Thrips Pest : Spider Mites Pest : Mealybugs Pest : Whiteflies Pest : Slugs and Snails Fungi : Powdery Mildew Fungi : Leaf Spots Pest : Scale Insects Fungi : Sooty Mold
407	<b>Causes allergies or is otherwise toxic to humans</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence
408	<b>Creates a fire hazard in natural ecosystems</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Twyford, A. D., Kidner, C. A., & Ennos, R. A. (2015). Maintenance of species boundaries in a Neotropical radiation of Begonia. <i>Molecular Ecology</i> , 24(19), 4982-4993	"Begonia nelumbiifolia grows in moist shaded areas,"

Qsn #	Question	Answer
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	"Damp thickets and forests, alt. 1-1,650 meters" ... "Herbaceous" [No evidence. Unlikely given wet habitat and herbaceous habit]

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Twyford, A. D., Kidner, C. A., & Ennos, R. A. (2015). Maintenance of species boundaries in a Neotropical radiation of <i>Begonia</i> . <i>Molecular Ecology</i> , 24(19), 4982-4993	" <i>Begonia nelumbiifolia</i> grows in moist shaded areas,"
	Parker, J.L. & Parsons, B. 2016. New Plant Records from the Big Island for 2015. <i>Bishop Museum Occasional Papers</i> 118: 17–22	"boundary between North and South Hilo Distr., roadside on Hwy 19, mauka side of highway, on crumbling lava embankment in heavy shade, damp pockets of humus on steep rock face, first naturalized record for the species on Hawai'i Island"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
	Source(s)	Notes
	Backyard Gardener. 2017. <i>Begonia nelumbiifolia</i> (Lily-pad Begonia). <a href="https://www.backyardgardener.com/plantname/begonia-nelumbiifolia-lily-pad-begonia/">https://www.backyardgardener.com/plantname/begonia-nelumbiifolia-lily-pad-begonia/</a> . [Accessed 24 Jul 2017]	"pH Range:6 to 7 Soil Range:Some Sand to Clay Loam Water Range:Moist to Moist "
	The National Gardening Association. 2017. Water Lily Begonia ( <i>Begonia nelumbiifolia</i> ). <a href="https://garden.org/plants/view/109118/Water-Lily-Begonia-Begonia-nelumbiifolia/">https://garden.org/plants/view/109118/Water-Lily-Begonia-Begonia-nelumbiifolia/</a> . [Accessed 24 Jul 2017]	"Soil pH Preferences: Slightly acid (6.1 – 6.5) Neutral (6.6 – 7.3)"
	Dave's Garden. 2017. Lotus Leaved Begonia, Water Lily Begonia - <i>Begonia nelumbiifolia</i> . <a href="http://davesgarden.com/guides/pf/go/49921/">http://davesgarden.com/guides/pf/go/49921/</a> . [Accessed 24 Jul 2017]	"Soil pH requirements: 6.1 to 6.5 (mildly acidic) 6.6 to 7.5 (neutral)"

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	"Herbaceous; rhizome reptent, short, 15 mm. thick, setose,"

412	Forms dense thickets	
	Source(s)	Notes



Qsn #	Question	Answer
	Parker, J.L. & Parsons, B. 2016. New Plant Records from the Big Island for 2015. Bishop Museum Occasional Papers 118: 17–22	[No evidence to date] "Originally collected by G. Staples on the Big Island in 2007, this Begonia is distinct with its circular, dinner-plate sized, lotus-shaped leaves, which give it its specific epithet. The material examined from our collection was from a steep hillside in a wet, shady valley in Honomū. Also collected by G. Staples in 2007 was material from O'ahu and determined to be a new naturalized record. Material examined. HAWAII: South Hilo Distr., Old Māmalahoa Hwy, Honomū Gulch, 2198093N 278941E, leaves over 12" across, white flowers on stalks 3–4 ft tall, 25 Jan 2012, J. Parker & R. Parsons BIED165; boundary between North and South Hilo Distr., roadside on Hwy 19, mauka side of highway, on crumbling lava embankment in heavy shade, damp pockets of humus on steep rock face, first naturalized record for the species on Hawaʻii Island, 15 Apr 2007, G. Staples 1303. O'AHU: Pali Hwy, windward side, 50 ft uphill from pulloff parking area by hairpin turn, steep rock bank in deep shade, under secondary disturbed vegetation of Psidium cattleianum, Citharexylum caudatum, Fraxinus, Schinus, growing in pockets of humus on rock face, first genuinely naturalized record for this species on O'ahu, 9 mar 2007, G. Staples 1300."
	Twyford, A. D., Kidner, C. A., & Ennos, R. A. (2014). Genetic differentiation and species cohesion in two widespread Central American Begonia species. Heredity, 112(4), 382–390	[Potentially yes] "They also differ in their ecologies, with B. nelumbiifolia growing in moist shaded areas and B. heracleifolia in dry sun-exposed areas. These species typically occur in small isolated populations, although they can be locally abundant and form dense stands (Twyford, personal observation)."

501	Aquatic	n
	Source(s)	Notes
	Anonymous. (1958). Flora of Panama. Part VII. Fascicle I. Annals of the Missouri Botanical Garden, 45(1), 1-91	"Herbaceous. Rhizome repent, short, 15 mm. thick, setose, internodes extremely short." ... "on rocky bank, forest along the Rio Indio de Gatun, near sea level"
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	[Terrestrial herb] "Damp thickets and forests, alt. 1-1,650 meters; Alta Verapaz; Izabal; Santa Rosa. Southern Mexico to Colombia."

502	Grass	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 21 Jul 2017]	Genus: Begonia Section: Gireoudia Family: Begoniaceae

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	"Herbaceous; rhizome repent, short, 15 mm. thick, setose" [Begoniaceae]

Qsn #	Question	Answer
504	<b>Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	"Herbaceous; rhizome repent, short, 15 mm. thick, setose, internodes extremely short; stipules persistent, lanceolate, over 2 cm. long, entire, rather firm, pilose; petioles 15-45 cm. long, 8 mm. thick, sparsely rufous-hirsute, soon glabrous; leaf-blades peltate, obliquely very broadly ovate or subelliptic, 7-9-nerved, evenly rounded except for the abruptly acuminate apex or slightly produced at the ends of the nerves, remotely denticulate, soon glabrous, the margin ciliate and sometimes purple, 17-40 cm. long, 10-28 cm. wide, thin"

601	<b>Evidence of substantial reproductive failure in native habitat</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. <a href="http://www.ars-grin.gov/npgs/index.html">http://www.ars-grin.gov/npgs/index.html</a> . [Accessed 21 Jul 2017]	"Native: Northern America Northern Mexico: Mexico - San Luis Potosi Southern Mexico: Mexico - Chiapas, - Federal District, - Hidalgo, - Oaxaca, - Puebla, - Tabasco, - Veracruz Southern America Central America: Belize; Costa Rica; El Salvador; Guatemala; Panama Western South America: Colombia"
	Twyford, A. D., Kidner, C. A., Harrison, N., & Ennos, R. A. (2012). Population history and seed dispersal in widespread Central American Begonia species (Begoniaceae) inferred from plastome derived microsatellite markers. Botanical Journal of the Linnean Society, 171(1), 260-276	[No evidence] "Their widespread distributions ( <i>B. heracleifolia</i> grows from Mexico to Honduras, <i>B. nelumbiifolia</i> from Mexico to Colombia) and their tendency to grow as ruderals differ from most other Begonia spp., which are often narrow endemics in primary habitat (Hughes & Hollingsworth, 2008)."

602	<b>Produces viable seed</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	"capsule erect or somewhat nutant, broadly ovoid, 6-10 mm. long, wings very unequal, the largest ovate or deltoid, obtuse, to 15 mm. wide, seeds ellipsoid, blunt."
	Twyford, A. D., Kidner, C. A., & Ennos, R. A. (2014). Genetic differentiation and species cohesion in two widespread Central American Begonia species. Heredity, 112(4), 382-390	"Self-compatibility was confirmed using greenhouse-grown plants. One cultivated accession of <i>B. nelumbiifolia</i> and five accessions of <i>B. heracleifolia</i> from different populations were self-fertilized. Seeds were germinated in 9-cm pots of finely sieved bark, which were kept in a propagator at 25 1C, and germination was recorded after 6 weeks."

603	<b>Hybridizes naturally</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>

Qsn #	Question	Answer
	Twyford, A. D., Kidner, C. A., & Ennos, R. A. (2015). Maintenance of species boundaries in a Neotropical radiation of <i>Begonia</i> . <i>Molecular Ecology</i> , 24(19), 4982-4993	"We selected two pairs of species that hybridize in the wild: <i>B. heracleifolia</i> and <i>B. nelumbiifolia</i> , and <i>B. heracleifolia</i> and <i>B. sericoneura</i> (Fig. 2; Burt-Utley 1985; R. Morris, pers. comm.)." ... " <i>Begonia nelumbiifolia</i> grows in moist shaded areas, while <i>B. heracleifolia</i> has a preference for dry or seasonally dry habitats (Hoover 1979; Burt-Utley 1985). Natural hybrids have been reported at a number of locations (Burt-Utley 1985), and here, we analyse three sites [sites 1, 2 and 3 (S1, S2 and S3), Table 1] in the South of Mexico."

604	Self-compatible or apomictic	y
	Source(s)	Notes
	Twyford, A. D., Kidner, C. A., & Ennos, R. A. (2014). Genetic differentiation and species cohesion in two widespread Central American <i>Begonia</i> species. <i>Heredity</i> , 112(4), 382-390	"Self-compatibility was confirmed using greenhouse-grown plants. One cultivated accession of <i>B. nelumbiifolia</i> and five accessions of <i>B. heracleifolia</i> from different populations were self-fertilized."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Twyford, A.D. (2012). Speciation and gene flow in Central American <i>Begonia</i> L. (Begoniaceae). PhD Dissertation. The University of Edinburgh, Edinburgh, Scotland	" <i>Begonia</i> have a distinct pollination biology and pattern of seed dispersal. Most <i>Begonia</i> species produce simple white or pink flowers, which are visited by generalist pollinators (Apidae, Halictidae and Trigona bees, Ågren & Schemske, 1991; Wyatt & Sazima, 2011). Pollinators are attracted to male flowers by a pollen reward, and visitation of female flowers is by deceit, as they produce no floral reward but are similar in appearance to the male flowers (Ågren & Schemske, 1991)."
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	"peduncle usually exceeding the leaves, to 66 cm. long, 6 mm. thick, soon glabrous; cymes regular, much branched, diffuse, 2-5 dm. broad; bracts deciduous, ovate, obtuse; pedicels slender, 9-22 mm. long; staminate tepals 2, suborbicular, 6-8 mm. long, white or pale pink; stamens few, anthers narrowly obovate, equaling or longer than the filaments; pistillate flowers ebracteolate; pistillate tepals 2, like the staminate; ovary 3-celled, placentae bifid, ovuliferous on all sides, styles connate at base, distinctly divided, the stigmatic surface linear, spiral, continuous"
	Twyford, A. D., Kidner, C. A., & Ennos, R. A. (2014). Genetic differentiation and species cohesion in two widespread Central American <i>Begonia</i> species. <i>Heredity</i> , 112(4), 382-390	[Self-compatible] "However, as many inflorescences are borne over a flowering season, there are plenty of opportunities for self-pollination. This would particularly be the case for species such as <i>B. nelumbiifolia</i> , which produces many densely-packed inflorescences that can easily become intertwined. Self-pollination in such a way would assure mating success if pollinators are rare, which may be expected in the isolated populations in which <i>Begonia</i> species typically grow."

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes

Qsn #	Question	Answer
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	"Herbaceous; rhizome repent"
	Backyard Gardener. 2017. Begonia nelumbiifolia (Lily-pad Begonia). <a href="https://www.backyardgardener.com/plantname/begonia-nelumbiifolia-lily-pad-begonia/">https://www.backyardgardener.com/plantname/begonia-nelumbiifolia-lily-pad-begonia/</a> . [Accessed 24 Jul 2017]	"Most begonias can be propagated from leaf, stem or rhizome cuttings in addition to being sown from seed. This begonia grows from a creeping rhizome."
	Dave's Garden. 2017. Lotus Leaved Begonia, Water Lily Begonia - <i>Begonia nelumbiifolia</i> . <a href="http://davesgarden.com/guides/pf/go/49921/">http://davesgarden.com/guides/pf/go/49921/</a> . [Accessed 21 Jul 2017]	"Propagation Methods: By dividing the rootball By dividing rhizomes, tubers, corms or bulbs (including offsets) From leaf cuttings From herbaceous stem cuttings From seed; winter sow in vented containers, coldframe or unheated greenhouse By simple layering"

607	Minimum generative time (years)	
	Source(s)	Notes
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	"Herbaceous; rhizome repent, short, 15 mm. thick, setose, internodes extremely short" [Unknown. Probably between 1-2 years]

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	Source(s)	Notes
	Anonymous. (1958). Flora of Panama. Part VII. Fascicle I. Annals of the Missouri Botanical Garden, 45(1), 1-91	"Chepigana District, Cana-Cuasi Trail (Camp I), alt. 240 m.," [Found along trail. Although seeds lack means of external attachment, the small size may allow for adherence to footwear, clothing or equipment]
	Parker, J.L. & Parsons, B. 2016. New Plant Records from the Big Island for 2015. Bishop Museum Occasional Papers 118: 17-22	"roadside on Hwy 19, mauka side of highway, on crumbling lava embankment in heavy shade, damp pockets of humus on steep rock face, first naturalized record for the species on Hawai'i Island, 15 Apr 2007, G. Staples 1303. O'AHU: Pali Hwy, windward side, 50 ft uphill from pulloff parking area by hairpin turn, steep rock bank in deep shade, under secondary disturbed vegetation " [Roadside distribution suggests possible inadvertent movement in soil attached to vehicles or machinery]

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes

Qsn #	Question	Answer
	Dave's Garden. 2017. Lotus Leaved Begonia, Water Lily Begonia - <i>Begonia nelumbiifolia</i> . <a href="http://davesgarden.com/guides/pf/go/49921/">http://davesgarden.com/guides/pf/go/49921/</a> . [Accessed 21 Jul 2017]	"This plant has been said to grow in the following regions: Anniston, Alabama Beverly Hills, California Big Pine Key, Florida Clearwater, Florida De Leon Springs, Florida New Port Richey, Florida Saint Petersburg, Florida Zephyrhills, Florida Kurtistown, Hawaii"
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	Cultivated in Hawaiian Islands as an ornamental

703	Propagules likely to disperse as a produce contaminant	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown. Possibly if grown with other ornamentals

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	de Lange, A. & Bournan, E. 1999. Seed Micromorphology of Neotropical Begonias. Smithsonian Contributions to Botany 90. Smithsonian Institution Press, Washington, D.C.	"On the basis of fruit and seed morphology, it is rather speculative to suggest other types of dispersal in Neotropical begonias. Secondary seed dispersal by rain-wash may occur in the majority of the begonias, including the wind dispersed ones."
	Twyford, A. D., Kidner, C. A., Harrison, N., & Ennos, R. A. (2012). Population history and seed dispersal in widespread Central American Begonia species (Begoniaceae) inferred from plastome derived microsatellite markers. Botanical Journal of the Linnean Society, 171(1), 260-276	[Poorly wind dispersed] "Begonia spp. have tiny seeds that are not known to be dispersed by any animal vectors and are poorly wind dispersed, and therefore effective seed dispersal between populations is expected to be low."

Qsn #	Question	Answer
705	<b>Propagules water dispersed</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Twyford, A. D., Kidner, C. A., Harrison, N., & Ennos, R. A. (2012). Population history and seed dispersal in widespread Central American Begonia species (Begoniaceae) inferred from plastome derived microsatellite markers. <i>Botanical Journal of the Linnean Society</i> , 171(1), 260-276	"Begonia spp. have tiny seeds that are not known to be dispersed by any animal vectors and are poorly wind dispersed, and therefore effective seed dispersal between populations is expected to be low."
	de Lange, A. & Bournan, E. 1999. Seed Micromorphology of Neotropical Begonias. <i>Smithsonian Contributions to Botany</i> 90. Smithsonian Institution Press, Washington, D.C.	"On the basis of fruit and seed morphology, it is rather speculative to suggest other types of dispersal in Neotropical begonias. Secondary seed dispersal by rain-wash may occur in the majority of the begonias, including the wind dispersed ones."
	Anonymous. (1958). <i>Flora of Panama</i> . Part VII. Fascicle I. <i>Annals of the Missouri Botanical Garden</i> , 45(1), 1-91	[Grows along rivers. Possibly water-dispersed] "on rocky bank, forest along the Rio Indio de Gatun, near sea level"
	Standley, P.C. & Williams, L.O. 1961. <i>Flora of Guatemala</i> . Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	[Overland water flow in damp habitat may facilitate dispersal of small Begonia seeds] "Damp thickets and forests, alt. 1-1,650 meters"

706	Propagules bird dispersed	n
	<b>Source(s)</b>	<b>Notes</b>
	Twyford, A. D., Kidner, C. A., Harrison, N., & Ennos, R. A. (2012). Population history and seed dispersal in widespread Central American Begonia species (Begoniaceae) inferred from plastome derived microsatellite markers. <i>Botanical Journal of the Linnean Society</i> , 171(1), 260-276	"Begonia spp. have tiny seeds that are not known to be dispersed by any animal vectors and are poorly wind dispersed, and therefore effective seed dispersal between populations is expected to be low." [No evidence]

707	Propagules dispersed by other animals (externally)	n
	<b>Source(s)</b>	<b>Notes</b>
	de Lange, A. & Bournan, E. 1999. Seed Micromorphology of Neotropical Begonias. <i>Smithsonian Contributions to Botany</i> 90. Smithsonian Institution Press, Washington, D.C.	[No apparent means of animal dispersal or external attachment in <i>Begonia nelumbiifolia</i> , a Neotropical species] "Seed dispersal of the Neotropical begonias, and most probably that of the Asian ones, distinctly differs from seed dispersal in African begonias. In the Neotropical begonias wind dispersal is predominant, and alternative types of dispersal are restricted to a limited number of sections. In Africa only about one fifth of the Begonia species are wind dispersed, almost two fifths are animal-dispersed, and over two-fifths are dispersed by a combination of rain-wash and epizoochory (de Lange and Bouman, 1992)."

708	Propagules survive passage through the gut	n
	<b>Source(s)</b>	<b>Notes</b>

Qsn #	Question	Answer
	de Lange, A. & Bournan, E. 1999. Seed Micromorphology of Neotropical Begonias. Smithsonian Contributions to Botany 90. Smithsonian Institution Press, Washington, D.C.	[No evidence of consumption] "Seed dispersal of the Neotropical begonias, and most probably that of the Asian ones, distinctly differs from seed dispersal in African begonias. In the Neotropical begonias wind dispersal is predominant, and alternative types of dispersal are restricted to a limited number of sections. In Africa only about one fifth of the Begonia species are wind dispersed, almost two fifths are animal-dispersed, and over two-fifths are dispersed by a combination of rain-wash and epizoochory (de Lange and Bouman, 1992)."

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	Standley, P.C. & Williams, L.O. 1961. Flora of Guatemala. Fieldiana: Botany. Volume 24 - Part VII - Number 1. Chicago Natural History Museum	"capsule erect or somewhat nutant, broadly ovoid, 6-10 mm. long, wings very unequal, the largest ovate or deltoid, obtuse, to 15 mm. wide, seeds ellipsoid, blunt." [Densities unknown]

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Royal Botanic Gardens Kew. (2017) Seed Information Database (SID). Version 7.1. Available from: <a href="http://data.kew.org/sid/">http://data.kew.org/sid/</a> . [Accessed 24 Jul 2017]	Unknown. Several Begonia species have orthodox seeds

803	Well controlled by herbicides	
	Source(s)	Notes
	Florida Natural Areas Inventory. 2014. <i>Begonia cucullata</i> . <a href="http://fnai.org/Invasives/Begonia_cucullata_FNAI.pdf">fnai.org/Invasives/Begonia_cucullata_FNAI.pdf</a>	[Unknown. Related taxon controlled with herbicide] "Control Methods: Mechanical: Hand pull seedlings (IFAS, CAIP and FWC) Chemical: Foliar (1% glyphosate, IFAS, CAIP and FWC)"
	WRA Specialist. 2017. Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

Qsn #	Question	Answer
804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	Backyard Gardener. 2017. Begonia nelumbiifolia (Lily-pad Begonia). <a href="https://www.backyardgardener.com/plantname/begonia-nelumbiifolia-lily-pad-begonia/">https://www.backyardgardener.com/plantname/begonia-nelumbiifolia-lily-pad-begonia/</a> . [Accessed 24 Jul 2017]	"Pinching tips and pruning outer stems in the growing season gives a bushier plant, good for hanging baskets."
	Dave's Garden. 2017. Lotus Leaved Begonia, Water Lily Begonia - Begonia nelumbiifolia. <a href="http://davesgarden.com/guides/pf/go/49921/">http://davesgarden.com/guides/pf/go/49921/</a> . [Accessed 24 Jul 2017]	"Propagation Methods: By dividing the rootball By dividing rhizomes, tubers, corms or bulbs (including offsets) From leaf cuttings From herbaceous stem cuttings From seed; winter sow in vented containers, coldframe or unheated greenhouse By simple layering" [Possibly. May be able to tolerate mutilation, or cutting into pieces, if able to be propagated vegetatively]

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown



**Summary of Risk Traits:**

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Thrives in tropical climates
- Naturalized on Hawaii Island and Puerto Rico
- Other *Begonia* species have become invasive
- Shade-tolerant
- May form dense stands in native range
- Reproduces by seeds and vegetatively by rhizomes
- Hybridizes with other *Begonia* species
- Self-compatible
- Seeds dispersed by wind, possibly water & intentionally by people

Low Risk Traits

- Despite naturalization, negative impacts have not been documented to date
- Unarmed (no spines, thorns, or burrs)
- Non-toxic
- Ornamental
- Herbicides may be able to effectively control this plant