

<i>Bruguiera gymnorrhiza</i> (Largeleaf mangrove, Oriental mangrove)		Answer	Score
1.01	Is the species highly domesticated?	n	0
1.02	Has the species become naturalised where grown?		
1.03	Does the species have weedy races?		
2.01	Species suited to FL climates (USDA hardiness zones; 0-low, 1-intermediate, 2-high)	2	
2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	
2.03	Broad climate suitability (environmental versatility)	y	1
2.04	Native or naturalized in regions with an average of 11-60 inches of annual precipitation	y	1
2.05	Does the species have a history of repeated introductions outside its natural range?	n	
3.01	Naturalized beyond native range	n	0
3.02	Garden/amenity/disturbance weed	n	0
3.03	Weed of agriculture	n	0
3.04	Environmental weed	?	
3.05	Congeneric weed		
4.01	Produces spines, thorns or burrs	n	0
4.02	Allelopathic	y	1
4.03	Parasitic	n	0
4.04	Unpalatable to grazing animals		
4.05	Toxic to animals	n	0
4.06	Host for recognised pests and pathogens	n	0
4.07	Causes allergies or is otherwise toxic to humans	n	0
4.08	Creates a fire hazard in natural ecosystems	n	0
4.09	Is a shade tolerant plant at some stage of its life cycle	y	1
4.10	Grows on infertile soils (oligotrophic, limerock, or excessively draining soils). North & Central Zones: infertile soils; South Zone: shallow limerock or Histisols.	n	0
4.11	Climbing or smothering growth habit	n	0
4.12	Forms dense thickets	n	0
5.01	Aquatic	y	5
5.02	Grass	n	0
5.03	Nitrogen fixing woody plant	n	0
5.04	Geophyte	n	0
6.01	Evidence of substantial reproductive failure in native habitat	n	0
6.02	Produces viable seed	y	1
6.03	Hybridizes naturally	y	1
6.04	Self-compatible or apomictic	n	-1
6.05	Requires specialist pollinators	n	0
6.06	Reproduction by vegetative propagation	n	-1
6.07	Minimum generative time (years)		

7.01	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
7.02	Propagules dispersed intentionally by people	y	1
7.03	Propagules likely to disperse as a produce contaminant	n	-1
7.04	Propagules adapted to wind dispersal	n	-1
7.05	Propagules water dispersed	y	1
7.06	Propagules bird dispersed	n	-1
7.07	Propagules dispersed by other animals (externally)	n	-1
7.08	Propagules dispersed by other animals (internally)	n	-1
8.01	Prolific seed production		
8.02	Evidence that a persistent propagule bank is formed (>1 yr)	n	-1
8.03	Well controlled by herbicides		
8.04	Tolerates, or benefits from, mutilation or cultivation		
8.05	Effective natural enemies present in U.S.		
	Total Score		5
	Implemented Pacific Second Screening		Yes
	Risk Assessment Results		Accept

	Reference	Source data
1.01		Cultivated, but no evidence of selection for reduced weediness.
1.02		Skip to question 2.01 since question 1.01 received a No.
1.03		Skip to question 2.01 since question 1.01 received a No.
2.01	1. PERAL NAPPFAST Global Plant Hardiness (http://www.nappfast.org/Plant_hardiness/NAPPFAST%20Global%20zones/10-year%20climate/PLANT_HARDINESS_10YR%20lgnnd.tif). 2. USDA/ARS-GRIN [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. Available: http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?405679 . 3. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	No computer analysis was performed. 1. Global plant hardiness zones: (8-?) 9-12. 2. Native: Africa (Kenya, Madagascar, Mauritius, Seychelles, South Africa, Tanzania); Asia-Temperate (Japan, Taiwan); Asia-Tropical (Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand, Vietnam); Australia (New South Wales, Northern Territory, Queensland); Pacific (Fiji, Marshall Islands, Micronesia, Samoa, Tonga). 3. Found in tropical intertidal areas from the eastern coast of Africa through Asia to the Ryukyu Islands of southern Japan, into Micronesia and Polynesia (Samoa), and southward to subtropical Australia (Queensland, New South Wales and Western Australia).
2.02		No computer analysis was performed. Native range is well known; refer to source data from 2.01.
2.03	1. Köppen-Geiger climate map (http://www.hydrol-earth-syst-sci.net/11/1633/2007/hess-11-1633-2007.pdf). 2. Refer to all references in question 2.01.	1. Distribution in the native and cultivated ranges is very widespread and occurs in more than 3 climatic groups.
2.04	1. Globalis (http://globalis.gvu.unu.edu/ [Accessed: 12/8/2010]). 2. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1. Africa: 100-1000 mm (4-39 in); Asia 1000-2000 mm (39-79 in); Australia 100-2000 mm (4-79 in). 2. Mean annual rainfall 1000-8000 mm (40-315 in).
2.05	1.a-b. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1.a. There is little evidence that large-leafed mangrove occurs widely outside of its natural range. 1.b. It is possible that it occurs in the Hawaiian Islands, but recently the species of <i>Bruguiera</i> naturalized on O'ahu was found to be <i>B. sexangula</i> , not <i>B. gymnorrhiza</i> as previously reported (Allen et al. 2000).

3.01	1.a-b. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1.a. There is little evidence that large-leafed mangrove occurs widely outside of its natural range. 1.b. It is possible that it occurs in the Hawaiian Islands, but recently the species of <i>Bruguiera</i> naturalized on O'ahu was found to be <i>B. sexangula</i> , not <i>B. gymnorrhiza</i> as previously reported (Allen et al. 2000).
3.02		
3.03		
3.04	1.a-b. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1.a. Invasive potential: Can be invasive; not recommended for planting outside of its natural range. 1.b. Although the invasiveness of large-leafed mangrove has not been demonstrated, it is likely to be easily opportunistic due to its shade tolerance and its relatively wide range of tolerance for salinity and soil conditions.
3.05		
4.01		
4.02	1. Chen et al. 2009. Effects of aqueous extracts of 5 mangrove spp. on cabbage germination and hypocotyl of <i>Kandelia candel</i> . <i>Allelopathy Journal</i> 23(2): 469-476. 2. Chen & Peng. 2008. Allelopathic potential of mangrove plants (<i>Aricennia marina</i> , <i>Aegiceras corniculata</i> and <i>Bruguiera gymnorrhiza</i>). <i>Allelopathy Journal</i> 22(1): 213-220.	1. The aqueous extracts prepared from fresh leaves of mangrove trees (... , <i>Bruguiera gymnorrhiza</i>) and applied to test species, reduced their germination rate and seedlings growth. The mangrove spp. (<i>R. stylosa</i> , <i>B. gymnorrhiza</i>) drastically inhibited the growth of <i>K. candel</i> and may replace it in natural succession. Our results suggested that allelopathy may be one of the major driving forces regulating the mangrove forest succession. 2. Abstract: We investigated the allelopathic potential of volatiles and soils of 3 mangrove species (<i>Aricennia marina</i> , <i>Aegiceras corniculata</i> and <i>Bruguiera gymnorrhiza</i>) on the germination and early growth of (<i>Raphanus sativus</i> L. and lettuce (<i>Lactuca sativa</i> L.). The volatiles of these mangroves spp at various concentrations, (i) reduced the germination and seedling growth of the test crops (radish, lettuce) and (ii) the soil leachates drastically decreased (60% of control) root and seedling elongation, when activated carbon (with high affinity to adsorb the organic compounds) was added. The roots of test species were most sensitive to allelochemicals. The results showed that these mangrove spp. were allelopathic.
4.03		

4.04	1. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1. Few mammals appear to use large-leafed mangrove as a major food source.
4.05	1. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1. Grapsid crabs and weevils frequently damage propagules and/or leaves. 1.b. Numerous insects, crabs, and mollusks graze on green leaves in the forest canopy. Sesarmid crabs consume an unknown quantity of fallen leaves and propagules. Organic matter processed by these herbivores is believed to broadly support aquatic food chains in coastal regions. Birds notably feed and depend on floral nectaries of <i>Bruguiera</i> species.
4.06	1.a-b. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1.a. No reports were found of large-leafed mangrove serving as the host for a known crop pest or pathogen. 1.b. Susceptibility to pests and pathogens is believed to be low, with the exception of grapsid crabs and weevils, which frequently damage propagules and/or leaves.
4.07	1. Rudjiman, 1991. <i>Bruguiera gymnorrhiza</i> (L.) Savigny[Internet] Record from Proseabase. Lemmens, R.H.M.J. and Wulijarni-Soetjipto, N. (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org .	1. Economic importance as a food additive for flavoring.
4.08	1. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1. It has no tolerance of fire in close proximity.
4.09	1. Rudjiman, 1991. <i>Bruguiera gymnorrhiza</i> (L.) Savigny[Internet] Record from Proseabase. Lemmens, R.H.M.J. and Wulijarni-Soetjipto, N. (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . 2. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1. It is a shade tolerant species, and able to establish itself even in pure stands of <i>Rhizophora</i> L. 2. Large-leafed mangrove is one of the most shade tolerant mangrove species. Seedlings may persist and grow under a full forest canopy (even less than 10% full sunlight).

4.10	1.a-b. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1.a. Wide range; trees thrive best in river estuaries. 1.b. Trees develop greatest stature and columnar growth form in estuaries of larger tropical rivers, characterized by fine clay and black mud sediments with relatively high levels of organic carbon.
4.11	1. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1. Large-leafed mangrove is normally a single-stemmed tree with short buttresses and characteristic "knee roots." It is a medium to tall tree that may reach 30–35 m (100–115 ft) in height, although it is commonly much shorter. Diameters are commonly about 15–35 cm (6–14 in).
4.12	1. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1. Large-leafed mangrove is normally a single-stemmed tree with short buttresses and characteristic "knee roots." It is a medium to tall tree that may reach 30–35 m (100–115 ft) in height, although it is commonly much shorter. Diameters are commonly about 15–35 cm (6–14 in).
5.01	1. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorrhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1. Intertidal zones, 0–2 m (0–6.6 ft), or the elevation range between mean sea level and highest tide.
5.02		1. Family: Rhizophoraceae
5.03	1. Uchino, et al. 1984. Nitrogen-fixing bacteria from warty lenticellate bark of a mangrove tree, <i>Bruguiera gymnorrhiza</i> (L.) Lamk. <i>Applied and Environmental Microbiology</i> 47(1): 44-48.	1. The nitrogen fixing bacteria associated with the warts of <i>B. gymnorrhiza</i> bark are considered to contribute to the nitrogen economy of the mangrove forest ecosystems. The results of this investigation suggest that the acetylene reduction activity of lenticellate warts of <i>Bruguiera gymnorrhiza</i> mangrove trunk bark is due to the presence in the warts of nitrogen-fixing bacteria belonging to the family <i>Enterobacteriaceae</i> .
5.04		1. Family: Rhizophoraceae
6.01		No evidence.

6.02	<p>1. Rudjiman, 1991. <i>Bruguiera gymnorhiza</i> (L.) Savigny[Internet] Record from Proseabase. Lemmens, R.H.M.J. and Wulijarni-Soetjipto, N. (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org. 2.a-c. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai‘i. <http://www.traditionaltree.org>.</p>	<p>1. Seed is viviparous, i.e. the seeds germinate while still attached to the tree. After the seedlings are released they fall vertically into the mud and immediately become established. 2.a. Flowering and “fruiting” occur continuously throughout the year, although distinctly seasonal peaks of hypocotyl production were reported for July–August in northern parts of the range and January–February in southern parts. 2.b. Large-leafed mangrove is viviparous, meaning that the species produces seeds hidden in the mature calyx (post-flowering) that germinate on the parent plant. 2.c. Large-leafed mangrove regenerates effectively by natural dispersal and seedling establishment.</p>
6.03	<p>1. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai‘i. <http://www.traditionaltree.org>.</p>	<p>1. <i>B. gymnorhiza</i> is also reported to hybridize with <i>B. sexangula</i> , giving progeny called <i>B. rhynchopetala</i> .</p>
6.04	<p>1. Ping Ge, J. et al. 2005. Mating system and population genetic structure of <i>Bruguiera gymnorhiza</i> (Rhizophoraceae), a viviparous mangrove species in China. <i>Journal of Experimental Marine Biology and Ecology</i> 326: 48-55.</p>	<p>1. The mating system of this species is of mix-mating and mainly of outcrossing.</p>
6.05	<p>1. Kondo, K. et al. 1991. Pollination in <i>Bruguiera gymnorhiza</i> Rhizophoraceae in Miyara River Ishigaki Island Japan and Phangnga Thailand. <i>Plant Species Biology</i> 6(2): 105-110. 2. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai‘i. <http://www.traditionaltree.org>.</p>	<p>1. <i>Bruguiera gymnorhiza</i> is bird-pollinated but with the possibility of some pollination indirectly by wind. 2. Birds notably feed and depend on floral nectaries of <i>Bruguiera</i> species. The relationship with birds is so well developed that this plant-animal relationship has co-evolved to create an unusual explosive pollen-release mechanism in <i>Bruguiera</i> plants to disperse pollen to neighboring trees using bird visitors.</p>
6.06	<p>1. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai‘i. <http://www.traditionaltree.org>.</p>	<p>Not capable of increasing its numbers by vegetative means. 1. Does not coppice well but does respond much better to cutting and leaf removal than <i>Rhizophora</i> species, with sprouting along larger stems below leafy rosettes.</p>
6.07	<p>1. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai‘i. <http://www.traditionaltree.org>.</p>	<p>1. Trees have notable and long periods of reproductive development.</p>

7.01		
7.02	1. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1. Large-leafed mangrove plantations have been established on Fiji for land reclamation and timber.
7.03		
7.04		
7.05	1. Rudjiman, 1991. <i>Bruguiera gymnorhiza</i> (L.) Savigny[Internet] Record from Proseabase. Lemmens, R.H.M.J. and Wulijarni-Soetjipto, N. (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . 2. The Herbarium Catalogue (2006). Published on the Internet http://www.kew.org/herbcat [12/7/2010]'. 2. The Herbarium Catalogue (2006). Published on the Internet http://www.kew.org/herbcat [12/7/2010]'	1. Seedlings can remain alive, floating in the water, for 5—6 months, which possibly explains the large area of distribution. 2. Floating in saltwater currents.
7.06		
7.07		
7.08		
8.01		
8.02	1. Rudjiman, 1991. <i>Bruguiera gymnorhiza</i> (L.) Savigny[Internet] Record from Proseabase. Lemmens, R.H.M.J. and Wulijarni-Soetjipto, N. (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia. http://www.proseanet.org . 2. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >. 3. Basak, U.C. & Das, P. 2002. <i>In vivo</i> induction of multiple shoots up of propagation of tree mangrove <i>Bruguiera gymnorhiza</i> (Linn.) Sav. (Rhizophoraceae). <i>Indian Journal of Marine Sciences</i> 31(3): 249-250.	1. Seed is viviparous, i.e. the seeds germinate while still attached to the tree. After the seedlings are released they fall vertically into the mud and immediately become established. 2. Large-leafed mangrove is viviparous, meaning that the species produces seeds hidden in the mature calyx (post-flowering) that germinate on the parent plant. 3. Natural regeneration is restricted due to...sporadic flowering and poor seed set.
8.03		
8.04	1. Allen, J.A., and N.C. Duke. 2006. <i>Bruguiera gymnorhiza</i> (large-leafed mangrove), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. < http://www.traditionaltree.org >.	1. No reports were found of pollarding practices.
8.05		