Lumnitzera racemosa (Black Mangrove, Whited-Flowered Black 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?	y	
3.01	Naturalized beyond native range	y	2
3.02	Garden/amenity/disturbance weed	n	0
3.03	Weed of agriculture	n	0
3.04	Environmental weed	n	0
3.05	Congeneric weed	n	0
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		
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.	y	1
4.11	Climbing or smothering growth habit	n	0
4.12	Forms dense thickets	n	0
5.01	Aquatic	n	0
5.02	Grass	n	0
5.03	Nitrogen fixing woody plant	?	
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	y	1
6.05	Requires specialist pollinators	n	0
6.06	Reproduction by vegetative propagation	y	1
6.07	Minimum generative time (years)		

7.01	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n	-1
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		
7.07	Propagules dispersed by other animals (externally)	n	-1
7.08	Propagules dispersed by other animals (internally)		
8.01	Prolific seed production	?	
8.02	Evidence that a persistent propagule bank is formed (>1 yr)	?	
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	**9**	
	Implemented Pacific Second Screening	**No**	
	Risk Assessment Results	**Reject**	

	Reference	Source data
1.01		Cultivated, but no evidence of selection for reduced weediness
1.02		Skip to 2.01
1.03		Skip to 2.01
2.01	1. PERAL NAPPFAST Global Plant Hardiness (http://www.nappfast.org/Plant_hardiness/NAPPFAST%20Global%20zones/10-year%20climate/PLANT_HARDINESS_10YR%20lgnd.tif). 2. Discover Life (http://pick5.pick.uga.edu/mp/20m?kind=lumnitzera+racemosa). 3. Flora of Taiwan Editorial Committee, ed. (1975) Flora of Taiwan, Vol.III. Epoch Pub. Co. Taipei, Taiwan.	**No computer analysis was performed**. 1. Global plant hardiness zones 9-13. 2. Distribution: Africa (Comoros, Madagascar, Tanzania); Australia (northern coasts of Western Australia, Northern Territory, & Queensland); Japan (Ishigaki Islandof the Yaeyama Islands); Papua New Guinea (Central, Gulf, Milne Bay, Morobe, Northern, Western); Philippines (Luzon Island); Seychelles; Sri Lanka (Eastern); Taiwan.
2.02		**No computer analysis was performed**. 1. Native range is well known; refer to 2.01 source data.
2.03	1. Köppen-Geiger climate map (http://www.hydrol-earth-syst-sci.net/11/1633/2007/hess-11-1633-2007.pdf).	1. Distribution in the native range is fairly widespread, so there are most likely at least 3 climatic groups.

2.04	1.a. Australia; b. Japan; c.New Caledonia; d. Papua New Guinea; e. Philillpines; f. Sri Lanka; g. Taiwan: Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005. Very high resolution interpolated climatesurfaces for global land areas. International Journal of Climatology 25:1965-1978 (http://www.worldclim.org/). 2. Comoros: Best Country Reports, World Trade Press; http://www.bestcountryreports.com/Precipitation_Map_Comoros.html. 3. Madagascar: Best Country Reports, World Trade Press; http://www.bestcountryreports.com/Precipitation_Map_Madagascar.html. 4. Seychelles: Irrigation in Africa in figures. Food and Agriculture Organization of the United Nations. Rome, 1995; http://www.fao.org/docrep/V8260B/V8260B1g.htm. 5. Tanzania: Best Country Reports, World Trade Press; http://www.bestcountryreports.com/Precipitation_Map_Tanzania.html. 6. Duke, N.C. Australia's Mangroves. The authoritative guid to Australia's mangrove plants. University of Queensland, Brisbane. p. 200. 7. Su, Guo-Hua, et al. Genetic variation in *Lumnitzera racemosa* , a mangrove species from the Indo-West Pacific. 8. Selvam, V. Trees and Shrubs of the Maldives. 2007. FAO Regional Office for Asia and the Pacific. Thammada Press Co.,Ltd., Bangkok, Thailand. RAP Publication No. 2007/12.	1. a. Australia: 11.8"-94.5"; b. Japan: 98"-118"; c. New Caledonia: 39"-118"; d. Papua New Guinea: 39"-197"; e. Philippines: 59"-197"; f. Sri Lanka: 59"-79"; g. Taiwan: 59"-98". 2. Comoros: 49.2"-98.4". 3. Madagascar: 3.9"-98.4". 4. Seychelles: 69". 5. Tanzania: 29.5"-98.4". 6. "*Lumnitzera racemosa* is distributed from East Africa to India, Asia and Australia (in AU: in estuaries and embayments along the northern coast from Roebuck Bay near Broom, Westen Australia (17° 57' S, 122° 15' E) in the west across the Northern Territory, to Moreton Bay, Queensland (27° 22' S, 153° 10' E) in the east." 7. "*Lumnitzera racemosa* is characteristic of landward, high salinity areas in the mangrove occurring from East Africa to Tonga in the Pacific and north Australia." 8. In Maldives: "common; found along the boarder of closed and open lagoons both in the northern and southern islands."
2.05	1. Fourqurean, J.W. et al. 2010. Are mangroves in the tropical Atlantic ripe for invasion? Exotic mangrove trees in the forests of South Florida. *Biological Invasions* , 12: 2509-2522.	1. *Lumnitzera racemosa* , was planted in Tonga for reclamation/stailization efforts of land.
3.01	1. Fourqurean, J.W. et al. 2010. Are mangroves in the tropical Atlantic ripe for invasion? Exotic mangrove trees in the forests of South Florida. *Biological Invasions* , 12: 2509-2522.	1. Clarke & Thaman (1993) report that *L. racemosa* is well-established in Tonga.
3.02		
3.03		
3.04		
3.05		
4.01		No evidence
4.02	1. Kathiresan, K. & B.L. Bingham. 2001. Biology of Mangroves and Mangrove Ecosystems. In: Advances in Marine Biology 40: 81-251. Accessed at: http://www.ac.wwu.edu/~bingham/mangroves.pdf; 6/16/2009.	1. "Toxic leachates from leaf litter of some mangroves (e.g. *Lumnitzera racemosa* …) inhibit the growth of roots and shoots of *Rhizophora apiculata* and *R. mucronata* seedlings."
4.03		No evidence

4.04		
4.05		No evidence
4.06	1. Burrows, D.W. & J.K. Balciunas. 1999. Host-Range and Distribution of *Eucerocoris suspecutus* (Hemiptera: Miridae), a Potential Biological Control Agent for the Paperbark Tree *Melaleuca quinquenervia* (Myrtaceae). Biological Control; 28(2): 290-99.	1. "Damage (from *Eucerocoris suspectus* , a leaf-blotching bug) was only noted on *Melaleuca* spp. except on one occasion where minor feeding damage from was found on 2 *L. racemosa* trees adjacent to a more heavily damaged *M. quinquenervia* ."
4.07	1. Upadhyay, V.P. et al. 2008. Distribution of Mangrove Species within Bhitarkanika National Park in Orissa, India. *Trees for Life Journal* ; 3:4.	1. "Indigenous medicines are prepared from *Lumnitzera racemosa* (herpes and itches)."
4.08		
4.09	1. Macnae, William. 1968. A General Account of the Fauna and Flora of Mangrove Swamps and Forests in the Indo-West-Pacific Region. *In* : Russell, Sir F.S. & Sir M. Yonge (eds.), Advance in Marine Biology, Vol. 6. Academic Press, New York. 2. Saenger, P. 2002. Mangrove ecology, silviculture, and conservation. Kluwer Academic Publishers, Boston. p. 350.	1. "*Lumnitzera racemose* normally develops under light shade of landward fringe avicennias or in the shelter of grasses and rushes." 2. "Presumed shade-tolerance characteristics of mature mangroves based on field and laboratory observations, Lumnizera spp. is shade-intolerant (represented in Table 4.2).
4.10	1. Tomlinson et al. 1978. Lumnitzera rosea (Comretaceae) - its status and floral morphology. J. Arnold Arboretum; 59(1): 342-51. 2. Selvam, V. Trees and Shrubs of the Maldives. 2007. FAO Regional Office for Asia and the Pacific. Thammada Press Co.,Ltd., Bangkok, Thailand. RAP Publication No. 2007/12.	1. *L. racemosa* is normally encountered under the harsh conditions at the margins of bare salt pans. 2. "It prefers less moist, well-drained, sandy soil mixed with clay for better performance."
4.11	1. Selvam, V. Trees and Shrubs of the Maldives. 2007. FAO Regional Office for Asia and the Pacific. Thammada Press Co.,Ltd., Bangkok, Thailand. RAP Publication No. 2007/12. 2.a-b Duke, N.C. 2006. Australia's Mangroves. The authoritative guid to Australia's mangrove plants. University of Queensland, Brisbane. p. 200.	1. Family: *Combretaceae* ; evergreen, medium sized, erect and much-branched tree that grows up to 10 m. 2.a. "*Lumnitzera racemosa* often occurs as scattered sparse shrubs along upland mangrove margins of relatively arid area." 2.b. "In wetter places, L. racemosa often form diminutive forests of slender trees…"
4.12	1. Duke, N.C. 2006. Australia's Mangroves. The authoritative guid to Australia's mangrove plants. University of Queensland, Brisbane. p. 200.	1.a. "*Lumnitzera racemosa* often occurs as scattered sparse shrubs along upland mangrove margins." 1.b. "In wetter places, *L. racemosa* often form diminutive forests of slender trees…"
5.01	1. Selvam, V. Trees and Shrubs of the Maldives. 2007. FAO Regional Office for Asia and the Pacific. Thammada Press Co.,Ltd., Bangkok, Thailand. RAP Publication No. 2007/12. 2. Duke, N.C. 2006. Australia's Mangroves. The authoritative guide to Australia's mangrove plants. University of Queensland, Brisbane. p. 200.	1. Evergreen, medium sized, erect and much-branched tree that grows up to 10 m. 2.a. "*Lumnitzera racemosa* often occurs along mangrove margins of relatively arid areas." 1.b. "*Lumnitzera racemosais* distributed in AU: in estuaries and embayments along the northern coast from Roebuck Bay near Broom**,** Westen Australia (17° 57' S, 122° 15' E) in the west across the Northern Territory, to Moreton Bay, Queensland (27° 22' S, 153° 10' E) in the east."

5.02	1. Selvam, V. Trees and Shrubs of the Maldives. 2007. FAO Regional Office for Asia and the Pacific. Thammada Press Co.,Ltd., Bangkok, Thailand. RAP Publication No. 2007/12.	1. Family: *Combretaceae* .
5.03	1. Selvam, V. Trees and Shrubs of the Maldives. 2007. FAO Regional Office for Asia and the Pacific. Thammada Press Co.,Ltd., Bangkok, Thailand. RAP Publication No. 2007/12. 2. Muzuka, A.N.N & J.P. Shunula (2006) Stable isotope compositions of organic carbon and nitrogen of two mangrove stands along the Tanzanian coastal zone. *Estuarine, Coastal and Shelf Science* , 66: 447-458.	1. Family: *Combretaceae* . 2. Low $\delta^{15}N$ values observed in the present study can be attributed to either atmospheric nitrogen fixation or utilization of inorganic nitrogen depleted in ^{15}N. Plants capable of fixing atmospheric nitrogen have ^{15}N values close to that of atmospheric nitrogen. Nitrongen fixation has been observed to take place in sediments underlying the mangroves and on pneumatophores. Cyanobacteria capable of fixing nitrogen in Tanzanian mangrove forests have been observed. These results indicate that mangrove species are capable of fixing atmospheric nitrogen, but more work is required to identify the type of bacteria responsible for nitrogen fixation and whether mangroves or organisms living symbiotically are responsible for the nitrogen fixation.
5.04	1. Selvam, V. Trees and Shrubs of the Maldives. 2007. FAO Regional Office for Asia and the Pacific. Thammada Press Co.,Ltd., Bangkok, Thailand. RAP Publication No. 2007/12.	1. Family: *Combretaceae* ; evergreen, medium sized, erect and much-branched tree that grows up to 10 m.
6.01		
6.02	1. Tomlinson, P.B. 1986. The botany of mangroves. Cambridge University Press. Petersham, Massachusetts. p.143. 2. Selvam, V. Trees and Shrubs of the Maldives. 2007. FAO Regional Office for Asia and the Pacific. Thammada Press Co.,Ltd., Bangkok, Thailand. RAP Publication No. 2007/12. 3. Clarke, P.J. et al. 2001. Dispersal potential and early growth in 14 tropical mangroves: do early life history traits correlate with patterns of adult distribution? Journal of Ecology; 89(4): 648-659	1. "...single trees in cultivation set viable seed, and seed set in wild populations is often high, with all the flowers in a head setting fruit." & "In nature most floating fruits lose their viability, but those taken directly from trees germinate fairly readily." 2. "Natural regeneration is very high. Germinations rates decrease with increasing salinity and no germination will be seen if the salinity increases beyond 25ppt." 3. "*L. racemosa* never showed signs of root or shoot development. Dissection of *L. racemosa* fruits revealed a viable embryo in 60% of fruits and this is therefore regarded as the only innately dormant species."

6.03	1. a.- d. Tomlinson, P.B., et al. 1978. Lumnitzera rosea (Combretaceae) - its status and floral morphology. *J. Arnold Arboretum* 59(1): 342-51. 2. Lovelock, Catherine. 1993 (Reprint 1999). Field guide to the Mangroves of Queensland. Australian Institute of Marine Sciences (www.aims.gov.au). 3. Duke, N.C. 2006. Australia's Mangroves. The authoritative guid to Australia's mangrove plants. University of Queensland, Brisbane. p. 200.	1.a. "We provide evidence that the form (*Lumnitzera* X *rosea*) is a hybrid, *L. littorea* X *L. racemosa* ." b. "The intermediate status of this (*Lumnitzera* X *rosea*) pink-flowered form strongly suggests its hybrid origin. This is further supported by pollen sterility of about 40%, a figure representing those grains that are collasped and shriveled and that remain unstained in iodine-potassium iodide solution. Pollen sterility in both putative parents is less that 1%." c. "Current evidence from the collections and observations made in Queensland populations strongly suggest that hybrid *Lumnitzera littorea* X *racemosa* occurs as occasional individuals when the parental species grow together." d. "Persistence for hybrids in *Lumnitzera* is facilitated by vegetative spread that results from rooting of pendulous lower branches." 2. "A hybrid of these two species (i.e., *L. racemosa* and *L. littorea*), called *Lumnitzera* X *rosea* , may also be found. The hybrid has pink flowers." 3. "*Limnitzura* X *rosea* is a the hybrid of *L. littorea* and *L. racemosa* ."
6.04	1. Kathiresan, K. & B.L. Bingham. 2001. Biology of Mangroves and Mangrove Ecosystems. In: Advances in Marine Biology 40: 81-251. Accessed at: http://www.ac.wwu.edu/~bingham/mangroves.pdf; 6/16/2009. 2. Tomlinson, P.B. 1986. The botany of mangroves. Cambridge University Press. Petersham, Massachusetts. p.143.	1. "*Lumnitzera racemosa* are self-pollinated." 2. "May be self-compatible, since single trees in cultivation set viable seed, and seed set in wild populations is often high."
6.05	1. Kathiresan, K. & B.L. Bingham. 2001. Biology of Mangroves and Mangrove Ecosystems. In: Advances in Marine Biology 40: 81-251. Accessed at: http://www.ac.wwu.edu/~bingham/mangroves.pdf; 6/16/2009. 2. Tomlinson, P.B. 1986. The botany of mangroves. Cambr	1.a. "*L. racemosa* are pollinated by insects." 1.b. "Some wasps and flies are highly dependent on mangroves for nesting and are particularly important pollinators of *Lumnitzera racemosa* ." 2. "Visited by a variety of day-active wasps, bees, butterflies, and moths."
6.06	1. Tomlinson, P.B. 1986. The botany of mangroves. Cambridge University Press. Petersham, Massachusetts. p.143. 2. Selvam, V. Trees and Shrubs of the Maldives. 2007. FAO Regional Office for Asia and the Pacific. Thammada Press Co.,Ltd., Bangkok, Thailand. RAP Publication No. 2007/12.	1. "Persistence for hybrids in *Lumnitzera* is facilitated by vegetative spread that results from rooting of pendulous lower branches." 2. "Natural regeneration is very high."
6.07		
7.01		

7.02	1. Schwartz, M.L (2005) Encyclopedia of Coastal Science. Accessed: http://books.google.com/books?id=VWnxpAxp6TMC&pg=PA61&lpg=PA61&dq=lumnitzera+racemosa+%2B+land+stabilization&source=bl&ots=9CvUEVbWbo&sig=gaUZYYrdm666DvZ0Fh1Ta0pKXJg&hl=en&ei=q3KVS5KvMM-vtgeXrInVCg&sa=X&oi=book_result&ct=result&resnum=3&ved=0CBIQ6AEwAjgK#v=onepage&q=lumnitzera%20racemosa%20%2B%20land%20stabilization&f=true [2010, March 8].	1. "A few mangrove species, especially *Lumnitzera racemosa* , tolerate the dry, acidic conditions on the slopes of coastal dikes. Local farmers in Vietnam often plant these mangroves to provide shade and wind protection for their houses and farmlands."
7.03		
7.04		Species does not posesses traits indicating wind disperseal.
7.05	1. Tomlinson, P.B. 1986. The botany of mangroves. Cambridge University Press. Petersham, Massachusetts. p.143. 2. Duke, N.C. Australia's Mangroves. The authoritative guid to Australia's mangrove plants. University of Queensland, Brisbane. p. 200. 3. Selvam, V. Trees and Shrubs of the Maldives. 2007. FAO Regional Office for Asia and the Pacific. Thammada Press Co.,Ltd., Bangkok, Thailand. RAP Publication No. 2007/12. 4. Su, Guo-Hua, et al. Genetic variation in Lumnitzera racemosa, a mangrove species from the Indo-West Pacific. 5. Clarke, P.J. et al. 2001. Dispersal potential and early growth in 14 tropical mangroves: do early life history traits correlate with patterns of adult distribution? *Journal of Ecology* ; 89(4): 648-659	1. "Fruits dispersed by water." 2. "Fruit is buoyant as drupe." 3. "Fruit...corky, buoyant, and dispersed by currents." 4. "Fruits are...fibrous after floating. These characteristics may help the fruits disperse through ocean currents. However, opinions on the ability of mangrove propagules or fruits to be dispersed over great ocean distances have long been contradictory." 5. "Buoyancy of *L. racemosa* varied with the density of the solution. *L. racemosa* floats for long periods and initiate roots and shoots more slowly than other floating species."
7.06		
7.07		No mechanisms of attachment.
7.08		
8.01	1. Tomlinson, P.B. 1986. The botany of mangroves. Cambridge University Press. Petersham, Massachusetts. p.143.	1. "Seed set in wild populations is often high, with all the flowers in a head setting fruit."

8.02	1. Saenger, P. 2002. Mangrove ecology, silviculture, and conservation. Kluwer Academic Publishers, Boston. p. 350.	1. "A persistent seedling bank appears to be an important survival strategy in mangrove communities, allowing the broadcasting of propagules throughout the intertidal zone, particularly in years when propagules are abundant. The broadcasted propagules can persist for some months, depending on the actual conditions encountered, undergo vigorous growth under optimal conditions, or gradually detetiorate if the conditions become or remain unfavorable. This strategy may be termed 'sow and reap' approach where propagules are dispersed as widely as locally possible, with outcomes determined by the specific conditions encountered by each propagule."
8.03		
8.04		
8.05		