

Australia/New Zealand Weed Risk Assessment adapted for Florida.

Data used for analysis published in: Gordon, D.R., D.A. Onderdonk, A.M. Fox, R.K. Stocker, and C. Gantz. 2008. Predicting Invasive Plants in Florida using the Australian Weed Risk Assessment. Invasive Plant Science and Management 1: 178-195.

<i>Artocarpus heterophyllus (jackfruit)</i>			
Question number	Question	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 Florida's USDA climate 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)		
2.04	Native or naturalized in habitats with periodic inundation	n	0
2.05	Does the species have a history of repeated introductions outside its natural range?	y	
3.01	Naturalized beyond native range	y	0
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	n	0
4.03	Parasitic	n	0
4.04	Unpalatable to grazing animals	n	-1
4.05	Toxic to animals	n	0
4.06	Host for recognised pests and pathogens	?	
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	?	
4.1	Grows on infertile soils (oligotrophic, limerock, or excessively draining soils)	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	n	0
5.04	Geophyte	n	0
6.01	Evidence of substantial reproductive failure in native habitat		
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 fragmentation	n	-1
6.07	Minimum generative time (years)	3	0
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	n	-1
7.06	Propagules bird dispersed	?	
7.07	Propagules dispersed by other animals (externally)	n	-1
7.08	Propagules dispersed by other animals (internally)	y	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 Florida, or east of the continental divide		
Total Score			-1

Outcome	Accept*
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*Used secondary screen from: Daehler, C. C., J.L. Denslow, S. Ansari, and H. Kuo. 2004. A risk assessment system for screening out harmful invasive pest plants from Hawaii's and other Pacific islands. *Conserv. Biol.* 18: 360-368.

section	# questions answered	satisfy minimum?
A	7	yes
B	10	yes
C	17	yes
total	34	yes

Data collected 2006-2007

Question number	Reference	Source data
1.01	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	"Since time immemorial it has been cultivated" [but selection has likely been for more fruits]
1.02		
1.03		
2.01	1. Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia. 2. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	1. "jackfruit thrives in warm and humid climates below 1000 m" 2. "The jackfruit is adapted only to humid tropical and near-tropical climates."
2.02		
2.03		
2.04	1. Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia. 2. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	1. "it has poor...flooding tolerance" 2. "It cannot tolerate 'wet feet'. If the roots touch water, the tree will not bear fruit or may die."
2.05	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	"The jackfruit is most probably indigenous to and in the past grew wild in the rain forests of the Western Ghats, India. Since time immemorial it has been cultivated; it was introduced and became naturalized in many parts of the tropics, particularly in the South-East Asian region."
3.01	1. Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia. 2. Kairo, Ali, Cheesman, Haysom, and Murphy (2003) Invasive Species Threats in the Caribbean Region. Report to the Nature Conservancy. 3. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	1. "The jackfruit is most probably indigenous to and in the past grew wild in the rain forests of the Western Ghats, India. Since time immemorial it has been cultivated; it was introduced and became naturalized in many parts of the tropics, particularly in the South-East Asian region." 2. Naturalized in Puerto Rico. 3. "It is common in the Philippines, both cultivated and naturalized."
3.02		no evidence

3.03		no evidence
3.04		no evidence
3.05		no evidence
4.01	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	no description of these traits
4.02		no evidence
4.03	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	no description of this
4.04	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	"Young leaves are readily eaten by cattle and other livestock."
4.05	1. Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia. 2. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	1. "Young leaves are readily eaten by cattle and other livestock." 2. "In some areas, the jackfruit is fed to cattle... Surplus jackfruit rind is considered a good stock food."
4.06	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	"A host of diseases and pests has been reported, but few are specific to jackfruit, and crop protection is not a major concern for growers."
4.07	1. Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia. 2. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	1. "pulp of ripe fruit is eaten fresh or made into various local delicacies... The seeds are eaten after boiling or roasting" 2. "Tender jackfruit leaves and young male flower clusters may be cooked and served as vegetables."
4.08		no evidence
4.09	1. Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia. 2. Crane, JH, CF Balerdi, and I Maguire (2005) Jackfruit growing in the Florida home landscape. University of Florida, IFAS Extension, HS882 (http://edis.ifas.ufl.edu/pdffiles/MG/MG37000.pdf).	1. "The seedlings are best raised under shade (50-70% of full light intensity)." 2. "In general, jackfruit trees should be planted in full sun for best growth and fruit production."
4.1	1. Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia. 2. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	1. "The tree can be grown on different types of soil but performs best on deep, well-drained, alluvial, sandy or clay loam soils with pH 6.0-7.5." 2. "The jackfruit tree flourishes in rich, deep soil of medium or open texture... It will grow, but more slowly and not as tall in shallow limestone. In India, they say that the tree grows tall and thin on sand, short and thick on stony land."
4.11	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	"Medium-sized, evergreen, monoecious tree up to 20(-30) m tall"

4.12		no evidence
5.01		terrestrial
5.02	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 (http://plants.usda.gov). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	Moraceae
5.03	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 (http://plants.usda.gov). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	Moraceae
5.04	Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	tap root
6.01		
6.02	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	"Propagation is normally by seeds".
6.03	1. Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia. 2. Wasielewski, J and RJ Campbell (1999) Jackfruit breeding at Fairchild Tropical Garden, Miami, FL, USA. Proceedings of the Florida State Horticultural Society 112: 218-219.	1. "Jackfruit and chempedak [<i>A. integer</i>] occasionally hybridize". 2. The cultivar 'Cheena' is a natural hybrid between jackfruit and chempedak (<i>Artocarpus integer</i>).
6.04	1. Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia. 2. Crane, JH, CF Balerdi, and I Maguire (2005) Jackfruit growing in the Florida home landscape. University of Florida, IFAS Extension, HS882 (http://edis.ifas.ufl.edu/pdffiles/MG/MG37000.pdf).	1. "Being protandrous and cross-pollinated..." 2. "Jackfruit...generally require cross-pollination for satisfactory fruit production."
6.05	1. Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia. 2. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami. 3. Campbell, RJ, S El-Sawa, J Wasielewski, N Ledesma, and T Ayala-Silva (2004) Breeding and selection of jackfruit for South Florida. Proceedings of the Florida State Horticultural Society 117: 193-194.	1. "At anthesis the male heads are dusted with sticky yellow pollen and emit a sweet scent which attracts small insects such as flies and beetles. These may be the pollinating agents, but few insects visit the female heads and in India pollination has been reported to be effected by wind." [either way, not specialist pollinators] 2. "normal wind-pollination" 3. "their breeding system is characterized as insect-assisted wind pollinated (El-Sawa, 1998). Beetles, ants and other insects are attracted to the male inflorescences, where they physically dislodge the pollen, which is transported on the wind to the receptive female inflorescence."
6.06	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	"vegetative propagation is difficult" [even artificial means of vegetative propagation are difficult]
6.07	1. Verheij and Coronel, eds. (1992) Plant Resources	1. "Trees raised from seed start

	of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia. 2. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami. 3. Crane, JH, CF Balerdi, and I Maguire (2005) Jackfruit growing in the Florida home landscape. University of Florida, IFAS Extension, HS882 (http://edis.ifas.ufl.edu/pdffiles/MG/MG37000.pdf).	flowering at the age of 2-8 years." [plus time to bear mature fruit] 2. "Seedlings may ordinarily take 4 to 14 years to come into bearing, though certain precocious cultivars may begin to bear in 2 1/2 to 3 1/2 years." 3. "trees may begin production in the 3rd to 4th year"
7.01		
7.02	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	"Since time immemorial it has been cultivated; it was introduced and became naturalized in many parts of the tropics"
7.03		no evidence
7.04	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	"Fruit (syncarp) barrel- or pear-shaped, 30-100 cm x 25-50 cm". [no evidence of any adaptations for wind dispersal]
7.05		no evidence
7.06		fleshy fruit, but possibly too large for birds
7.07	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	"Fruit (syncarp) barrel- or pear-shaped, 30-100 cm x 25-50 cm". [no evidence of any means of attachment]
7.08	Cunha, AA, MV Vieira, and CEV Grelle (2006) Preliminary observations on habitat, support use and diet in two non-native primates in an urban Atlantic forest fragment: the capuchin monkey (<i>Cebus</i> sp.) and the common marmoset (<i>Callithrix jacchus</i>) in the Tijuca forest, Rio de Janeiro. Urban Ecosystems 9: 351-359.	"For <i>Cebus</i> sp. the exotic jackfruit (<i>Artocarpus heterophyllus</i>) was the most important food item."
8.01	1. Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia. 2. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami. 3. Crane, JH, CF Balerdi, and I Maguire (2005) Jackfruit growing in the Florida home landscape. University of Florida, IFAS Extension, HS882 (http://edis.ifas.ufl.edu/pdffiles/MG/MG37000.pdf).	1. "A well-developed fruit may contain up to 500 seeds...The usual density [in an orchard] is 100-120 trees/ha...Potential yield has been variously estimated as (20-)100-200(-500) fruit/tree per year, each fruit weighing (10-)20-30(-50) kg...However, the actual yield is a tiny fraction of these unrealistic figures...The average yield is about 70-100 kg/tree per year in Malaysia and the Philippines". 2. "There may be 100 or up to 500 seeds in a single fruit...In India, a good yield is 150 large fruits per tree annually, though some bear as many as 250". 3. "number [of seeds] per fruit varies from 30 to 500...Mature jackfruit trees may produce from 40 to over 250 pounds (18-114 kg) per

		tree...Trees that average 150 pounds (68 kg) per tree or more are considered good producers." [-300 seeds/fruit x 150 fruits/tree gives 45,000 seeds/tree; 120 trees/ha x 45,000 seeds/tree gives 5,400,000 seeds/10,000 m ² = 540 seeds/m ² ; but this is under orchard conditions designed to maximize yield, and estimates of seed number and actual yield highly variable]
8.02	Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	"The seed is sown fresh; if short-term storage is necessary, the seed should not be allowed to dry out...Under suitable conditions germination begins within 10 days and 80-100% germination is achieved within 35-40 days after sowing." [implies little to no dormancy]
8.03		
8.04		
8.05		