

**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>Aleurites moluccana (Indian walnut)</i>			
Question number	Question	Answer	Score
1.01	Is the species highly domesticated?	y	-3
1.02	Has the species become naturalised where grown?	y	1
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	y	0
3.05	Congeneric weed	?	
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		
4.05	Toxic to animals	y	1
4.06	Host for recognised pests and pathogens	n	0
4.07	Causes allergies or is otherwise toxic to humans	y	1
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		
6.04	Self-compatible or apomictic		
6.05	Requires specialist pollinators		

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)	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	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	n	-1
8.02	Evidence that a persistent propagule bank is formed (>1 yr)	y	1
8.03	Well controlled by herbicides	y	-1
8.04	Tolerates, or benefits from, mutilation or cultivation	?	
8.05	Effective natural enemies present in Florida, or east of the continental divide		
<b>Total Score</b>			<b>3</b>

<b>Outcome</b>	<b>Evaluate*</b>
----------------	------------------

\*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.

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

Data collected 2006-2007

Question number	Reference	Source data
1.01	1. Hunter (1990) Candlenut tree: a Polynesian legacy. Pacific Horticulture 51: 54-55. 2. Elevitch and Manner (2006) <i>Aleurites moluccana</i> (kukui), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i ( <a href="http://www.agroforestry.net/tti/Aleurites-kukui.pdf">http://www.agroforestry.net/tti/Aleurites-kukui.pdf</a> ).	1. "Botanical author Sterling Macoboy called it 'one of the great domesticated trees of the world.'" 2. "Kukui is one of the great domesticated multipurpose trees of the world."
1.02	1. Kairo, Ali, Cheesman, Haysom, and Murphy (2003) Invasive Species Threats in the Caribbean Region. Report to the Nature Conservancy. 2. New Zealand Plant Conservation Network (2005) New Zealand Adventive Vascular Plant List. 3. Elevitch and Manner (2006) <i>Aleurites moluccana</i> (kukui), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i ( <a href="http://www.agroforestry.net/tti/Aleurites-kukui.pdf">http://www.agroforestry.net/tti/Aleurites-kukui.pdf</a> ).	1. considered naturalized in Puerto Rico and the Dominican Republic 2. considered fully naturalized in New Zealand 3. "Kukui has naturalized in several Pacific islands, particularly in Hawai'i, and has the potential to become established outside of cultivation."
1.03		
2.01	1. USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA. 2. Elevitch and Manner (2006) <i>Aleurites moluccana</i> (kukui), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i ( <a href="http://www.agroforestry.net/tti/Aleurites-kukui.pdf">http://www.agroforestry.net/tti/Aleurites-kukui.pdf</a> ).	1. minimum temperature: 49°F 2. "Subtropical dry to wet and tropical very dry to wet forest climates."
2.02		
2.03		
2.04	1. de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden. 2. Elevitch and Manner (2006) <i>Aleurites moluccana</i> (kukui), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i ( <a href="http://www.agroforestry.net/tti/Aleurites-kukui.pdf">http://www.agroforestry.net/tti/Aleurites-kukui.pdf</a> ).	1. " <i>A. moluccana</i> occurs commonly in the drier regions of South-East Asia." 2. "requires free drainage" of soil
2.05	Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256.	"grows wild in the rainforests of the islands of Malaysia...; also in Melanesia and Polynesia; and is widely cultivated in the tropics"
3.01	1. Kairo, Ali, Cheesman, Haysom, and Murphy (2003) Invasive Species Threats in the Caribbean Region. Report to the Nature Conservancy. 2. New Zealand Plant Conservation Network (2005) New Zealand Adventive Vascular Plant List. 3. Elevitch and Manner (2006) <i>Aleurites moluccana</i> (kukui), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i ( <a href="http://www.agroforestry.net/tti/Aleurites-kukui.pdf">http://www.agroforestry.net/tti/Aleurites-kukui.pdf</a> ).	1. considered naturalized in Puerto Rico and the Dominican Republic 2. considered fully naturalized in New Zealand 3. "Kukui has naturalized in several Pacific islands, particularly in Hawai'i,

		and has the potential to become established outside of cultivation."
3.02		no evidence
3.03		no evidence
3.04	1. Kairo, Ali, Cheesman, Haysom, and Murphy (2003) Invasive Species Threats in the Caribbean Region. Report to the Nature Conservancy. 2. Meyer, J-Y (2000) Preliminary review of the invasive plants in the Pacific islands (SPREP Member Countries). In: Sherley, G. (tech. ed.). Invasive species in the Pacific: A technical review and draft regional strategy. South Pacific Regional Environment Programme, Samoa.	1. Considered naturalized and invasive in the Dominican Republic. 2. Considered a moderate invader in the Pitcairn Islands.
3.05	1. Kairo, Ali, Cheesman, Haysom, and Murphy (2003) Invasive Species Threats in the Caribbean Region. Report to the Nature Conservancy. 2. de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	<i>A. fordii</i> and <i>A. trisperma</i> considered naturalized and invasive in the Dominican Republic (1), but de Guzman and Siemonsma (1999) consider these species to be in different genera.
4.01	Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256.	no description of these traits
4.02	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	not allelopathic
4.03	Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256.	no description of this
4.04		
4.05	de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	"The oil cake...is not recommended as animal feed because of its toxic effects."
4.06	1. Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256. 2. Elevitch and Manner (2006) <i>Aleurites moluccana</i> (kukui), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i ( <a href="http://www.agroforestry.net/tti/Aleurites-kukui.pdf">http://www.agroforestry.net/tti/Aleurites-kukui.pdf</a> ).	1. "The tree is free of pests" 2. "Pests or diseases rarely seriously affect kukui. There are no pests of economic importance (Siemonsma 1999)."
4.07	1. Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256. 2. Elevitch and Manner (2006) <i>Aleurites moluccana</i> (kukui), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i ( <a href="http://www.agroforestry.net/tti/Aleurites-kukui.pdf">http://www.agroforestry.net/tti/Aleurites-kukui.pdf</a> ). 3. USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center,	1. "It is somewhat toxic, indigestible, or purgative when raw...After roasting, the kernel is edible and widely consumed." 2. "Caution is advised in using the plant medicinally or for consumption, as all parts of the tree are toxic." BUT 3. no toxicity

	Baton Rouge, LA 70874-4490 USA.	
4.08		no evidence
4.09	1. USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA. 2. Elevitch and Manner (2006) <i>Aleurites moluccana</i> (kukui), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i ( <a href="http://www.agroforestry.net/tti/Aleurites-kukui.pdf">http://www.agroforestry.net/tti/Aleurites-kukui.pdf</a> ).	1. shade tolerance: intermediate 2. "Kukui can grow in a modest amount of shade, up to 25%."
4.1	1. Elevitch and Manner (2006) <i>Aleurites moluccana</i> (kukui), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i ( <a href="http://www.agroforestry.net/tti/Aleurites-kukui.pdf">http://www.agroforestry.net/tti/Aleurites-kukui.pdf</a> ). 2. de Guzman and Siemonsma, eds. (1999) Plant Resources of South-East Asia. No 13. Spices. Backhuys Publishers, Leiden.	1. "Prefers light and medium textured soils; grows even on basalt, red loams, stony clay ground, sand, and limestone." "grows readily on poor soils" 2. "In the more humid parts [of South-East Asia] it is found naturally in rather specific locations, such as well-drained sands near the coast and on limestone"
4.11	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	growth habit: tree
4.12		no evidence
5.01		terrestrial
5.02	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	Euphorbiaceae
5.03	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	does not fix nitrogen (and Euphorbiaceae)
5.04	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	not propagated by bulbs, corms, or tubers
6.01		
6.02	1. USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA. 2. Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256.	propagated by seed (1, 2)
6.03		
6.04		
6.05		
6.06	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various	vegetative spread rate: none

	sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	
6.07	1. Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256. 2. Elevitch and Manner (2006) <i>Aleurites moluccana</i> (kukui), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i ( <a href="http://www.agroforestry.net/tti/Aleurites-kukui.pdf">http://www.agroforestry.net/tti/Aleurites-kukui.pdf</a> ).	1. "Some trees flower and fruit when only 3 yrs old" 2. "Flowering and fruiting begins at 3–4 years old."
7.01	1. Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256. 2. Wagner, Herbst, and Sohmer (1999) Manual of the flowering plants of Hawai'i. University of Hawai'i Press/Bishop Museum Press, Honolulu.	1. "nearly round fruits, to 2 1/2 in wide" 2. seed is 3-4 cm in diameter [very large fruit/seed with no means of attachment, and no spread by vegetative means]
7.02	Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256.	"widely cultivated in the tropics"
7.03		no evidence
7.04	Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256.	"nearly round fruits, to 2 1/2 in wide"
7.05	Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256.	"the seeds are believed incapable of floating on ocean currents"
7.06	Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256.	"The candlenut is a favorite food of the cassowary" [unclear whether they are seed dispersers or predators]
7.07	Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256.	"nearly round fruits, to 2 1/2 in wide" [no evidence of any means of attachment]
7.08	1. Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256. 2. Osunkoya (1994) Postdispersal survivorship of north Queensland rainforest seeds and fruits: effects of forest, habitat and species. Australian Journal of Ecology 19: 52-64.	1. "The kernels were an important food for wild hogs" [unclear whether they are seed dispersers or predators] 2. Mammals are considered the major dispersal vector of <i>A. moluccana</i> .
8.01	1. Morton (1992) The candlenut tree, handsome and wind-resistant, is a neglected ornamental in Florida. Proceedings of the Florida State Horticultural Society 105: 251-256. 2. Elevitch and Manner (2006) <i>Aleurites moluccana</i> (kukui), ver. 2.1. In: Elevitch, C.R. (ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i ( <a href="http://www.agroforestry.net/tti/Aleurites-kukui.pdf">http://www.agroforestry.net/tti/Aleurites-kukui.pdf</a> ).	1. Mature trees produce between 5,000 and 15,000 nuts annually. 2. Yields 80 kg seeds per tree/year in cultivation; about 100-120 seeds/kg (gives 8,000 to 9,600 seeds per tree/year). Tree commonly attains height of 10 m, with canopy diameter about

		as wide as tree is tall. (Assuming 10 m crown diameter, crown area = 78.5 m <sup>2</sup> . Morton's broader yield range gives 64-191 seeds/m <sup>2</sup> .)
8.02	<p>1. Hunt, Sakuma, and Shibata (2002) New Caledonian crows drop candle-nuts onto rock from communally used forks on branches. <i>Emu</i> 102: 283-290. 2. Osunkoya (1994) Postdispersal survivorship of north Queensland rainforest seeds and fruits: effects of forest, habitat and species. <i>Australian Journal of Ecology</i> 19: 52-64. 3. de Guzman and Siemonsma, eds. (1999) <i>Plant Resources of South-East Asia</i>. No 13. Spices. Backhuys Publishers, Leiden.</p>	<p>1. "After falling from the tree they [the nuts] lose their thick exocarp then dry to a hard, stone-like ball and remain viable on the ground for many months, if not years." 2. germination of freshly dispersed seeds considered delayed (&gt;6 months); seeds have very hard seed coats 3. "The hard-shelled seeds retain their viability for over a year."</p>
8.03	<p>PIER, Institute of Pacific Islands Forestry (<a href="http://www.hear.org/pier/species/aleurites_moluccana.htm">http://www.hear.org/pier/species/aleurites_moluccana.htm</a>).</p>	<p>"Where control is needed, trees can be cut down and stumps treated with glyphosate to prevent resprouting."</p>
8.04	<p>Elevitch and Manner (2006) <i>Aleurites moluccana</i> (kukui), ver. 2.1. In: Elevitch, C.R. (ed.). <i>Species Profiles for Pacific Island Agroforestry</i>. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i (<a href="http://www.agroforestry.net/tti/Aleurites-kukui.pdf">http://www.agroforestry.net/tti/Aleurites-kukui.pdf</a>).</p>	<p>"The species is probably intolerant of fire." "Kukui regrows very well even after severe pruning, although it has a tendency to die after two or more prunings in quick succession."</p>
8.05		