

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>Melaleuca quinquenervia (paper bark)</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	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	0
3.02	Garden/amenity/disturbance weed	n	0
3.03	Weed of agriculture	y	0
3.04	Environmental weed	y	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		
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	y	1
4.08	Creates a fire hazard in natural ecosystems	y	1
4.09	Is a shade tolerant plant at some stage of its life cycle	y	1
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	y	1
5.01	Aquatic	n	0

5.02	Grass	n	0
5.03	Nitrogen fixing woody plant	n	0
5.04	Geophyte		
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	y	1
6.05	Requires specialist pollinators	n	0
6.06	Reproduction by vegetative fragmentation	y	1
6.07	Minimum generative time (years)	2	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	y	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	y	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	y	1
8.05	Effective natural enemies present in Florida, or east of the continental divide		
<b>Total Score</b>			<b>20</b>

<b>Outcome</b>	<b>Reject*</b>
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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	11	yes
C	19	yes
total	37	yes

Data collected 2006-2007

Question number	Reference	Source data
1.01		cultivated, but no evidence of selection for reduced weediness
1.02		
1.03		
2.01	Geary and Woodall (1990) <i>Melaleuca quinquenervia</i> (Cav.) S. T. Blake. In Burns and Honkala (eds) <i>Silvics of North America, Vol. 2. Hardwoods. Agricultural Handbook 654.</i> Washington, DC: USDA, Forest Service.	In Hawaii, good growth of melaleuca occurs at mean annual temperatures from 24° to 18°C.
2.02		
2.03		
2.04	Geary and Woodall (1990) <i>Melaleuca quinquenervia</i> (Cav.) S. T. Blake. In Burns and Honkala (eds) <i>Silvics of North America, Vol. 2. Hardwoods. Agricultural Handbook 654.</i> Washington, DC: USDA, Forest Service.	"In melaleuca's Australian habitat, soils are...flooded or wet for most of the year".
2.05	1. Wagner, Herbst, and Sohmer (1999) <i>Manual of the flowering plants of Hawai'i.</i> University of Hawai'i Press/Bishop Museum Press, Honolulu. 2. Geary and Woodall (1990) <i>Melaleuca quinquenervia</i> (Cav.) S. T. Blake. In Burns and Honkala (eds) <i>Silvics of North America, Vol. 2. Hardwoods. Agricultural Handbook 654.</i> Washington, DC: USDA, Forest Service.	1. "in Hawai'i over 1.7 million trees have been planted in forestry plots" 2. brought to the US as an ornamental
3.01	1. Wagner, Herbst, and Sohmer (1999) <i>Manual of the flowering plants of Hawai'i.</i> University of Hawai'i Press/Bishop Museum Press, Honolulu. 2. Kairo, Ali, Cheesman, Haysom, and Murphy (2003) <i>Invasive Species Threats in the Caribbean Region. Report to the Nature Conservancy.</i>	1. "it is now naturalized in disturbed mesic forest" 2. naturalized or invasive on several Caribbean islands
3.02		no evidence
3.03	Waterhouse (1997) <i>The major invertebrate pests and weeds of agriculture and plantation forestry in the southern and western Pacific.</i> ACIAR Monograph No. 44, 99p.	<i>M. quinquenervia</i> considered a major weed of agriculture in the Pacific
3.04	Kairo, Ali, Cheesman, Haysom, and Murphy (2003) <i>Invasive Species Threats in the Caribbean Region. Report to the Nature Conservancy.</i>	<i>M. quinquenervia</i> considered invasive in the Bahamas, Puerto

		Rico, and the Dominican Republic.
3.05		no evidence
4.01	Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	no description of these traits
4.02		no evidence
4.03	Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	no description of this
4.04		
4.05		no evidence
4.06	Geary and Woodall (1990) <i>Melaleuca quinquenervia</i> (Cav.) S. T. Blake. In Burns and Honkala (eds) Silvics of North America, Vol. 2. Hardwoods. Agricultural Handbook 654. Washington, DC: USDA, Forest Service.	"Melaleuca seems to be unusually free of disease , even in its native habitat."
4.07	Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	produces allergies in some humans
4.08	Turner, Center, Burrows, and Buckingham (1998) Ecology and Management of <i>Melaleuca quinquenervia</i> , an invader of wetlands in Florida, U.S.A. Wetlands Ecology and Management 5: 165-178.	"The fire hazard associated with proximity to paperbark forests is perhaps of greater concern. Paperbark trees burn with extremely hot crown fires because of high foliar concentrations of essential oils. Such fires are difficult to extinguish and often threaten buildings near infested areas."
4.09	Hortocopia 4.0	full shade to full sun
4.1	Geary and Woodall (1990) <i>Melaleuca quinquenervia</i> (Cav.) S. T. Blake. In Burns and Honkala (eds) Silvics of North America, Vol. 2. Hardwoods. Agricultural Handbook 654. Washington, DC: USDA, Forest Service.	"In melaleuca's Australian habitat, soils are nutrient deficient"
4.11	Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	tree
4.12	Turner, Center, Burrows, and Buckingham (1998) Ecology and Management of <i>Melaleuca quinquenervia</i> , an invader of wetlands in Florida, U.S.A. Wetlands Ecology and Management 5: 165-178.	"Fire also induces massive seed release, which can create extremely dense stands of trees, with as many as 250,000/ha in stands of 3-4 m tall trees."
5.01	Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	tree
5.02	Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	Myrtaceae
5.03	Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	Myrtaceae
5.04		
6.01		
6.02	Rayachhetry, Van, and Center (1998) Regeneration potential of the canopy-held seeds of <i>Melaleuca quinquenervia</i> in South Florida. International Journal of Plant Sciences 159: 648-654.	An average of 15%, 9%, and 7% of total seeds were filled (embryonic), viable, and germinable, respectively.
6.03		
6.04	Munger, Gregory T. 2005. <i>Melaleuca quinquenervia</i> . In: Fire Effects Information System, [Online]. U.S.	Melaleuca has a mixed breeding system in which outcrossing is

	Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <a href="http://www.fs.fed.us/database/feis/">http://www.fs.fed.us/database/feis/</a> [2005, December 9].	promoted, but inbreeding is allowed.
6.05	Munger, Gregory T. 2005. <i>Melaleuca quinquenervia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <a href="http://www.fs.fed.us/database/feis/">http://www.fs.fed.us/database/feis/</a> [2005, December 9].	pollinated by a variety of insects, especially honeybees
6.06	1. Turner, Center, Burrows, and Buckingham (1998) Ecology and Management of <i>Melaleuca quinquenervia</i> , an invader of wetlands in Florida, U.S.A. <i>Wetlands Ecology and Management</i> 5: 165-178. 2. Geary and Woodall (1990) <i>Melaleuca quinquenervia</i> (Cav.) S. T. Blake. In Burns and Honkala (eds) <i>Silvics of North America</i> , Vol. 2. Hardwoods. Agricultural Handbook 654. Washington, DC: USDA, Forest Service.	1. <i>Melaleuca</i> "has the capability of root sprouting" 2. "Root suckering is rare but can be profuse when it occurs."
6.07	1. Munger, Gregory T. 2005. <i>Melaleuca quinquenervia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <a href="http://www.fs.fed.us/database/feis/">http://www.fs.fed.us/database/feis/</a> [2005, December 9]. 2. Geary and Woodall (1990) <i>Melaleuca quinquenervia</i> (Cav.) S. T. Blake. In Burns and Honkala (eds) <i>Silvics of North America</i> , Vol. 2. Hardwoods. Agricultural Handbook 654. Washington, DC: USDA, Forest Service.	1. Flowering and seed production observed in numerous wild <i>melaleuca</i> seedlings estimated at < 2 years old. 2. "flowering typically begins by age 3"
7.01		
7.02	1. Hortocopia 4.0. 2. Geary and Woodall (1990) <i>Melaleuca quinquenervia</i> (Cav.) S. T. Blake. In Burns and Honkala (eds) <i>Silvics of North America</i> , Vol. 2. Hardwoods. Agricultural Handbook 654. Washington, DC: USDA, Forest Service.	Used ornamentally in the U.S. (1), and planted in Hawaii to conserve soil on deforested sites (2).
7.03		no evidence
7.04	Woodall (1982) Seed dispersal in <i>Melaleuca quinquenervia</i> . <i>Florida Scientist</i> 45: 81-93.	"The distance of effective dispersal was within 15 times the height of the seed tree...the greatest total number of seeds were caught, and at the greatest distance, downwind of the prevailing winds."
7.05	Woodall (1982) Seed dispersal in <i>Melaleuca quinquenervia</i> . <i>Florida Scientist</i> 45: 81-93.	"...some seed inevitably falls during flooded periods. Fresh <i>melaleuca</i> seeds resist wetting and can rest atop the surface-tension film for days. Dispersal by water currents...may in very special - and limited - circumstances transport

		seeds farther than wind dispersal."
7.06		wind dispersed
7.07	Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	no evidence of any means of attachment
7.08		wind dispersed
8.01	Rayachhetry, Van, and Center (1998) Regeneration potential of the canopy-held seeds of <i>Melaleuca quinquenervia</i> in South Florida. International Journal of Plant Sciences 159: 648-654.	"...we estimated that a paperbark tree...may bear as much as...1.7 kg (about 51 million) of dry seeds...This tree may bear about 5.6 million (9% of 51 million) viable seeds that are capable of producing seedlings."
8.02	1. Rayachhetry, Van, and Center (1998) Regeneration potential of the canopy-held seeds of <i>Melaleuca quinquenervia</i> in South Florida. International Journal of Plant Sciences 159: 648-654. 2. Woodall (1982) Seed dispersal in <i>Melaleuca quinquenervia</i> . Florida Scientist 45: 81-93.	1. " <i>Melaleuca quinquenervia</i> produces and maintains extensive seed reservoirs in the forest canopy...Overall, an average of...7% of the total seeds were...germinable." % germinable was lower for oldest capsule clusters, but appears >1% (see Fig. 2; age of clusters unknown). 2. "...a 15% germination percentage can be maintained by even the oldest capsules found on large old trees"
8.03	Stocker and Sanders (1997) Control of melaleuca seedlings and trees by herbicides. Journal of Aquatic Plant Management 35: 55-59.	"Field tests of several herbicides at Lake Okeechobee, Florida, demonstrated effective control of melaleuca seedlings and mature trees. The lowest tested rates...of bromacil, hexazinone, and tebuthiuron...produced complete mortality of melaleuca seedlings within six weeks of treatment."
8.04	Munger, Gregory T. 2005. <i>Melaleuca quinquenervia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <a href="http://www.fs.fed.us/database/feis/">http://www.fs.fed.us/database/feis/</a> [2005, December 9].	" <i>Melaleuca</i> sprouts from branches and stems in response to frost, fire, mechanical, and herbicidal damage. When branches or stems are cut or broken, multiple sprouts are produced from buds located beneath the bark and within inches of the injury. Entire crowns of saplings and large trees that are defoliated by frost or fire can recover in just a few months by epicormic sprouting." The release of seeds is also triggered by disturbance.
8.05		