

**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>Manilkara zapota (sapodilla)</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	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	y	1
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	n	0
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	?	
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	y	1
6.05	Requires specialist pollinators	n	0
6.06	Reproduction by vegetative fragmentation		
6.07	Minimum generative time (years)	4	-1
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	n	-1
8.02	Evidence that a persistent propagule bank is formed (>1 yr)	?	
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>5</b>

<b>Outcome</b>	<b>Evaluate*</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	10	yes
C	16	yes
total	33	yes

Data collected 2006-2007

Question number	Reference	Source data
1.01	Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	"The species is found in forests throughout Central America where it has apparently been cultivated since ancient times." [selection has likely been for more fruit, making it potentially more, not less, weedy]
1.02		
1.03		
2.01	1. Rocas (2003) <i>Manilkara zapota</i> (L.) P. Royen. Tropical Tree Seed Manual, Species Descriptions. Reforestation, Nurseries, and Genetics Resources ( <a href="http://www.rngr.net/Publications/ttsm/Folder.2003-07-11.4726/PDF.2004-03-15.2415/file">http://www.rngr.net/Publications/ttsm/Folder.2003-07-11.4726/PDF.2004-03-15.2415/file</a> ). 2. Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	1. "The regions where the tree is found have an average annual temperature of 26°C, with a maximum temperature of 36.7°C and a minimum temperature of 14.9°C." 2. hardiness zones 10-11
2.02		
2.03		
2.04	Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	"Good drainage is essential, the tree bearing poorly in low, wet locations."
2.05	Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	"The species is found in forests throughout Central America where it has apparently been cultivated since ancient times. It was introduced long ago throughout tropical America... Early in colonial times, it was carried to the Phillipines and later was adopted everywhere in the Old World tropics."
3.01	Kairo, Ali, Cheesman, Haysom, and Murphy (2003) Invasive Species Threats in the Caribbean Region. Report to the Nature Conservancy.	Considered naturalized and invasive in the Bahamas.
3.02		no evidence
3.03		no evidence
3.04	Kairo, Ali, Cheesman, Haysom, and Murphy (2003) Invasive Species Threats in the Caribbean Region.	Considered naturalized and invasive in the Bahamas.

	Report to the Nature Conservancy.	
3.05		no evidence
4.01	Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	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 (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	no description of this
4.04		
4.05	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.	no toxicity
4.06	Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	"The ripening and overripe fruits are favorite hosts of the Mediterranean, Caribbean, Mexican and other fruit flies."
4.07	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 (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	1. no toxicity 2. fruits extensively eaten; young leafy shoots eaten in Indonesia.
4.08		no evidence
4.09	1. Hortocopia 4.0 2. Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	1. exposure: full sun 2. "requires full sun for best form"
4.1	1. Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida. 2. Hortocopia 4.0 3. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	1. "almost any soil (alkaline to very poor), but grows better on well-drained soils" 2. "they appear to adapt to just about any soil" 3. "The sapodilla grows naturally in the calcareous marl and disintegrated limestone of its homeland...It flourishes also in deep, loose, organic soil, or on light clay, diabase, sand or lateritic gravel. Good drainage is essential..."
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	Rocas (2003) <i>Manilkara zapota</i> (L.) P. Royen. Tropical Tree Seed Manual, Species Descriptions. Reforestation, Nurseries, and Genetics Resources ( <a href="http://www.rngr.net/Publications/ttsm/Folder.2003-07-11.4726/PDF.2004-03-15.2415/file">http://www.rngr.net/Publications/ttsm/Folder.2003-07-11.4726/PDF.2004-03-15.2415/file</a> ).	"sometimes forming extensive groupings"
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	Sapotaceae

	various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	
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 Sapotaceae)
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. Hortocopia 4.0 3. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	1. propagated by seed 2. "Seedlings develop in the landscape where they could become a weed problem." 3. seeds germinate readily
6.03		
6.04	Balerdi and Crane (2000) The sapodilla ( <i>Manilkara zapota</i> Van Royen) in Florida. University of Florida, IFAS Extension, HS-1.	"some sapodilla cultivars are self-incompatible...Other cultivars may not require cross-pollination but produce more fruit when cross-pollinated."
6.05	1. Heithaus, Fleming, and Opler (1975) Foraging patterns and resource utilization in seven species of bats in a seasonal tropical forest. Ecology 56: 841-854. 2. Verheij and Coronel, eds. (1992) Plant Resources of South-East Asia. No. 2. Edible Fruits and Nuts. Prosea, Bogor, Indonesia.	1. "Only <i>Manilkara zapota</i> had both bat-dispersed pollen and seeds." BUT 2. "Cross-pollination by insects, e.g. bees, is recommended and is necessary for low-yield cultivars" [so pollinators include, but are not limited to, specialists]
6.06		
6.07	1. Rocas (2003) <i>Manilkara zapota</i> (L.) P. Royen. Tropical Tree Seed Manual, Species Descriptions. Reforestation, Nurseries, and Genetics Resources ( <a href="http://www.rngr.net/Publications/ttsm/Folder.2003-07-11.4726/PDF.2004-03-15.2415/file">http://www.rngr.net/Publications/ttsm/Folder.2003-07-11.4726/PDF.2004-03-15.2415/file</a> ). 2. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami.	1. "The tree begins to yield flowers and fruits between 4 and 5 years of age." 2. "the trees take 5 to 8 years to bear"
7.01		
7.02	Rocas (2003) <i>Manilkara zapota</i> (L.) P. Royen. Tropical Tree Seed Manual, Species Descriptions. Reforestation, Nurseries, and Genetics Resources ( <a href="http://www.rngr.net/Publications/ttsm/Folder.2003-07-11.4726/PDF.2004-03-15.2415/file">http://www.rngr.net/Publications/ttsm/Folder.2003-07-11.4726/PDF.2004-03-15.2415/file</a> ).	"It is cultivated primarily for its edible fruits...It is also appreciated as an ornamental in streets, parks, and gardens."
7.03		no evidence
7.04	Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	fruits are berries, to 4 inches wide
7.05		no evidence
7.06	Alcorn (1994) The chicle tree ( <i>Manilkara zapota</i> ) in	"These observations [of

	northwest Belize: natural history, forest floristics, and management. MS Thesis, University of Florida.	animals taking chicle fruits] included both howler and spider monkeys, various parrots, kinkajous, bats and a tapir." [possibly too big for birds to disperse?]
7.07	Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	no evidence of any means of attachment - fruits are berries
7.08	1. Alcorn (1994) The chicle tree ( <i>Manilkara zapota</i> ) in northwest Belize: natural history, forest floristics, and management. MS Thesis, University of Florida. 2. Langeland and Stocker (2001) Control of non-native plants in natural areas of Florida. University of Florida, IFAS Extension, SP 242 ( <a href="http://edis.ifas.ufl.edu/pdffiles/WG/WG20900.pdf">http://edis.ifas.ufl.edu/pdffiles/WG/WG20900.pdf</a> ). 3. Janzen (1982) Seeds in tapir dung in Santa Rosa National Park, Costa Rica. <i>Brenesia</i> 19/20: 129-135.	1. "These observations [of animals taking chicle fruits] included both howler and spider monkeys, various parrots, kinkajous, bats and a tapir." Viable seeds were recovered from tapir scat. 2. "seeds dispersed by raccoons and opossums" BUT 3. <i>Manilkara zapota</i> seeds are crushed during consumption by tapirs.
8.01	1. Rocas (2003) <i>Manilkara zapota</i> (L.) P. Royen. Tropical Tree Seed Manual, Species Descriptions. Reforestation, Nurseries, and Genetics Resources ( <a href="http://www.rngr.net/Publications/ttism/Folder.2003-07-11.4726/PDF.2004-03-15.2415/file">http://www.rngr.net/Publications/ttism/Folder.2003-07-11.4726/PDF.2004-03-15.2415/file</a> ). 2. Dehgan, B. (1998) Landscape Plants for Subtropical Climates. University Press of Florida.	1. "The fruits are produced at an annual rate of three to four thousand fruits per tree... Each fruit contains one to five seeds." [giving 3,000 to 20,000 seeds per tree] 2. tree has a spread of about 25 feet [~8 m, giving crown area of ~50 m <sup>2</sup> ] This gives 60-400 seeds/m <sup>2</sup> .
8.02	1. Morton (1987) Fruits of Warm Climates. Julia F. Morton, Miami. 2. Rocas (2003) <i>Manilkara zapota</i> (L.) P. Royen. Tropical Tree Seed Manual, Species Descriptions. Reforestation, Nurseries, and Genetics Resources ( <a href="http://www.rngr.net/Publications/ttism/Folder.2003-07-11.4726/PDF.2004-03-15.2415/file">http://www.rngr.net/Publications/ttism/Folder.2003-07-11.4726/PDF.2004-03-15.2415/file</a> ).	1. "Seeds remain viable for several years if kept dry." 2. "Seeds remain viable for approximately 7 months when stored under ambient conditions...With longer storage their viability quickly diminishes." [neither in soil]
8.03	Langeland and Stocker (2001) Control of non-native plants in natural areas of Florida. University of Florida, IFAS Extension, SP 242 ( <a href="http://edis.ifas.ufl.edu/pdffiles/WG/WG20900.pdf">http://edis.ifas.ufl.edu/pdffiles/WG/WG20900.pdf</a> ).	"Treatment: Hand pull seedlings; basal bark application of 10% Garlon 4, larger trees may require several applications or increasing the Garlon 4 to 20%; or cut stump application with 50% Garlon 3A...All methods listed have been found effective under certain circumstances."
8.04		
8.05		