UF IFAS UNIVERSITY of FLORIDA

Assessment of Non-native Plants in Florida's Natural Areas

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Amended For Zones 26 Sept 2016

	Millettia pinnata (syn Pongamia pinnata) **South zone**	**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) North Zone: suited to Zones 8, 9 Central Zone: suited to Zones 9, 10 South Zone: suited to Zone 10	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 habitats with periodic inundation North Zone: mean annual precipitation 50-70 inches Central Zone: mean annual precipitation 40-60 inches South Zone: mean annual precipitation 40-60 inches	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	y	2
3.03	Weed of agriculture	?	
3.04	Environmental weed	unk	
3.05	Congeneric weed	n	0
4.01	Produces spines, thorns or burrs	n	0
4.02	Allelopathic	?	
4.03	Parasitic	n	0
4.04	Unpalatable to grazing animals	?	
4.05	Toxic to animals	unk	0
4.06	Host for recognised pests and pathogens	y	1
4.07	Causes allergies or is otherwise toxic to humans	y	1
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	y	1
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	n	-1
6.04	Self-compatible or apomictic	n	-1
6.05	Requires specialist pollinators	n	0
6.06	Reproduction by vegetative propagation	y	1
6.07	Minimum generative time (years)	4	-1
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	n	-1
7.07	Propagules dispersed by other animals (externally)	n	-1
7.08	Propagules dispersed by other animals (internally)		
8.01	Prolific seed production	y	1
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	y	1
8.05		n	1
	Total Score	**10**	
	Implemented Pacific Second Screening	**no**	
	Risk Assessment Results	**High**	

section	# questions answered	satisfy minimum?
A	9	yes
B	8	yes
C	21	yes
total	38	yes

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Amended For Zones 26 Sept 2016

	Millettia pinnata (syn Pongamia pinnata) **Central zone**	**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) North Zone: suited to Zones 8, 9 Central Zone: suited to Zones 9, 10 South Zone: suited to Zone 10	1	
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 habitats with periodic inundation North Zone: mean annual precipitation 50-70 inches Central Zone: mean annual precipitation 40-60 inches South Zone: mean annual precipitation 40-60 inches	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	y	2
3.03	Weed of agriculture	?	
3.04	Environmental weed	unk	
3.05	Congeneric weed	n	0
4.01	Produces spines, thorns or burrs	n	0
4.02	Allelopathic	?	
4.03	Parasitic	n	0
4.04	Unpalatable to grazing animals	?	
4.05	Toxic to animals	unk	0
4.06	Host for recognised pests and pathogens	y	1
4.07	Causes allergies or is otherwise toxic to humans	y	1
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	y	1
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	n	-1
6.04	Self-compatible or apomictic	n	-1
6.05	Requires specialist pollinators	n	0
6.06	Reproduction by vegetative propagation	y	1
6.07	Minimum generative time (years)	4	-1
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	n	-1
7.07	Propagules dispersed by other animals (externally)	n	-1
7.08	Propagules dispersed by other animals (internally)		
8.01	Prolific seed production	y	1
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	y	1
8.05		n	1
	Total Score	**8**	
	Implemented Pacific Second Screening	**no**	
	Risk Assessment Results	**High**	

section	# questions answered	satisfy minimum?
A	9	yes
B	8	yes
C	21	yes
total	38	yes

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Amended For Zones 26 Sept 2016

	Millettia pinnata (syn Pongamia pinnata) **North zone**	**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) North Zone: suited to Zones 8, 9 Central Zone: suited to Zones 9, 10 South Zone: suited to Zone 10	0	
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 habitats with periodic inundation North Zone: mean annual precipitation 50-70 inches Central Zone: mean annual precipitation 40-60 inches South Zone: mean annual precipitation 40-60 inches	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	y	2
3.03	Weed of agriculture	?	
3.04	Environmental weed	unk	
3.05	Congeneric weed	n	0
4.01	Produces spines, thorns or burrs	n	0
4.02	Allelopathic	?	
4.03	Parasitic	n	0
4.04	Unpalatable to grazing animals	?	
4.05	Toxic to animals	unk	0
4.06	Host for recognised pests and pathogens	y	1
4.07	Causes allergies or is otherwise toxic to humans	y	1
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	y	1
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	n	-1
6.04	Self-compatible or apomictic	n	-1
6.05	Requires specialist pollinators	n	0
6.06	Reproduction by vegetative propagation	y	1
6.07	Minimum generative time (years)	4	-1
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	n	-1
7.07	Propagules dispersed by other animals (externally)	n	-1
7.08	Propagules dispersed by other animals (internally)		
8.01	Prolific seed production	y	1
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	y	1
8.05		n	1
	Total Score	**8**	
	Implemented Pacific Second Screening	**no**	
	Risk Assessment Results	**High**	

section	# questions answered	satisfy minimum?
A	9	yes
B	8	yes
C	21	yes
total	38	yes

	Reference	Source data
1.01	1. Murphy et al. (2012) A common view of the opportunities, challenges, and research actions for Pongamia in Australia. Bioenerg Res 5: 778-800.	Cultivated, but no evidence of selection for reduced weediness. 1. Has not undergone extensive domestication either in Australia or India.
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/10Fyear%20climate/PLANT_HARDINESS_10YR%20lgnd.tif). 2. Gilman and Watson (2011) Pongamia pinnata: Pongam. Environmental Horticulture, Florida Cooperative Extension Service, UF/IFAS EDIS DOC #ENH657. 3. The IUCN Red List of Threatened Species. (http://www.iucnredlist.org/ [accessed 13 March 2014]) 4. Csurhes and Hankamer (2010) Pongamia: Millettia pinnata syn. Pongamia pinnata Weed Risk Assessment. Dept Employment, Economic Development, and Innovation, Biosecurity Queensland. 5. Orwa et al. (2009) Agroforestry Database: a tree reference and selection guide. version 4.0. World Agroforestry Centre, Kenya (http://www.worldagroforestry.org/resources/databases/agroforestree [accessed 13 March 2014]).	No computer analysis performed 1. Global Hardiness 10-12 2. USDA Hardiness 10B-11. 3. Australia (Australian Capital Territory, New South Wales, Northern Territory, Queensland, South Australia, Victoria, Western Australia); Bangladesh; China (Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Yunnan, Zhejiang); Fiji; French Polynesia; Hong Kong; India (Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Dadra-Nagar-Haveli, Daman, Delhi, Diu, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu-Kashmir, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Mizoram, Nagaland, Orissa, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal); Indonesia (Bali, Bali); Japan; Malaysia; Myanmar; Papua New Guinea; Philippines; Seychelles; Singapore; Sri Lanka; Taiwan, Province of China; Thailand 4 & 5. Prefers humid tropical and subtropical climates. Can tolerate wide variety of conditions: rainfall 200-2500mm and temp 0-16° C minimum and 27-50° C maximum.
2.02		No computer analysis performed. See 2.01 source data
2.03	1. Csurhes and Hankamer (2010) Pongamia: Millettia pinnata syn. Pongamia pinnata Weed Risk Assessment. Dept Employment, Economic Development, and Innovation, Biosecurity Queensland. 2. Orwa et al. (2009) Agroforestry Database: a tree reference and selection guide. version 4.0. World Agroforestry Centre, Kenya (http://www.worldagroforestry.org/resources/databases/agroforestree [accessed 13 March 2014]).	1. Described as a maritime species occurring naturally along the coasts in native range. 2. Prefers humid tropical and subtropical climates. Can tolerate wide variety of conditions: rainfall 200-2500mm and temp 0F16° C minimum and 27-50° C maximum. 2. Can grow at altitudes from sea level to approximately 1200m.
2.04	1. Csurhes and Hankamer (2010) Pongamia: Millettia pinnata syn. Pongamia pinnata Weed Risk Assessment. Dept Employment, Economic Development, and Innovation, Biosecurity Queensland.	1. rainfall 200-2500mm (7.87-98.4 inches)
2.05	1. The IUCN Red List of Threatened Species. (http://www.iucnredlist.org/ [accessed 13 March 2014]) 2. USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network F (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.arsFgrin.gov/cgiFbin/npgs/html/taxon.pl?409896 (13 March 2014). 3. Morton (1990) The pongam tree, unfit for Florida landscaping, has multiple practical uses in underdevelpoed lands. Proc Fla State Hort Soc 103: 338-343. 4. USDA Plants Database (http://plants.usda.gov accessed 13 March 2014]). 5. Allen & Allen (1981) The Leguminosae, a source book of characteristics, uses, and nodulation. The University of Wisconsin Press, Madision, USA, pp 224, 543, 812.	1. Introduced: Djibouti; Egypt; Mauritius; Nicaragua; Pakistan; Sudan; Tanzania, United Republic of; Uganda; United States. 2. Cultivated in Africa 3. Introduced to Hawaii in the 1860s, 1910 to Florida. Seeds from Mauritius in 1911, Egypt in 1916, and India in 1926. 4. Present in Puerto Rico. 5. Present in Aust, Florida, Hawaii, India, Malaysia, Oceania, Philippines, and Seychelles.

3.01	1.Wunderlin and Hansen (2008)Atla sof Florida Vascular Plants (http://www.plantatlas.usf.edu/). [S.M. Landry and K.N. Campbell (application development), Florida Centerfor Community Design and Research.] Institute for Systematic Botany,University of South Florida, Tampa. [Accessed13March 2014]. 2. Floristic Inventory of South Florida Database Online, The Institute for Regional Conservation (http://regionalconservation.org/ircs/DBChoice.asp [accessed13 March2014]). 3. USDA Plants Database(http://plants.usda.gov accessed13March2014]). 4. Binggelietal. (1998) An overview of invasive woody plants in the tropics, School of Agricultural and Forest Sciences publication no.13. University of Wales, Bangor. 5. Murphy et al.(2012) A common view of the opportunities, challenges,and research actions for Pongamia in Australia. Bioenerg Res 5: 778-800.	1. Herbarium records collected in 2013 and 1997 include seedlings growing under parent tree in south Florida. 2. Documented as not native, naturalized in 27 natural areas in south Florida (habitats affected include coastal berm, mesic hammock, pine rockland, rockland hammock). 3. Present in Florida and Puerto Rico. 4. Listed as moderately invasive as it is documented that it is spreading but still occurs at low densities and is not considered an immediate problem. 5. The extent of native range is uncertain due to long history of cultivation and transport. Naturalized in China, Maylaysia, Indonesia, Japan, Vietnam, and the US.
3.02	1. Binggeli et al. (1998) An overview of invasive woody plants in the tropics, School of Agricultural and Forest Sciences publication no. 13. University of Wales, Bangor. 2. Daniel (1997) Pongamia pinnata-a nitrogen fixing tree for oilseed. NFT Highlights (http://factnet.winrock.org/fnrm/factnet/factpub/FACTSH/P_pinnata.html [accessed 17 March 2014]) 3. Murphy et al. (2012) A common view of the opportunities, challenges, and research actions for Pongamia in Australia. Bioenerg Res 5: 778-800.	1. Listed as moderately invasive as it is documented that it is spreading but still occurs at low densities and is not considered an immediate problem. 2. it produces root suckers profusely. Because of these characteristics, pongam is unsuitable for agroforestry and has the potential to become a weed if not managed carefully. 3. "WRA determined that Pongamia poses low risk to Queensland based primarily on the fact that there is currently no evidence that Pongamia has significant negative impacts as a weed elsewhere in the world"
3.03	1. Binggeli et al. (1998) An overview of invasive woody plants in the tropics, School of Agricultural and Forest Sciences publication no. 13. University of Wales, Bangor. 2. Daniel (1997) Pongamia pinnata-a nitrogen fixing tree for oilseed. NFT Highlights (http://factnet.winrock.org/fnrm/factnet/factpub/FACTSH/P_pinnata.html [accessed 17 March 2014]) 3. Murphy et al. (2012) A common view of the opportunities, challenges, and research actions for Pongamia in Australia. Bioenerg Res 5: 778-800.	1. Listed as moderately invasive as it is documented that it is spreading but still occurs at low densities and is not considered an immediate problem. 2. it produces root suckers profusely. Because of these characteristics, pongam is unsuitable for agroforestry and has the potential to become a weed if not managed carefully. 3. "WRA determined that Pongamia poses low risk to Queensland based primarily on the fact that there is currently no evidence that Pongamia has significant negative impacts as a weed elsewhere in the world"
3.04	1. Binggeli et al. (1998) An overview of invasive woody plants in the tropics, School of Agricultural and Forest Sciences publication no. 13. University of Wales, Bangor. 2. Daniel (1997) Pongamia pinnata F a nitrogen fixing tree for oilseed. NFT Highlights (http://factnet.winrock.org/fnrm/factnet/factpub/FACTSH/P_pinnata.html [accessed 17 March 2014]) 3. Murphy et al. (2012) A common view of the opportunities, challenges, and research actions for Pongamia in Australia. Bioenerg Res 5: 778-800.	1. Listed as moderately invasive as it is documented that it is spreading but still occurs at low densities and is not considered an immediate problem. 2. it produces root suckers profusely. Because of these characteristics, pongam is unsuitable for agroforestry and has the potential to become a weed if not managed carefully. 3. "WRA determined that Pongamia poses low risk to Queensland based primarily on the fact that there is currently no evidence that Pongamia has significant negative impacts as a weed elsewhere in the world"
3.05	1. Randall (2007) Global Compendium of Weeds-Index (http://www.hear.org/gcw [accessed 13 March 2014])	1. Millettia dura is listed as a weed, but impacts are unspecified.
4.01		No evidence found
4.02	1. Marzouk et al. (2008) Isoflavonoid glycosides and rotenoids from Pongamia pinnata leaves. Z Naturforsch C 63: 1-2. 2. Morton (1990) The pongam tree, unfit for Florida landscaping, has multiple practical uses in under-developed lands. Proc Fla State Hort Soc. 103: 338-343. 3. Latha et al. (2001) Studies on the effects of leaf leachates of Pongamia pinnata on certain crops and weeds and the soil mycoflora. Nat Academy Sci Lett 24: 63-68.	1. Produces a suite of secondary metabolites in leaves and seeds, but no definitive evidence of allelopathic inhibition. 2. Possesses saponins, several chalcones, and related compounds. Also quercetin, karanjin, etc. 3. Leachates of P pinnata studied in laboratory inhibited the performance of rice and wheat, but had no effect of weeds. Reduced the diversity of mycoflora.
4.03		No evidence found

4.04	1. Morton (1990) The pongam tree, unfit for Florida landscaping, has multiple practical uses in under-developed lands. Proc Fla State Hort Soc. 103: 338-343. 2. Murphy et al. (2012) A common view of the opportunities, challenges, and research actions for Pongamia in Australia. Bioenerg Res 5: 778-800.	1. Not particularly palatable, but used as fodder in arid areas. Commonly made into presscake as it should not be fed to animals alone since it contains a number of toxins including karanjin. 2. Poor palatability, antiFnutritional factors, and protien content known to provide low nutritional benefit because of poor amino acid composition (as feed). However, animals (rabbits) will pull out seedlings and livestock will feed on the lower branches of trees if other feed is scarce. No kangaroo damage observed in plantations suggesting that macropods avoid the plant.
4.05	1. Morton (1990) The pongam tree, unfit for Florida landscaping, has multiple practical uses in underFdeveloped lands. Proc Fla State Hort Soc. 103: 338-343. 2. Daniel (1997) Pongamia pinnata-a nitrogen fixing tree for oilseed. NFT Highlights (http://factnet.winrock.org/fnrm/factnet/factpub/FACTSH/P_pinnata.html [accessed 17 March 2014])	1. Used as fodder, but commonly made into presscake as it should not be fed to animals alone since it contains a number of toxins including karanjin. 2. "Opinions vary on the usefulness of this species as a fodder. Troup (GOI 1983) reports that the leaves are eaten by cattle and readily consumed by goats. However, in many areas it is not commonly eaten by farm animals. Its fodder value is greatest in arid regions. According to Singh (1982) the leaves contain 43% dry matter, 18% crude protein, 62% neutral detergent fiber, 40% acid detergent fiber, and in vitro dry matter digestibility of 50%. The presscake, remaining when oil is extracted from the seeds, is used as a poultry feed. "
4.06	1. Daniel (1997) Pongamia pinnata-a nitrogen fixing tree for oilseed. NFT Highlights (http://factnet.winrock.org/fnrm/factnet/factpub/FACTSH/P_pinnata.html [accessed 17 March 2014]). 2. Schroer et al. (2008) Parasitoids of Paratachardina lobata (Hem., Kerriidae): surveys for biological control of the invasive lobate lac scale. J Appl Entomol 132:12-17.	1. Pongam attracts many pests and diseases. Some of the important pests are Parnara mathias, Gracillaria sp., Indarbela quadrinotata, Myllocerus curvicornis, and Acrocercops sp. (Anon. 1994). Attacks by these insects cause whitish streaks and the formation of galls on affected leaves. 2. Host in native range for lobate lac scale (invasive in Florida).
4.07	1. Csurhes and Hankamer (2010) Pongamia: Millettia pinnata syn. Pongamia pinnata Weed Risk Assessment. Dept Employment, Economic Development, and Innovation, Biosecurity Queensland. 2. Morton (1990) The pongam tree, unfit for Florida landscaping, has multiple practical uses in underFdeveloped lands. Proc Fla State Hort Soc. 103: 338-343. 3. Gilman and Watson (2011) Pongamia pinnata: Pongam. Envoronmental Horticulture, Florida Cooperative Extension Service, UF/IFAS EDIS DOC #ENH657.	1. Can be problematic due to its toxicity (induced vomiting if ingested) and flowers can irritate skin. 2. The seed kernals are toxic to cold blooded animals and might be dangerous if consumed by children. All parts induce vomiting. In Florida, the flowers emit a respiratory, skin, and eye irritant. 3. Brown seedpods are poisonous.
4.08		No evidence found
4.09	1. Mukati & Sreevalli (2010) Propagation techniques, evaluation and improvement of the biodiesel plant, Pongamia pinnata (L.) PierreFA review. Indust Crops Prod 31: 1-12. 2. Orwa et al. (2009) Agroforestry database: a tree reference and selection guide. Version 4.0 http://www.worldagroforestry.org/treeb2/AFTPDFS/Pongamia_pinnata.pdf [accessed 17 March 2014]).	1. Shade had an adverse effect, but most responses were plastic and indicate a tolerance (i.e. shift in root to shoot ratios, increases in both leaf area and leaf number). 2. In its natural environment, it is a shade bearer and can grow under the shade of other trees; it is, however, not a shade demander and grows well even with full overhead light. In the nursery, it can be planted at a close spacing, as young plants tolerate shade well.

4.10	1. Raut et al. (2011) Seed variability in Pongamia pinnata (L.) Pierre from Konkan region of Maharashtra. J Biodiversity 2: 27-30. 2. Csurhes and Hankamer (2010) Pongamia: Millettia pinnata syn. Pongamia pinnata Weed Risk Assessment. Dept Employment, Economic Development, and Innovation, Biosecurity Queensland. 3. Mukati & Sreevalli (2010) Propagation techniques, evaluation and improvement of the biodiesel plant, Pongamia pinnata (L.) PierreFA review. Indust Crops Prod 31: 1-12. 4. Murphy et al. (2012) A common view of the opportunities, challenges, and research actions for Pongamia in Australia. Bioenerg Res 5: 778-800.	1. Can grow on most soil types ranging from stony to sandy to clay, including verticals. 2. Pongamia can tolerate a wide range of soil types including saline, alkaline, sandy, heavy clay, and rocky soils (including oolitic limestone) and waterlogged soils. 3. Can grow on most soil types (including degraded mine spoils). 4. Observed growing on a range of soil types, sodic acid soils, alkaline soils, and heavy clay soils with a sodic subsoil. Reported to not do well on sandy soils.
4.11		No evidence found
4.12		No evidence found
5.01	1. USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network F (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.arsFgrin.gov/cgiFbin/npgs/html/taxon.pl?409896 (13 March 2014).	1. Family Fabaceae
5.02	1. USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network F (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.arsFgrin.gov/cgiFbin/npgs/html/taxon.pl?409896 (13 March 2014).	1. Family Fabaceae
5.03	1. USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network F (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.arsFgrin.gov/cgiFbin/npgs/html/taxon.pl?409896 (13 March 2014). 2. Orwa et al. (2009) Agroforestry database: a tree reference and selection guide. Version 4.0 http://www.worldagroforestry.org/treeb2/AFTPDFS/Pongamia_pinnata.pdf [accessed 17 March 2014]).	1. Family Fabaceae 2. Medium sized, fast growing tree or shrub.
5.04		No evidence found
6.01		No evidence found
6.02	1. Wunderlin andHansen (2008) Atlas of Florida Vascular Plants (http://www.plantatlas.usf.edu/). [S. M. Landry and K. N. Campbell (application development), Florida Center for Community Design and Research.] Institute for Systematic Botany, University of South Florida, Tampa. [Accessed 13 March 2014].	1. Herbarium records collected in 2013 and 1997 include seedlings growing under parent tree in south Florida.
6.03		No evidence found
6.04	1. Kukade & Tidke (2013) Studies on pollination and reproductive biology of Pongamia pinnata L. (Fabaceae). Indian J Fund Appl Life Sci 3:149-155.	1. P. pinnata is dieocious, plants of different "sex."
6.05	1. Kukade & Tidke (2013) Studies on pollination and reproductive biology of Pongamia pinnata L. (Fabaceae). Indian J Fund Appl Life Sci 3:149-155. 2. Raju & Rao (2006) Explosive pollen release and pollination as a function of nectar-feeding activity of certain bees in the biodiesel plant, Pongamia pinnata (L.) Pierre (Fabaceae). Current Science 90: 960-967. 3. Mukati & Sreevalli (2010) Propagation techniques, evaluation and improvement of the biodiesel plant, Pongamia pinnata (L.) Pierre-A review. Indust Crops Prod 31: 1-12.	1. Primarily rely on several species of bees, many longFtongued (Apis dorsata, A cerana indica, Amegilla spp., Megachile spp, and Xylocopa spp.)(Requires pollination from a specialist functional group). 2. P. pinnata is a specialist with highly intricate pollination mechanism adapted to certain nectarFseeking bees. But, such a pollination mechanism is nonFfunctional in the absence or rarity of pollinator bees, and it will surely reflect in fruit set rate. 3. A breakdown of the specialized pollination system occurs in the absence or rarity of pollinator bees.

6.06	1. Orwa et al. (2009) Agroforestry Database: a tree reference and selection guide. version 4.0. World Agroforestry Centre, Kenya (http://www.worldagroforestry.org/resources/databases/agroforestree [accessed 13 March 2014]).	1. Vegetative propagation can be prolific occurring from cuttings and root suckers with new plants growing from lateral roots of the parent tree.
6.07	1. Csurhes and Hankamer (2010) Pongamia: Millettia pinnata syn. Pongamia pinnata Weed Risk Assessment. Dept Employment, Economic Development, and Innovation, Biosecurity Queensland. 2. Mukati & Sreevalli (2010) Propagation techniques, evaluation and improvement of the biodiesel plant, Pongamia pinnata (L.) PierreFA review. Indust Crops Prod 31: 1-12. 3. Murphy et al. (2012) A common view of the opportunities, challenges, and research actions for Pongamia in Australia. Bioenerg Res 5: 778-800.	1& 2. Producing seeds in 4-7 years. 3. Plants observed to flower between 4-5 years. Produce pods 4-7 years. Some plants as early as 2 years.
7.01	1. Raut et al. (2011) Seed variability in Pongamia pinnata (L.) Pierre from Konkan region of Maharashtra. J Biodiversity 2: 27-30.	1. Average pod weight 2.80F7.64g, heavy seeds, accidental dispersal unlikely.
7.02	1. Daniel (1997) Pongamia pinnata F a nitrogen fixing tree for oilseed. NFT Highlights (http://factnet.winrock.org/fnrm/factnet/factpub/FACTSH/P_pinnata.html [accessed 17 March 2014]). 2. 1. Csurhes and Hankamer (2010) Pongamia: Millettia pinnata syn. Pongamia pinnata Weed Risk Assessment. Dept Employment, Economic Development, and Innovation, Biosecurity Queensland. 2. Mukati & Sreevalli (2010) Propagation techniques, evaluation and improvement of the biodiesel plant, Pongamia pinnata (L.) PierreF A review. Indust Crops Prod 31: 1-12. 3. Scott et al. (2008) Pongamia pinnata: An untapped resource for the biofuels industry of the future. Bioenerg Res 1: 2-11.	1 & 2. Planted for agroforestry, as a shade/street tree. 3. Resource for agroforestry and urban landscaping.
7.03	1. Raut et al. (2011) Seed variability in Pongamia pinnata (L.) Pierre from Konkan region of Maharashtra. J Biodiversity 2: 27-30.	1. Average pod weight 2.80F7.64g, heavy seeds, large seeds conspicuous and unlikely as produce contaminent.
7.04	1. Raut et al. (2011) Seed variability in Pongamia pinnata (L.) Pierre from Konkan region of Maharashtra. J Biodiversity 2: 27-30.	1. Average pod weight 2.80F7.64g, heavy seeds not wind dispersed.
7.05	1. Nakanshi (1988) Dispersal ecology of the maritime plants in the Ryukyu islands, Japan. Ecol Res 3: 163-173. 2. Csurhes and Hankamer (2010) Pongamia: Millettia pinnata syn. Pongamia pinnata Weed Risk Assessment. Dept Employment, Economic Development, and Innovation, Biosecurity Queensland. 3. Arathi et al. (1999) Seed abortion in Pongamia pinnata. Am J Bot 86: 659-662.	1. Pongamia pinnata has woody pods, which are indehiscent and have spaces around the seeds. Floating in sea water, the exocarps of most of these species are eroded and mesocarps exposed. 2. Seeds are dispersed by flowing water. 3. the pods stay afloat in water for more than two months (personal observation). Therefore, reduced wing loading by decreasing seed number could be hypothesized as a selection towards increased dispersal efficiency.
7.06	1. Gilman and Watson (2011) Pongamia pinnata: Pongam. Envoronmental Horticulture, Florida Cooperative Extension Service, UF/IFAS EDIS DOC #ENH657.	1. seeds do not attract wildlife. Seeds are toxic.
7.07	1. Raut et al. (2011) Seed variability in Pongamia pinnata (L.) Pierre from Konkan region of Maharashtra. J Biodiversity 2: 27-30.	1. Average pod weight 2.80F7.64g, heavy seeds with no adaptations for external attachment.
7.08	1. Gilman and Watson (2011) Pongamia pinnata: Pongam. Envoronmental Horticulture, Florida Cooperative Extension Service, UF/IFAS EDIS DOC #ENH657.	1. seeds do not attract wildlife. Seeds are toxic.

8.01	1. Csurhes and Hankamer (2010) Pongamia: Millettia pinnata syn. Pongamia pinnata Weed Risk Assessment. Dept Employment, Economic Development, and Innovation, Biosecurity Queensland. (and references therin) 2. Mukati & Sreevalli (2010) Propagation techniques, evaluation and improvement of the biodiesel plant, Pongamia pinnata (L.) PierreFA review. Indust Crops Prod 31: 1-12.	1. Seed production is prolific, with a single tree producing 9F90kg of seeds per year (yield potential of 900F9000 kg of seeds/ha). Individual trees are capable of producing 30000 seeds per year in Australia. 2. 800F1200 seeds per kg.
8.02	1. Millettia Plantations (2010) Milletia pinnata: the sustainable biofuel crop of the future. (http://millettiaplantations.com [accessed 17 March 2014]). 2. Murphy et al. (2012) A common view of the opportunities, challenges, and research actions for Pongamia in Australia. Bioenerg Res 5: 778-800.	1. Seed longevity may exceed 60 years. 2. The rate of germination of seeds declines quickly (12 mos for dry storage, less in field where fungal attack can destroy the seed).
8.03		No evidence found
8.04	1. Daniel (1997) Pongamia pinnata F a nitrogen fixing tree for oilseed. NFT Highlights (http://factnet.winrock.org/fnrm/factnet/factpub/FACTSH/P_pinnata.html [accessed 17 March 2014]) 2. Misra & Singh (1989) Coppice regeneration of Cassia siamea and Pongamia pinnata Nit. Fixing Tree Res Rep 7:4	1. When cultivated, it can be persistent, due to its ability to tolerate coppicing and produce. 2. This species can be regenerated by coppice management suckers.
8.05	1. Gilman and Watson (2011) Pongamia pinnata: Pongam. Environmental Horticulture, Florida Cooperative Extension Service, UF/IFAS EDIS DOC #ENH657.	1. No pests or diseases of major concern, but caterpillars occasionally cause some defoliation