Taxon: Cupaniopsis anacardioides (A. Rich.) Radlk. **Family:** Sapindaceae

Common Name(s): beach tamarind
carrotwood
cashew leaf cupania
green-leaf-tamarind
tuckeroo

Synonym(s): Cupania anacardioides A. Rich.

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 7 Sep 2017

WRA Score: 10.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Tropical Tree, Environmental Weed, Dense Stands, Self-Compatible, Bird-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	n
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	n
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	>3
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	n
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed		
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)	y=1, n=-1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"C. anacardioides is native to northern and eastern regions of Australia, Irian Jaya, Indonesia and Papua New Guinea (Coile, 1997). Weber (2003) states nativity as Australia, tropical Asia, Madagascar and Micronesia, though without specific locations. It has been introduced as a landscape tree into three states in the USA: California, Florida, and Hawaii. To date, only Florida reports this plant on their list of invasive exotic species and the tree is still commonly used as a landscape plant in California. Cupaniopsis has not been widely planted in Hawaii."
	WRA Specialist. 2017. Personal Communication	No evidence of domestication that would reduce invasiveness

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	NA

201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**High**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 3 Sep 2017]	"Native: Asia-Tropical Papuasia: Indonesia - Irian Jaya; Papua New Guinea Australasia Australia: Australia - New South Wales, - Northern Territory, - Queensland, - Western Australia"

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 3 Sep 2017]	

203	**Broad climate suitability (environmental versatility)**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	"Temperature is likely the key factor limiting the spread of Cupaniopsis anacardioides into north Florida. A temperature of -6°C has been published as a lethal lower limit for the species, although test specimens maintained in north Florida have survived winter temperatures as low or lower than this value (Lockhart 2006). "
	Lockhart, C. S., Austin, D. F., Jones, W. E., & Downey, L. A. (1999). Invasion of carrotwood (Cupaniopsis anacardioides) in Florida natural areas (USA). Natural Areas Journal, 19(3), 254-262	"The tolerance of carrotwood to a broad range of soils, soil moisture, elevations, and salt, reduces the factors that could limit its growth or occurrence in different locations or habitats. The highest densities occur in Sarasota County, where it was first introduced. Sarasota County has had 1 0 to 1 5 more years of exposure than other parts of Florida." ... "Much is still unknown about carrotwood - its germination rate, its elevation limits, its success rate in the wild, its effects and rate of impact and displacement in native habitats."
	Gilman, E.F. & Watson, D.G. 1993. Cupaniopsis anacardiopsis: carrotwood. ENH380. Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL. http://edis.ifas.ufl.edu. [Accessed 4 Sep 2017]	"USDA hardiness zones: 10A through 11"

204	**Native or naturalized in regions with tropical or subtropical climates**	**y**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 4 Sep 2017]	"Native: Asia-Tropical Papuasia: Indonesia - Irian Jaya; Papua New Guinea Australasia Australia: Australia - New South Wales, - Northern Territory, - Queensland, - Western Australia Naturalized: Northern America : United States"

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"In the USA, C. anacardioides was introduced in Florida, partly due to its success as a landscape tree in California. The date of introduction into California is unknown. This tree has not been reported as invasive or naturalized in California to date; however, natural regeneration is noted. C. anacardioides has had two separate introductions in Florida, USA, one in the 1950s on the east coast (St Lucie County), and one in 1968 on the gulf coast in Sarasota County. It was widely propagated and distributed throughout the 1970s and 1980s. It began to appear as naturalized populations by the late 1980s and quickly became invasive in many habitats. As of 2001, Florida prohibits its propagation, transport or sale. Hawaii's earliest record is from a 1951 herbarium specimen, but limited horticultural use may reduce the risk of expansion on the Hawaiian islands."

Qsn #	Question	Answer
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	Rarely cultivated in Hawaii

301	Naturalized beyond native range	y
	Source(s)	**Notes**
	Lockhart, C. S., Austin, D. F., Jones, W. E., & Downey, L. A. (1999). Invasion of carrotwood (Cupaniopsis anacardioides) in Florida natural areas (USA). Natural Areas Journal, 19(3), 254-262	"Abstract : Six study sites in 5 counties in Florida, USA, were sampled for the invasive, non indigenous tree carrotwood (Cupaniopsis anacardioides). C. anacardioides was found to have escaped cultivation in 14 southern and central Florida counties. Mean maximum densities were 14.6 plants m-2 in mangroves, 21.5 plants m-2 in tropical hammocks and 0.2 plants m-2 in coastal strand. The distribution of naturalized C. anacardioides coincided with that of the 3 native mangrove tree species (Avicennia germinans, Laguncularia racemosa and Rhizophora mangle). The presence of C. anacardioides tended to be associated with an increase of species richness in mangroves and may cause a reduction of species richness in tropical hammock communities."
	Morgan, E. C., & Overholt, W. A. (2005). New records of invasive exotic plant species in St. Lucie county, Florida. Castanea, 70(1): 59-62	"Cupaniopsis anacardioides (A. Rich.) Radlk. (SAPINDACEAE)- Carrotwood. Uncommon escape, common ornamental planting. Morgan & Overholt 0017 (FLAS)."
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	"In Florida, carrotwood can be found in coastal lands and estuarine margins and riparian zones, and within disturbed wetlands. Carrotwood can be found in all six IRL watershed counties and is considered to be naturalized from at least Brevard County southward. "
	Starr, F. & Starr, K. 2011. New plant records from midway Atoll, Maui and Kahoʻolawe. Bishop Museum Occasional Papers. 110: 23-35	"in Hawaiʻi, carrotwood is cultivated as a street tree and in yards. after roadside surveys on Maui in 2009 it was found to be not that common in landscaping though did show signs of reproduction and spread in a few areas where it was found, including Wailea." ... "this collection represents a new naturalized record for Hawaiʻi from the island of Maui. Material examined: MAUI: east Maui, Wailea, Keawakapu, beach park, planted near parking area and spreading locally, mature trees with scattered seedlings and saplings in area, growing in association with Nerium oleander and Ipomoea obscura, 30 ft [9 m], 19 Aug 2009, Starr & Starr 090819-01."
	Frohlich, D. & Lau, A. 2010. New plant records from Oʻahu for 2008. Bishop Museum Occasional Papers 107: 3-18	"Native to Australia, this species was previously uncollected as naturalized in the state." ... "Although it has been recommended as a street tree by the City and County of Honolulu, this tree has begun to spread in southern Florida by way of its bird-dispersed seeds (Staples & Herbst 2005), and its further cultivation in Hawaiʻi should be discouraged. Several individuals were found naturalizing in hedges around Mililani. Material examined. OʻAHU: Mililani (UTM 2373214, 603010), sapling ca 1.5 m tall, growing in Breynia disticha hedge in yard, no flowers or fruit, no mature individuals seen in area, 8 Feb 2008, D. Frohlich & A. Lau 2008020801."

Qsn #	Question	Answer
302	**Garden/amenity/disturbance weed**	**n**
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	See 3.04

303	Agricultural/forestry/horticultural weed	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

304	Environmental weed	y
	Source(s)	**Notes**
	Lockhart, C. S., Austin, D. F., Jones, W. E., & Downey, L. A. (1999). Invasion of carrotwood (Cupaniopsis anacardioides) in Florida natural areas (USA). Natural Areas Journal, 19(3), 254-262	"Carrotwood (Cupaniopsis anacardioides) was first identified as a potentially invasive tree in 1989, approximately ten years after it became popular as a landscape tree. Since then, seedlings to medium.;.sized trees have established themselves outside of cultivation in disturbed sites and undisturbed natural areas. Birds disperse the seeds, and contribute to a rapidly expanding wild population that includes isolated islands. As of 1996, carrotwood has invaded a wide variety of habiiats in 14 southern and central Florida counties. Wild carrotwood has become reproductive in three counties. Densities range to 0.21 plants per m2 in coastal strand, to 21.47 plants per m2 in coastal hammocks, and to 24.16 plants per m2 in mangroves. Presence of carrotwood is involved in alteration of the natural species diversity of mangrove and coastal hammock communities. The invasibility of carrotwood has been compared to Brazilian pepper (Schinus terebinthifolius). The distribution of wild carrotwood also coin□ides with that of all three mangrove tree species. Education and ·regulatory actions are essential now to reduce costly removal efforts in the near future."
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	"Carrotwood occurs in at least 14 Florida counties and is capable of displacing native plants to form monotypic stands. Lockhart et al. (1999) report carrotwood densities are highest in mangrove and coastal hammock habitats, reaching greater than 24 plants per square meter and 21 plants per square meter, respectively. "
	Kaufman, S.R. & Kaufman, W. 2012. Invasive Plants: A Guide to Identification and the Impacts and Control of Common North American Species. Second Edition, Revised and Updated. Stackpole Books, Mechanicsburg, PA	"Thick stands of carrotwood displace native species, outcompeting them for light, nutrients, and space. Birds and probably small mammals disperse the seeds to new locations. Carrotwood is of particular concern in mangrove forests because mangroves serve as nurseries to many fish and crustaceans and as habitat for threatened bird species."

Qsn #	Question	Answer
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Within a relatively short period after introduction (20 to 30 years), C. anacardioides has escaped from cultivation and become an invasive plant in Florida, USA. Even though it is prohibited from sale, transport, or propagation within that state since 2001, there is an abundance of seed in the landscape and the extent for potential expansion remains to be seen. Although it may appear to be an attractive landscape tree, it can be an undesirable invader with prolific seed production which is easily spread throughout the landscape and to isolated areas via bird dispersal. It threatens biodiversity, especially in sensitive mangrove forest ecosystems. Other areas with mild climates and moderate or greater rainfall may provide a good environment for naturalization and expansion of C. anacardioides, and the availability of seed for ornamental purposes poses risks of further introduction."

305	Congeneric weed	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**
	Stanley, T.D. & Ross, E.M. (1983). Flora of south-eastern Queensland. Volume 1. Queensland Department of Primary Industries, Brisbane	[No evidence] "Small tree, young parts, petioles, petiolules, peduncles pubescent. Petioles 3-7 cm long; leaflets 5-11; petiolules 2 -7 mm long; leaflet blades elliptic, obovate or oblong, apex broad, retuse, base cuneate, margin entire, 5.5-19 cm X 2.5-6.5 cm, shining, glabrous above, pale, glabrous or puberulent below, lateral nerves spreading, parallel. Panicles 8-25 cm long, pedicels up to 2.5 mm long; outer calyx lobes 2.5 mm long, inner 3-4 mm long, puberulent; petals 1.5-3 mm long; stamens 8. Capsules yellow, subglobose, 3-furrowed and 3-ribbed, apiculate, 1.5 cm X 1.5 cm, shortly stipitate, valves thick, wrinkled and puberulent outside, densely rusty tomentose inside; seeds almost enclosed by red-orange aril"

402	Allelopathic	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	Unknown

403	Parasitic	n
	Source(s)	**Notes**
	Tropicos.org. 2017. Tropicos [Online Database]. Missouri Botanical Garden. http://www.tropicos.org/. [Accessed 4 Sep 2017]	"Medium sized tree. Leaves 13-20 cm long, glabrous mostly impari¬pinnate, leaflets 5-11, subsessile, 5-7.5 cm long, c. 3 cm broad, alternate to sub-opposite, obovate, entire, upper surface glaucescent, apex retuse." [Sapindaceae. No evidence]

404	Unpalatable to grazing animals	

Qsn #	Question	Answer
	Source(s)	**Notes**
	Melzer, A., Baudry, C., Kadiri, M., & Ellis, W. (2011). Tree use, feeding activity and diet of koalas on St Bees Island, Queensland. Australian Zoologist, 35(3), 870-875	"Table 2. Relative occurrence of species in faecal pellets from St Bees Island koalas." [Cupaniopsis anacardioides not present in fecal pellets of koalas]
	WRA Specialist. 2017. Personal Communication	Unknown

405	Toxic to animals	n
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Related members of the Sapindaceae have been known to have toxic effects, but no health risks are known from C. anacardioides. The aril is edible (Cribb and Cribb, 1987)."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Coile (1997) notes a caterpillar that eats most of the seed in Australia, as also cited in Reynolds (1985) and this herbivore could be a potential candidate for biocontrol. Numerous insects have been reported on C. anacardioides in nurseries, including 32 collections of a quarantined root weevil, Diaprepes abbreviatus and 12 genera of scale insects. Alfieri et al. (1994) report various pathogens, including 10 genera of leaf spot pathogens (e.g. Colletotrichum sp.), root rot (Fusarium sp. and Pythium sp.), and a parasitic lichen (Strigula sp.). A web blight caused by Thanatephorus cucumeris was the first reported on C. anacardioides in the USA (McMillan et al., 1994). Predators and pathogens found in its native range need to be explored. In Florida, USA, a number of C. anacardioides trees have developed an expanded, irregularly-shaped base with swollen knots on the trunk at about 18 to 20 years of age. Fungus was ruled out and age was believed to be the likely source of these distortions. Termites are known to also infest trees."
	Gilman, E.F. & Watson, D.G. 1993. Cupaniopsis anacardiopsis: carrotwood. ENH380. Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL. http://edis.ifas.ufl.edu. [Accessed 4 Sep 2017]	"No pests or diseases are of major concern."

Qsn #	Question	Answer
407	**Causes allergies or is otherwise toxic to humans**	**n**
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Related members of the Sapindaceae have been known to have toxic effects, but no health risks are known from C. anacardioides. The aril is edible (Cribb and Cribb, 1987)."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence

Qsn #	Question	Answer
408	**Creates a fire hazard in natural ecosystems**	**n**
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[Unlikely. Fire risk not among listed impacts, & habitat invaded not among the most fire prone ecosystems] "In its native range, C. anacardioides is found in a broad range of habitats, from stable dunes, rock outcrops, hilly scrub, monsoon forests, vine thickets, and riverine forests (Reynolds, 1985; Brock, 1988). Populations in both its native Australia and in Florida, USA where introduced, grow on beaches, scrub and freshwater forests."
	Lockhart, C. 2005. PCA fact sheet: carrotwood Cupaniopsis anacardioides. Plant Conservation Alliance's Alien Plant Working Group. http://www.nps.gov/plants/alien/fact/cuan1.htm. [Accessed 11 Jan 2011]	[Unlikely] "While carrotwood invades a variety of natural communities, including dunes, coastal strand, sand pine scrub, slash pine flatwoods, cypress swamps, freshwater marshes and river banks, it poses a special threat to coastal ecosystems like mangrove swamps and tropical hammocks."

Qsn #	Question	Answer
409	**Is a shade tolerant plant at some stage of its life cycle**	**y**
	Source(s)	**Notes**
	Gilman, E.F. & Watson, D.G. 1993. Cupaniopsis anacardiopsis: carrotwood. ENH380. Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL. http://edis.ifas.ufl.edu. [Accessed 7 Sep 2017]	"Full sun"
	Langeland, K.A., Cherry, H.M., McCormick, C.M. & Craddock Burks, K.A. 2008. Identification & Biology of Non-Native Plants in Florida's Natural Areas. Second Edition. IFAS Publications, Gainesville, FL	"Tolerant of salt, full sun, full shade, poor soils, poor drainage, and dry areas (Oliver 1992)."
	Lockhart, C. 2005. PCA fact sheet: carrotwood Cupaniopsis anacardioides. Plant Conservation Alliance's Alien Plant Working Group. http://www.nps.gov/plants/alien/fact/cuan1.htm. [Accessed 11 Jan 2011]	Tolerant of shade and sun.

Qsn #	Question	Answer
410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**y**
	Source(s)	**Notes**

Qsn #	Question	Answer
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"C. anacardioides is tolerant of a broad range of soils, soil moisture, elevations, and salt." ... "Soil drainage - free impeded; Soil reaction - acid alkaline neutral; Soil texture - light medium; Special soil tolerances - infertile saline shallow"
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	"Carrotwood is tolerant of a wide range of soil moisture conditions and thrives in disturbed and undisturbed wetlands but can readily adapt to dry areas as well (Lockhart et al. 1999)."
	Langeland, K.A., Cherry, H.M., McCormick, C.M. & Craddock Burks, K.A. 2008. Identification & Biology of Non-Native Plants in Florida's Natural Areas. Second Edition. IFAS Publications, Gainesville, FL	"Tolerant of salt, full sun, full shade, poor soils, poor drainage, and dry areas (Oliver 1992)."
	Lockhart, C. 2005. PCA fact sheet: carrotwood Cupaniopsis anacardioides. Plant Conservation Alliance's Alien Plant Working Group. http://www.nps.gov/plants/alien/fact/cuan1.htm. [Accessed 11 Jan 2011]	Tolerant of salt, poor soils, poor drainage.

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Langeland, K.A., Cherry, H.M., McCormick, C.M. & Craddock Burks, K.A. 2008. Identification & Biology of Non-Native Plants in Florida's Natural Areas. Second Edition. IFAS Publications, Gainesville, FL	"Botanical Description: Slender evergreen tree, usually single trunked, to 10 m (33 ft) tall, with dark gray outer bark and often orange inner bark (hence the common name). Leaves alternate, once compound (usually even-pinnate), with petioles swollen at the base; 4-12 leaflets, stalked, oblong, leathery, shiny yellowish green, to 20 cm (8 in) long and 7.5 cm (3 in) wide, with margins entire and tips rounded or slightly indented."

Qsn #	Question	Answer
412	**Forms dense thickets**	**y**
	Source(s)	**Notes**
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Because the species is shade tolerant, it is able to invade intact forests and form dense stands (Gordon, 1998)."
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	"Once it invades a new area, Cupaniopsis anacardioides can crowd out and outcompete native vegetation to form dense monospecific stands (Randall and Marinelli 1996)."
	Lockhart, C. S., Austin, D. F., Jones, W. E., & Downey, L. A. (1999). Invasion of carrotwood (Cupaniopsis anacardioides) in Florida natural areas (USA). Natural Areas Journal, 19(3), 254-262	"Plant sizes described for Table 1 included seedlings to five meter tall trees, and incidences per site ranged from a · single or a few plants to dense nearly monoculture populations. While field reports cited reproductive carrotwood trees in Sarasota, Martin, arid Brevard counties,· there were no reproductive trees within the test plots used for density sampling." ... "There was a broad range of carrotwood density between sites, between habitats. and between disturbed and undisturbed plots. A total of 1,240 square meters were sampled during this study (Table 2). The lowest densities occurred in the coastal strand, ranging from 0.03 to 0.21 plants per m2. The highest densities occurred in the mangroves, ranging from 0 to 24.16 plants per m2. Hardwood hammocks were almost as dense as mangroves, ·with a range of 0.1 to 21.47 plants per m2."

501	**Aquatic**	**n**
	Source(s)	**Notes**
	Langeland, K.A., Cherry, H.M., McCormick, C.M. & Craddock Burks, K.A. 2008. Identification & Biology of Non-Native Plants in Florida's Natural Areas. Second Edition. IFAS Publications, Gainesville, FL	[Terrestrial] "Distribution: Occurs naturally along north and east coasts of Australia on rocky beaches, sand dunes, and in hilly scrub and riverine and monsoon forests (Reynolds 1985). Cultivated in various subtropical areas, including California (Oliver 1992). In Florida, naturalized in coastal counties from Brevard and Hillsborough south to Dade and Collier (EPPC 1996)."

502	**Grass**	**n**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 7 Sep 2017]	Family: Sapindaceae Subfamily: Sapindoideae

503	**Nitrogen fixing woody plant**	**n**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 7 Sep 2017]	Family: Sapindaceae Subfamily: Sapindoideae

504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Langeland, K.A., Cherry, H.M., McCormick, C.M. & Craddock Burks, K.A. 2008. Identification & Biology of Non-Native Plants in Florida's Natural Areas. Second Edition. IFAS Publications, Gainesville, FL	"Slender evergreen tree, usually single trunked, to 10 m (33 ft) tall, with dark gray outer bark and often orange inner bark (hence the common name)."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	No evidence found. Widespread native distribution

602	Produces viable seed	y
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Capsules generally have three locules and produce one seed per locule. Hawkeswood (1983b) described capsules from his study in Queensland, Australia as producing an average of 2 seeds per fruit with an estimated 9,200 to 10,800 seeds produced by a single, mature tree (size and age of trees are not given). Observations in Florida, USA indicate that there are regularly three seeds per fruit."
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	"Sexual reproduction and propagation by means of seeds is the chief means of reproduction in Cupaniopsis anacardioides, a species that is recognized as a prolific seed producer."

603	Hybridizes naturally	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	Unknown

604	Self-compatible or apomictic	y
	Source(s)	**Notes**
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	"Carrotwood is monoecious, with both male and female flowers occurring on the same plant."
	Benson, D. & McDougall, L. 2001. Ecology of Sydney plant species. Part 8. Dicotyledon families Rutaceae to Zygophyllaceae. Cunninghamia 7(2): 255-462	"Insects attracted by nectar and prolific pollen, visited by small native bee Trigona carbonaria for nectar and pollen, probably effecting a high level of self-pollination and a low level of cross-pollination"
	Adam, P., & Williams, G. (2001). Dioecy, self-compatibility and vegetative reproduction in Australian subtropical rainforest trees and shrubs. Cunninghamia, 7(1), 89-100	"The results from the bagged flowers indicate that 16 of the studied species (in 14 families) have the ability to automatically self. This number may be fewer if those species with very low percentages, which may represent contamination, are discounted. Nine species demonstrated relatively high levels of selfing: Abrophyllum ornans, Acradenia euodiiformis, Cupaniopsis anacardioides ... "

605	Requires specialist pollinators	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	Benson, D. & McDougall, L. 2001. Ecology of Sydney plant species. Part 8. Dicotyledon families Rutaceae to Zygophyllaceae. Cunninghamia 7(2): 255-462	"Flowers: Yellowish, June–August. Separate male and female flowers on same plant or separate plants (Harden 1991). Insects attracted by nectar and prolific pollen, visited by small native bee Trigona carbonaria for nectar and pollen, probably effecting a high level of selfpollination and a low level of cross-pollination; flies Stomorhina discolor, Baccha sp., fruit fly Dacus murrayi, green bee Palaeorhiza sp. carried small amounts of pollen and probably play a lesser role in pollination (Hawkeswood 1983)."
	Lockhart, C. 2005. PCA fact sheet: carrotwood Cupaniopsis anacardioides. Plant Conservation Alliance's Alien Plant Working Group. http://www.nps.gov/plants/alien/fact/cuan1.htm. [Accessed 11 Jan 2011]	"In its native range, carrotwood is pollinated by bees."
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Pollination occurs primarily through melittophily (Hawkeswood, 1983a), and despite a physiology that might suggest pollination by visiting flies, small, native black bee species (Trigona carbonaria) were observed regularly carrying C. anacardioides pollen. Flowers open and are fragrant in the morning, and nectar glands may act as an insect attractor. Both male and female flowers emerge on the panicle. Flowers that are not pollinated drop from the plant and as a result, only maturing female flowers remain on the tree."

606	**Reproduction by vegetative fragmentation**	**n**
	Source(s)	**Notes**
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Fruits are abundantly produced and seeds are mainly dispersed by frugivorous birds, which bring the seeds from planted sites into natural vegetation (Langeland and Craddock Burks, 1998)." [No evidence]
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	"Sexual reproduction and propagation by means of seeds is the chief means of reproduction in Cupaniopsis anacardioides, a species that is recognized as a prolific seed producer."
	Benson, D. & McDougall, L. 2001. Ecology of Sydney plant species. Part 8. Dicotyledon families Rutaceae to Zygophyllaceae. Cunninghamia 7(2): 255-462	"Vegetative spread: No"

607	**Minimum generative time (years)**	**>3**
	Source(s)	**Notes**
	Tierney, D. & Watson, P. 2009. Fire and the Vegetation of the Hunter Central Rivers CMA. Nature Conservation Council, Sydney	"Table 3. Important fire response characteristics of some prominent species considered likely to be fire sensitive in HCR CMA Dry Rainforests" [Cupaniopsis anacardioides - Minimum maturity (years) = 5]
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	"This fast growing tree can reach a height of 10 m."

701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Lockhart, C. S., Austin, D. F., Jones, W. E., & Downey, L. A. (1999). Invasion of carrotwood (Cupaniopsis anacardioides) in Florida natural areas (USA). Natural Areas Journal, 19(3), 254-262	"Bird dispersal explains carrotwood populations on isolated islands in the Gulf and Atlantic Intracoastal Waterways, and numerous seedlings under trees and telephone poles. Fish-eating crows, which roost on those islands, and mockingbirds have been observed fighting over the seed (D. Austin, personal observation, 1990-1996). Seedlings have been observed under telephone poles where starlings perch in a Broward County park (G. Phillips, personal communication, 1996)."
	Lockhart, C. 2005. PCA fact sheet: carrotwood Cupaniopsis anacardioides. Plant Conservation Alliance's Alien Plant Working Group. http://www.nps.gov/plants/alien/fact/cuan1.htm. [Accessed 11 Jan 2011]	"The brightly colored fruit is a yellow, three-lobed capsule which, when ripe (May to June) splits open to expose three shiny black seeds encased in red or orange fleshy tissue."

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"C. anacardioides was introduced for ornamental use in Florida based on the success of its ornamental use in California. It is currently still widely available by seed and various sizes of nursery-grown materials and as such further spread is likely via intentional introduction. Propagation, transport, and sale of this species are prohibited in Florida, USA, but seed and nursery-grown stock of C. anacardioides are available from Australia and California, USA. There are no records of accidental introduction."
	Lockhart, C. 2005. PCA fact sheet: carrotwood Cupaniopsis anacardioides. Plant Conservation Alliance's Alien Plant Working Group. http://www.nps.gov/plants/alien/fact/cuan1.htm. [Accessed 11 Jan 2011]	"University of Florida Herbarium specimens document carrotwood cultivation as early as 1955 in eastern Florida. A separate introduction in Sarasota, Florida in 1968 resulted in large scale propagation and use as an ornamental tree. Carrotwood became a popular landscape tree throughout southern Florida in the late 1970s and early 1980s. By 1990, wild carrotwood seedlings began to be seen in the wild in various habitats."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Propagation, transport, and sale of this species are prohibited in Florida, USA, but seed and nursery-grown stock of C. anacardioides are available from Australia and California, USA. There are no records of accidental introduction."
	Lockhart, C. 2005. PCA fact sheet: carrotwood Cupaniopsis anacardioides. Plant Conservation Alliance's Alien Plant Working Group. http://www.nps.gov/plants/alien/fact/cuan1.htm. [Accessed 11 Jan 2011]	"While carrotwood invades a variety of natural communities, including dunes, coastal strand, sand pine scrub, slash pine flatwoods, cypress swamps, freshwater marshes and river banks, it poses a special threat to coastal ecosystems like mangrove swamps and tropical hammocks." [not grown or invading produce areas]

704	Propagules adapted to wind dispersal	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Langeland, K.A., Cherry, H.M., McCormick, C.M. & Craddock Burks, K.A. 2008. Identification & Biology of Non-Native Plants in Florida's Natural Areas. Second Edition. IFAS Publications, Gainesville, FL	"Seeds dispersed by birds, including mockingbirds and fish-eating crows (Austin 1996)."
	Lockhart, C. 2005. PCA fact sheet: carrotwood Cupaniopsis anacardioides. Plant Conservation Alliance's Alien Plant Working Group. http://www.nps.gov/plants/alien/fact/cuan1.htm. [Accessed 11 Jan 2011]	"The brightly colored fruit is a yellow, three-lobed capsule which, when ripe (May to June) splits open to expose three shiny black seeds encased in red or orange fleshy tissue." [no adaptation for wind dispersal]

705	Propagules water dispersed	
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"The presence of numerous C. anacardioides seedlings on isolated islands in the river estuaries is attributed to bird transport of seed." ... "Seeds of C. anacardioides have been observed in the tidal lines of an estuary shorelines indicating dispersal by water as another possible means, though viability of seed dispersed this way is not known."
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	[Possibly water dispersed] "Within it's native range Cupaniopsis anacardioides is found along rocky beaches and in sand dunes, and in hilly scrub and forested wetlands." "Seed dispersal by birds and small mammals is important, and transport via water may be important as well."

706	Propagules bird dispersed	y
	Source(s)	**Notes**
	Hall, D., Wayne L. Currey, & Joseph R. Orsenigo. (1998). Weeds from Other Places: The Florida Beachhead Is Established. Weed Technology, 12(4), 720-725	"Carrotwood is a small ornamental tree in the soapberry family (Sapindaceae) that was introduced from Australia and is planted in increasing numbers for ornamental purposes in the southern part of the peninsula. In the 1950s- 1970s, one rarely saw a crow in the organic soil farming area, whereas crows were very common on adjacent sandy soils. Now, for the past 6 yr or so, crows have come to feed on the carrotwood fruit and are seen in a residential area only when the fruit is ripe. Carrotwood is an ornamental that is able to successfully compete with native vegetation and is rapidly invading native communities."
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	"Seed dispersal by birds and small mammals is important, and transport via water may be important as well."

Qsn #	Question	Answer
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Seeds are dispersed by several species of birds, attracted to its brightly coloured seed and fleshy aril. Various species of birds have been observed feeding and sometimes fighting over the seed including the northern mockingbird (Mimus polyglottos), fish crows (Corvus ossigragus), starlings (Sturnus vulgaris), cardinals (Cardinalis cardinalis) and blue jays (Cyanocitta cristata) (Lockhart et al., 1999). The distance that the seed is carried from the parent tree will vary based on the amount of time that a given bird species keeps the seed in its digestive tract, but may be several kilometres. The presence of numerous C. anacardioides seedlings on isolated islands in the river estuaries is attributed to bird transport of seed. The maximum distance between feeding and roosting varies with different bird species. In urban areas, seedlings have been observed under telephone poles and in the cracks in pavements."
	Kaufman, S.R. & Kaufman, W. 2012. Invasive Plants: A Guide to Identification and the Impacts and Control of Common North American Species. Second Edition, Revised and Updated. Stackpole Books, Mechanicsburg, PA	"Yellow-orange seed capsules open into three sections, revealing three shiny black seeds covered in orange arils (fleshy tissue)." ... "Birds and probably small mammals disperse the seeds to new locations."

707	Propagules dispersed by other animals (externally)	
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Small mammals appear to be secondary dispersers of C. anacardioides seed." [Unknown whether seeds are carried externally or consumed along with aril]
	Lockhart, C. 2005. PCA fact sheet: carrotwood Cupaniopsis anacardioides. Plant Conservation Alliance's Alien Plant Working Group. http://www.nps.gov/plants/alien/fact/cuan1.htm. [Accessed 7 Sep 2017]	"The brightly colored fruit is a yellow, three-lobed capsule which, when ripe (May to June) splits open to expose three shiny black seeds encased in red or orange fleshy tissue." [Arils may attract secondary dispersers]

708	Propagules survive passage through the gut	y
	Source(s)	**Notes**
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	"Seed dispersal by birds and small mammals is important, and transport via water may be important as well."
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Seeds are dispersed by several species of birds, attracted to its brightly coloured seed and fleshy aril. Various species of birds have been observed feeding and sometimes fighting over the seed including the northern mockingbird (Mimus polyglottos), fish crows (Corvus ossigragus), starlings (Sturnus vulgaris), cardinals (Cardinalis cardinalis) and blue jays (Cyanocitta cristata) (Lockhart et al., 1999). The distance that the seed is carried from the parent tree will vary based on the amount of time that a given bird species keeps the seed in its digestive tract, but may be several kilometres."

801	Prolific seed production (>1000/m2)	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Lockhart, C. 2005. PCA fact sheet: carrotwood Cupaniopsis anacardioides. Plant Conservation Alliance's Alien Plant Working Group. http://www.nps.gov/plants/alien/fact/cuan1.htm. [Accessed 11 Jan 2011]	"Carrotwood is a prolific seed producer, and the brightly colored fruits are very attractive to birds which disperse it widely."
	Masterson, J. 2007. Cupaniopsis anacardioides (carrotwood). Smithsonian Marine Stations, Fort Pierce, FL. www.sms.si.edu/	"Sexual reproduction and propagation by means of seeds is the chief means of reproduction in Cupaniopsis anacardioides, a species that is recognized as a prolific seed producer.

802	Evidence that a persistent propagule bank is formed (>1 yr)	n
	Source(s)	**Notes**
	Cook, A., Turner, S. R., Baskin, J. M., Baskin, C. C., Steadman, K. J., & Dixon, K. W. (2008). Occurrence of physical dormancy in seeds of Australian Sapindaceae: a survey of 14 species in nine genera. Annals of botany, 101 (9), 1349-1362	"Other reports on the germination characteristics of Sapindaceae supports our results that Ganophyllum, Alectryon, Cupaniopsis and Harpullia do not have PY since fresh (non-treated) seeds in several species in each of these genera germinate readily (Nicholson and Nicholson, 1991a, b, 1992, 1994, 2000, 2004)."

803	Well controlled by herbicides	y
	Source(s)	**Notes**
	Lockhart, C. S., Austin, D. F., Jones, W. E., & Downey, L. A. (1999). Invasion of carrotwood (Cupaniopsis anacardioides) in Florida natural areas (USA). Natural Areas Journal, 19(3), 254-262	"Control of carrotwood can be achieved in uplands by the use of a basal bark treatment with Garlon IV (E. Freeman, personal communication 1996). Information is not available for treatment in wetlands. Small trees can be girdled and sprayed with Roundup or Rodeo, but stump sprouts may need retreatment. Chemical treatment, however, should be used judiciously and as a last resort. Caution is indicated not only because of the sensitivity of mangroves to chemicals, but also because many such chemicals mimic hormones that disrupt fertility (Colburn, et al. , 1996)."
	Langeland, K.A. 2009. Natural area weeds: carrotwood (Cupaniopsis). Revised. SS-AGR-165. University of Florida IFA Extension, Gainesville, FL. http://edis.ifas.ufl.edu. [Accessed 7 Sep 2017]	"Stumps that are not treated with a herbicide will sprout to form multiple-trunked trees. If it is not objectionable for dead trees to be left standing, certain herbicides can be applied directly to the bark at the base of the tree (basal bark application). Herbicides that contain the active ingredient triclopyr amine (e.g. Brush B-Gon, Garlon 3A Ultra) or glyphosate (e.g. Roundup) can be applied to cut stumps to prevent resprouting. The herbicide should be applied as soon as possible after felling the tree and concentrated on the thin layer of living tissue (cambium) that is just inside the bark. Herbicides with the active ingredient triclopyr ester can be used for basal bark applications."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	**Notes**
	Langeland, K.A. 2009. Natural area weeds: carrotwood (Cupaniopsis). Revised. SS-AGR-165. University of Florida IFA Extension, Gainesville, FL. http://edis.ifas.ufl.edu. [Accessed 11 Jan 2011]	"The final cut should be made as close to the ground as possible and as level as possible to facilitate application of a herbicide to prevent sprouting. Stumps that are not treated with a herbicide will sprout to form multiple-trunked trees."

Qsn #	Question	Answer
	Tierney, D. & Watson, P. 2009. Fire and the Vegetation of the Hunter Central Rivers CMA. Nature Conservation Council, Sydney	[Resprouts after fire] "Table 3. Important fire response characteristics of some prominent species considered likely to be fire sensitive in HCR CMA Dry Rainforests" [Cupaniopsis anacardioides - Regeneration (fire response) S = seed R = resprouts]

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[Unknown in Hawaiian Islands] "The USDA and the Australian Biological Control Laboratory have observed and collected larvae that were feeding on C. anacardioides fruit, probably Prosotas felderi (Lepidoptera: Lycaenidae), and galls that were feeding on the young foliage. Further work is underway and biological control for C. anacardioides is required."

Summary of Risk Traits:

High Risk / Undesirable Traits
• Thrives in tropical climates
• Naturalized on Oahu and Maui, Hawaiian Islands, as well as Florida
• Environmental weed in Florida (displaces native vegetation)
• Shade tolerant
• Tolerates many soil types
• Forms dense stands
• Self-compatible
• Seeds dispersed by birds, possibly water & intentionally by people
• Prolific seed production
• Able to coppice & resprout after cutting & fire

Low Risk Traits
• Unarmed (no spines, thorns, or burrs)
• Provides fodder for livestock (palatable despite reports of toxicity)
• Ornamental
• Not reported to spread vegetatively
• Reaches maturity in 5 years
• Seeds lack physical dormancy (no reports of persistent seed banks)
• Herbicides may provide effective control