

Family: *Arecaceae*

Taxon: *Arenga pinnata*

Synonym: *Arenga gamuto* (Houtt.) Merr.
Arenga griffithii Seem. ex H. Wendl.
Arenga saccharifera Labill. ex DC.
Borassus gomutus Lour.
Caryota onusta Blanco
Gomutus rumphii Corrêa
Gomutus saccharifer (Labill. ex DC.) Spreng.
Gomutus vulgaris Oken
Saguerus gamuto Houtt.
Saguerus pinnatus Wurm (basionym)
Saguerus rumphii (Corrêa) Roxb.
Saguerus saccharifer (Labill. ex DC.) Blume
Sagus gomutus (Lour.) Perr.

Common Name sugar palm

Questionnaire :	current 20090513	Assessor:	Chuck Chimera	Designation: H(HPWRA)
Status:	Assessor Approved	Data Entry Person:	Chuck Chimera	WRA Score 7
101	Is the species highly domesticated?		y=-3, n=0	n
102	Has the species become naturalized where grown?		y=1, n=-1	
103	Does the species have weedy races?		y=1, n=-1	
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	y
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)	
305	Congeneric weed		n=0, y = 1*multiplier (see Appendix 2)	n
401	Produces spines, thorns or burrs		y=1, n=0	y
402	Allelopathic		y=1, n=0	n
403	Parasitic		y=1, n=0	n
404	Unpalatable to grazing animals		y=1, n=-1	

405	Toxic to animals	y=1, n=0	
406	Host for recognized pests and pathogens	y=1, n=0	n
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	y
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	y=1, n=-1	y
604	Self-compatible or apomictic	y=1, n=-1	
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	y=1, n=-1	
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)	y=1, n=-1	n
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	
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	

Supporting Data:

101	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Several forms of the sugar palm exist in Malaya, varying mainly in how long is required for plants to begin flowering [could affect ability to naturalize, but otherwise, domestication does not seem to have significantly altered tree to point of becoming potentially less invasive]
101	2008. Janick, J./Paull, R. E.. The encyclopedia of fruit & nuts. Cabi Publishing, Wallingford, UK	While some degree of regional selection has been applied to sugar palm, mostly towards reducing the juvenile period, no rigorous breeding or cultivar evaluation programme has ever been conducted.
101	2010. World Agroforestry Center. Agroforestry Tree Database - Arenga pinnata. http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=119	History of cultivation Although the origin of <i>A. pinnata</i> is not known with certainty, it may be from the region of Minahassa in North Sulawesi, Indonesia, in view of the great abundance of this palm at all sites. As early as 1821 it was reported that 439 450 sugar palms were harvested for ijuk (black fibres), yielding as much as 300 000 ropes from a single factory during one month. At that time the sea water-resistant fibres were the main product, as in the extensive sugar palm plantings in Malacca in the 19th century. Its great versatility makes it one of the oldest cultivated plants, and it was probably a source of plant sugar long before sugarcane was cultivated for that purpose. Among the Minahassa, for example, legends about the use of the 'toddy' date back to the time of Toar and Lumimuut, who were the first human beings on earth, according to their traditional belief. [long history of cultivation, but no significant changes by domestication known]
201	1998. Chan, E./Tettoni, L. I.. Tropical Plants. Tuttle Publishing, North Clarendon, VT	<i>Arenga pinnata</i> is the sugar palm of Malaysia and Java that is said to give a rich sugar...Indigenous to Southeast Asia, it grows wild, but is sometimes cultivated.
202	1998. Chan, E./Tettoni, L. I.. Tropical Plants. Tuttle Publishing, North Clarendon, VT	<i>Arenga pinnata</i> is the sugar palm of Malaysia and Java that is said to give a rich sugar...Indigenous to Southeast Asia, it grows wild, but is sometimes cultivated.
203	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Ranging from Subtropical Dry to Moist through Tropical Dry to Wet Forest Life Zones, sugar palm is reported to tolerate annual precipitation of 7 to 40 dm (mean of 8 cases = 19.1), annual temperature of 19 to 27 degrees C, (mean of 8 cases = 24.5), and pH of 5.0 to 8.0 (mean of 5 cases = 6.4). More or less a forest tree, but not restricted to jungles; it can be grown on very poor rocky hillsides and in waste places. It flourishes best in humid tropics in a rich moist soil, from sea-level to elevations of 1,200 m, being grown at higher elevations than coconut.
204	1998. Chan, E./Tettoni, L. I.. Tropical Plants. Tuttle Publishing, North Clarendon, VT	<i>Arenga pinnata</i> is the sugar palm of Malaysia and Java that is said to give a rich sugar...Indigenous to Southeast Asia, it grows wild, but is sometimes cultivated.
205	2006. Daehler, C. C./Baker, R. F.. New Records of Naturalized and Naturalizing Plants Around Lyon Arboretum, Mānoa Valley, O'ahu. Bishop Museum Occasional Papers. 87: 3-18.	Cultivated and naturalized in Hawaii
205	2008. Dawson, W./Mndolwa, A. S./Burslem, D. F. R. P./Hulme, P. E.. Assessing the risks of plant invasions arising from collections in tropical botanical gardens. Biodiversity and Conservation. 17: 979-1995.	Cultivated and spreading in Tanzania
205	2010. Dave's Garden. PlantFiles: Solitary Sugar Palm. Dave's Garden, http://davesgarden.com/guides/pf/go/62892/	This plant has been said to grow in the following regions: Corte Madera, California Thousand Oaks, California Westminster, California Loxahatchee, Florida Naples, Florida Saint Petersburg, Florida
301	2006. Daehler, C. C./Baker, R. F.. New Records of Naturalized and Naturalizing Plants Around Lyon Arboretum, Mānoa Valley, O'ahu. Bishop Museum Occasional Papers. 87: 3-18.	First planted in the Arboretum in 1932. Naturalized plants around the Arboretum are probably in their third generation, and they form dense stands locally. Material examined: O'AHU: Naturalized plant growing on ridge in upper Haukulu, Lyon Arboretum; 25 Jul 2005, C. Daehler 1318 (HAW); Lyon Arboretum (cultivated material), 25 Jul 1968, F.B. Essig 680725 (HLA).
301	2008. Dawson, W./Mndolwa, A. S./Burslem, D. F. R. P./Hulme, P. E.. Assessing the risks of plant invasions arising from collections in tropical botanical gardens. Biodiversity and Conservation. 17: 979-1995.	Table 5 Spreading species with known planting history in ABG... <i>Arenga pinnata</i> ...Naturalised or Invasive elsewhere: Yes
301	2010. Hashim, N. R./Hughes, F./Bayliss-Smith, T.. Non-native Species in Floodplain Secondary Forests in Peninsular Malaysia. EnvironmentAsia. 3: 43-49. www.tshe.org/EA	Unlike the relatively recent introduction of cocoa, oil palm and <i>G. sepium</i> , four other species (sago, areca, <i>Arenga pinnata</i> and the tree bamboo) are all believed to have been introduced into the peninsula many centuries ago and are now considered naturalized. [Malaysia]

302	2007. Randall, R.P.. Global Compendium of Weeds - <i>Arenga pinnata</i> [Online Database]. Hawaii Ecosystems at Risk Project (HEAR), http://www.hear.org/gcw/species/arenga_pinnata/	Starting to naturalize from gardens (see Daehler and Baker 2006) and spread into native forests (see question 3.04) but not currently regarded as a weed of gardens, or disturbance
303	2007. Randall, R.P.. Global Compendium of Weeds. http://www.hear.org/gcw/	No evidence that <i>A. pinnata</i> has become a weed of agriculture, horticulture or forestry, but may have potential to become an environmental weed of wet forests.
304	2000. Binggeli, P.. The East Usambaras (Tanzania) - The Pearl of Africa. <i>Aliena</i> . 10: 14-15.	Casual observations at two other locations indicate that other species, hitherto not thought to be invading, are also spreading into natural forest including two tree species, <i>Castilla elastica</i> and <i>Arenga pinnata</i> , and a bamboo.
304	2008. Darwin Initiative Project. Usambara Invasive Plants - <i>Arenga pinnata</i> . Darwin Initiative Project, http://www.tropical-biology.org/research/dip/species/Arenga%20pinnata.htm	Introduced range: Invasive in Tanzania. Introduced but not invasive throughout tropical Asia. [no information on impacts]
304	2008. Meyer, J-Y./Lavergne, C./Hodel, D. R.. Time Bombs in Gardens: Invasive Ornamental Palms in Tropical Islands, with Emphasis on French Polynesia (Pacific Ocean) and the Mascarenes (Indian Ocean). <i>Palms</i> . 52: 71-83.	In 1999, Meyer officially advised the Department of the Environment of French Polynesia to ban introduction of <i>Licualagrandis</i> , <i>Washingtonia</i> spp. And <i>Elaeis guineensis</i> . All new importation of palms of the genera <i>Adonidia</i> , <i>Areca</i> , <i>Arenga</i> , <i>Borassus</i> , <i>Dypsis</i> , <i>Corypha</i> , <i>Howea</i> , <i>Livistona</i> , <i>Ptychosperma</i> and <i>Roystonea</i> , as well as <i>Elaeis guineensis</i> , <i>Washingtonia robusta</i> and <i>Phoenix dactylifera</i> , are officially illegal in French Polynesia Decree °276 CM 23 May 2005), primarily because of the risk of disease to the coconut, the most economically important plant of the islands.
305	2007. Randall, R.P.. Global Compendium of Weeds. http://www.hear.org/gcw/	No other <i>Arenga</i> species lists as invasive
401	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	old leaf-bases covering trunk with a mat of tough, black fibers and long spines
401	2010. Dave's Garden. PlantFiles: Solitary Sugar Palm. Dave's Garden, http://davesgarden.com/guides/pf/go/62892/	Danger: Plant has spines or sharp edges; use extreme caution when handling
402	2010. World Agroforestry Center. Agroforestry Tree Database - <i>Arenga pinnata</i> . http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=119	As the heavy shade and the dense root system of the sugar palm limit its combination with other crop plants, it is best planted on steeper slopes, easily eroding lands, or in single or double rows near the boundaries of fields, where it contributes to soil stabilization without taking up considerable land area [but no evidence of allelopathy]
403	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Not parasitic
404	2007. Ecocrop. <i>Arenga pinnata</i> . FAO, http://ecocrop.fao.org/ecocrop/srv/en/cropView?id=3348	Young leaves, still white, are eaten in the same way as palm cabbage. [refers to human consumption, but young leaves probably palatable to browsing/grazing animals as well, and older leaves probably unpalatable]
404	2007. Riley, E. P.. Flexibility in Diet and Activity Patterns of <i>Macaca tonkeana</i> in Response to Anthropogenic Habitat Alteration. <i>International Journal of Primatology</i> . 28: 107-133.	Dietary diversity is significantly lower in the Anca group, with 52% of their diet being palm fruits from <i>Arenga pinnata</i> . [fruits palatable to Sulawesi Tonkean macaques (<i>Macaca tonkeana</i>)]
404	2010. WRA Specialist. Personal Communication.	Palatability of foliage to browsing or grazing animals unknown
405	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Juice of the outer covering of fruit is highly corrosive and may cause pain and skin inflammation...Juice of ripe fruit is poisonous. [but animal toxicity unknown]
405	2006. Daehler, C. C./Baker, R. F.. New Records of Naturalized and Naturalizing Plants Around Lyon Arboretum, Mānoa Valley, O'ahu. Bishop Museum Occasional Papers. 87: 3-18.	The fruits are dark red, about 2.5 cm in diameter, and are extremely irritating to the skin, containing calcium oxalate crystals. [but no other evidence of toxicity to animals or humans]
406	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	reported to tolerate disease, drought, fungus, high pH, insects, poor soil, shade, and slope...It is little subject to drought damage, typhoons, insect pests, or fungal diseases...Sugar palm is virtually insect-, pest- and disease-free, one fungus attacking the palm being <i>Ganoderma pseudoferreum</i> .
407	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Juice of the outer covering of fruit is highly corrosive and may cause pain and skin inflammation...Juice of ripe fruit is poisonous.
407	2006. Daehler, C. C./Baker, R. F.. New Records of Naturalized and Naturalizing Plants Around Lyon Arboretum, Mānoa Valley, O'ahu. Bishop Museum Occasional Papers. 87: 3-18.	The fruits are dark red, about 2.5 cm in diameter, and are extremely irritating to the skin, containing calcium oxalate crystals.

408	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	It flourishes best in humid tropics in a rich moist soil, from sea-level to elevations of 1,200 m, being grown at higher elevations than coconut. [No evidence from native range that <i>A. pinnata</i> contributes to fire frequency or is adapted to fire prone regimens]
409	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	reported to tolerate disease, drought, fungus, high pH, insects, poor soil, shade, and slope.
410	2008. Palm Doctor. Palm of the Month: <i>Arenga pinnata</i> . Palm Doctor, LLC, http://www.palmdoctor.com/Palm_Of_The_Month/Arenga_pinnata.htm	Widely adaptable to many soil types
411	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Tall, stout palm, 8 to 15 m tall, bole solitary, straight
412	2006. Daehler, C. C./Baker, R. F.. New Records of Naturalized and Naturalizing Plants Around Lyon Arboretum, Mānoa Valley, O'ahu. Bishop Museum Occasional Papers. 87: 3-18.	Naturalized plants around the Arboretum are probably in their third generation, and they form dense stands locally.
501	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Terrestrial tree
502	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Arecaceae [not a grass]
503	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Arecaceae [not a nitrogen fixing woody plant]
504	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Tall, stout palm, 8 to 15 m tall, bole solitary, straight [not a geophyte]
601	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	No evidence of substantial reproductive failure in native habitat
602	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	seeds 2 to 3 per fruit, dull-metallic, gray-brown, trigonous, oblong, 2.5 to 3.5 cm long, 2 to 2.5 cm wide, with copious endosperm
603	1986. Utami, N.. Natural hybrid between <i>Arenga pinnata</i> and <i>A. obtusifolia</i> in Bogor Botanical Garden (Indonesia). <i>Berita Biologi (Indonesia)</i> . 3: 296-299.	The morphology and leaf anatomy of three collections of <i>Arenga</i> sp. of uncertain identity, grown in the Bogor Botanical Gardens (Indonesia) are investigated and compared with those of <i>Arenga pinnata</i> and <i>Arenga obtusifolia</i> . Results showed that the characteristics of those collection oscillate between <i>A. pinnata</i> and <i>A. obtusifolia</i> . It is suggested consequently that the plants represent a natural hybrid of these two latter species.
604	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	plants monoecious...female inflorescences usually preceding male
604	2008. Janick, J./Paull, R. E.. The encyclopedia of fruit & nuts. Cabi Publishing, Wallingford, UK	No information given on self-compatibility
604	2010. World Agroforestry Center. Agroforestry Tree Database - <i>Arenga pinnata</i> . http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=119	Reproductive Biology This monoecious palm first flowers when around 10-12 years old; however, sometimes it flowers as early as 5-6 years. Maturity is indicated by simultaneous appearance of 2 short leaves at the top of the stem. The average flowering period of an untapped tree is 4-6 years. [self-compatibility unknown]
605	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Flowers are presumably wind-pollinated.
606	2002. Jungle Music Palms and Cycads. <i>Arenga pinnata</i> . http://www.junglemusic.net/palms/arenga-pinnata.htm	Suckering/Solitary: Solitary, (single trunk)
606	2010. World Agroforestry Center. Agroforestry Tree Database - <i>Arenga pinnata</i> . http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=119	<i>A. pinnata</i> can also be propagated through suckers. [but no evidence of vegetative spread]
607	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Trees reach reproductive maturity (flowering stage) in 6 to 12 years and continue to flower for about 15 years before replanting.
607	2010. World Agroforestry Center. Agroforestry Tree Database - <i>Arenga pinnata</i> . http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=119	Reproductive Biology This monoecious palm first flowers when around 10-12 years old; however, sometimes it flowers as early as 5-6 years. Maturity is indicated by simultaneous appearance of 2 short leaves at the top of the stem. The average flowering period of an untapped tree is 4-6 years.
701	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	seeds 2 to 3 per fruit, dull-metallic, gray-brown, trigonous, oblong, 2.5 to 3.5 cm long, 2 to 2.5 cm wide, with copious endosperm [no evidence of unintentional dispersal, and fruits and seeds fairly large without means of external attachment]

702	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	grown for its sugar, starch and fiber
703	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	seeds 2 to 3 per fruit, dull-metallic, gray-brown, trigonous, oblong, 2.5 to 3.5 cm long, 2 to 2.5 cm wide, with copious endosperm [unlikely to contaminate produce due to relatively large seed size]
704	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	fruit obovoid to subglobose, smooth, 5 to 6 cm in diameter [no adaptations for wind dispersal]
705	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	Trees are hardy, self-sustaining, growing readily in well-drained soil of dark cool valleys, along banks of mountain streams, along forest margins and on partially open hillsides. [distribution along streams suggest fruit may be carried along water courses]
706	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	fruit obovoid to subglobose, smooth, 5 to 6 cm in diameter, [large, fleshy-fruited, too large for most birds, but probably able to be secondarily dispersed on ground by birds or mammals]
707	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	fruit obovoid to subglobose, smooth, 5 to 6 cm in diameter...In forests of Indo-Malaysia, ripe fruits are distributed by various fruit bats, civet cats, and wild swine. [possibly that fruit bats and other dispersers may transport fruits without ingesting seeds]
708	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	fruit obovoid to subglobose, smooth, 5 to 6 cm in diameter...In forests of Indo-Malaysia, ripe fruits are distributed by various fruit bats, civet cats, and wild swine.
801	2000. Duke, J. A.. Handbook of nuts. CRC Press, Boca Raton, FL	fruit obovoid to subglobose, smooth, 5 to 6 cm in diameter...seeds 2 to 3 per fruit, dull-metallic, gray-brown, trigonous, oblong, 2.5 to 3.5 cm long, 2 to 2.5 cm wide, with copious endosperm [unlikely given relatively large fruit and seed sizes]
802	2010. World Agroforestry Center. Agroforestry Tree Database - <i>Arenga pinnata</i> . http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=119	Germplasm Management Behaviour of seed in storage is recalcitrant; the seed is short-lived, and only 25% survive for 3 months in open storage. [no evidence of seed bank formation in field conditions]
803	2010. WRA Specialist. Personal Communication.	No information on herbicide control of <i>A. pinnata</i>
804	2010. WRA Specialist. Personal Communication.	Unknown whether <i>A. pinnata</i> will tolerate mutilation, cultivation or fire [unlikely, but no information found]
805	2010. WRA Specialist. Personal Communication.	Unknown whether any effective natural enemies are present locally