Taxon: Terminalia kaernbachii Warb. **Family:** Combretaceae

Common Name(s): okari nut **Synonym(s):** Terminalia okari C. T. White

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 1 Mar 2023

WRA Score: **-2.0** **Designation:** L **Rating:** Low Risk

Keywords: Tropical Tree, Edible Nut, Full Sun, Large-Seeded, Cassowary 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	n
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)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
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
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	n
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		

Qsn #	Question	Answer Option	Answer
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	n
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		
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	n
706	Propagules bird dispersed		
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)		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
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**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	[No evidence] "The species is indigenous to Indonesian Irian Jaya (West Papua), the Aru Islands, Papua New Guinea (Madang, Morobe, Western, Gulf, Central, Northern and Bougainville) and the Solomon Islands. It was introduced to Queensland (Australia)."

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. (2023). Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. (2023). 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**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"The species is indigenous to Indonesian Irian Jaya (West Papua), the Aru Islands, Papua New Guinea (Madang, Morobe, Western, Gulf, Central, Northern and Bougainville) and the Solomon Islands. It was introduced to Queensland (Australia)."

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"The species is indigenous to Indonesian Irian Jaya (West Papua), the Aru Islands, Papua New Guinea (Madang, Morobe, Western, Gulf, Central, Northern and Bougainville) and the Solomon Islands. It was introduced to Queensland (Australia)."

203	**Broad climate suitability (environmental versatility)**	**n**
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"Okari occurs scattered in lowland rainforest and riverine forest, in areas with a wide range of rainfall of 2,000–7,000 mm per annum. Wild populations of this species are known from many areas in Irian Jaya, Papua New Guinea and from the Solomon Islands, where it is also widely cultivated in forests and semi-cultivated areas. It does poorly near the ocean and grows best inland in lowland and intermediate altitudes below 1,000 m. It tolerates poorly drained soils."

Qsn #	Question	Answer
204	**Native or naturalized in regions with tropical or subtropical climates**	**y**
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"The species is indigenous to Indonesian Irian Jaya (West Papua), the Aru Islands, Papua New Guinea (Madang, Morobe, Western, Gulf, Central, Northern and Bougainville) and the Solomon Islands. It was introduced to Queensland (Australia)."
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	No evidence in the Hawaiian Islands

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	Source(s)	**Notes**
	Imada, C.T., Staples, G.W. & Herbst, D.R. (2005). Annotate(Checklist of Cultivated Plants of Hawai'i. http://www2.bishopmuseum.org/HBS/botany/cultivatedp lants/. [Accessed 27 Feb 2023]	"Locations: Harold L. Lyon Arboretum Ho'omaluhia Botanical Garden Kahanu Garden (a satellite garden of National Tropical Botanical Garden) Pacific Tropical Botanical Garden (now National Tropical Botanical Garden) Waimea Arboretum & Botanical Garden"
	CABI. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabic ompendium.53161. [Accessed 27 Feb 2023]	"Terminalia kaernbachii is indigenous to Indonesia, specifically West Papua (formerly Irian Jaya) and the Aru Islands, Papua New Guinea (Madang, Morobe, Western, Gulf, Central, Northern and Bougainville) and is also grown in the Solomon Islands. It has also been introduced more recently to Queensland, Australia and Sri Lanka (Bourke, 2010; Lim, 2012). It is considered domesticated in Papua New Guinea (Bourke and Allen (2009)."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"The species is indigenous to Indonesian Irian Jaya (West Papua), the Aru Islands, Papua New Guinea (Madang, Morobe, Western, Gulf, Central, Northern and Bougainville) and the Solomon Islands. It was introduced to Queensland (Australia)."

Qsn #	Question	Answer
301	**Naturalized beyond native range**	**n**
	Source(s)	**Notes**
	CABI. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.53161. [Accessed 27 Feb 2023]	"Terminalia kaernbachii is indigenous to Indonesia, specifically West Papua (formerly Irian Jaya) and the Aru Islands, Papua New Guinea (Madang, Morobe, Western, Gulf, Central, Northern and Bougainville) and is also grown in the Solomon Islands. It has also been introduced more recently to Queensland, Australia and Sri Lanka (Bourke, 2010; Lim, 2012). It is considered domesticated in Papua New Guinea (Bourke and Allen (2009)."
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	No evidence
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

302	**Garden/amenity/disturbance weed**	**n**
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
	CABI. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.53161. [Accessed 27 Feb 2023]	No evidence

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
	CABI. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.53161. [Accessed 27 Feb 2023]	No evidence

304	**Environmental weed**	**n**
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
	CABI. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.53161. [Accessed 27 Feb 2023]	No evidence

305	**Congeneric weed**	**y**
	Source(s)	**Notes**
	Enloe, S. F., Langeland, K., Ferrell, J., Sellers, B. and MacDonald, G. (2018). Integrated Management of Non-Native Plants in Natural Areas of Florida. SP 242. Revised. University of Florida, IFAS, Gainesville, FL	"Comments: The Indian almond is deciduous and invades coastal habitats, hammocks, and disturbed sites"

Qsn #	Question	Answer
	Global Invasive Species Database (2023) Species profile: Terminalia catappa. http://www.iucngisd.org/gisd/. [Accessed 27 Feb 2023]	"Terminalia catappa is a native plant of Asia that has escaped from cultivation. Due to its ability to cope with sandy, well draining soil, and salt spray it is often found on coastal regions. It is considered invasive in Florida, United States, and several Carribean Islands, including Montserrat, Puerto Rico and the Cayman Islands. Its seeds are highly bouyant which allows it disperse vast distances however they are highly edible so are eaten by bats, crabs and humans. However despite its potential as being an invasive species it is being considered for multiple applications. Due to its extensive and deep-rooting structure it is considered a possible species to use as a dune retention species against proposed climate change and sea-level rise, and in Brazil it is also being considered a potential cultivar to use in bio-fuel creation."

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	[No evidence] "Okari is a small, mid-canopy, tree 20–30 m tall, with a spreading crown, straight and cylindrical trunk and grey bark. Twigs are often massive, hairy when young, with leaves crowded towards the tips (Plate 1). Leaves are spirally arranged, simple, obovate or narrow obovate, 15–28 cm long by 6–13 cm broad (Plates 1 – 3). Inflorescences are axillary with flowers on unbranched axis."

402	Allelopathic	
	Source(s)	**Notes**
	WRA Specialist. (2023). Personal Communication	Unknown. No evidence found

403	Parasitic	n
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"Okari is a small, mid-canopy, tree 20–30 m tall, with a spreading crown, straight and cylindrical trunk and grey bark." [No evidence]

404	Unpalatable to grazing animals	
	Source(s)	**Notes**
	CABI. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.53161. [Accessed 27 Feb 2023]	[Unknown. Edible seeds, but no information on foliage palatability] "Uses List Human food and beverage > Nuts Human food and beverage > Oil/fat Materials > Wood/timber"

405	Toxic to animals	n
	Source(s)	**Notes**
	Tropical Plants Database, Ken Fern. (2023). Terminalia kaernbachii. https://tropical.theferns.info. [Accessed 1 Mar 2023]	"Known Hazards None known"

Qsn #	Question	Answer
	Pangau-Adam, M., & Mühlenberg, M. (2014). Dispersal of Terminalia seeds by the Northern Cassowary in the lowland forest of Papua, Indonesia. Asian Journal of Conservation Biology, 3(2): 115-119	[No evidence. Seeds dispersed by cassowaries] "Although the trees of Terminalia complanata and T. kaernbachii were absent in logged forest, their seeds were found in cassowary droppings collected from this habitat. The movement of cassowary from other habitats may apparently facilitate the seed dispersal proc-ess of these species."
	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. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.53161. [Accessed 1 Mar 2023]	"Fruits are subject to attack by birds and the larvae of mango fly (Bactrocera frauenfeldi), a pest widespread across Papua New Guinea and Micronesia including the Solomon Islands (LeBlanc et al., 2004)."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	**Notes**
	Tropical Plants Database, Ken Fern. (2023). Terminalia kaernbachii. https://tropical.theferns.info. [Accessed 1 Mar 2023]	"Known Hazards None known"
	Bourke, R. M. & Harwood, T. (2009). Food and Agriculture in Papua New Guinea. ANU E Press, Canberra, ACT	"Okari (T. kaernbachii) nuts are eaten raw. Trees are preserved in garden land or planted. Villagers either harvest nuts from trees or, more commonly, collect the fallen fruit." [No evidence]
	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

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	[No evidence. Occurs in wet habitats not known to be fire prone] "Okari occurs scattered in lowland rainforest and riverine forest, in areas with a wide range of rainfall of 2,000–7,000 mm per annum."

Qsn #	Question	Answer
409	**Is a shade tolerant plant at some stage of its life cycle**	**n**
	Source(s)	**Notes**
	Top Tropicals. (2023). Terminalia kaernbachii, Terminalia okari. https://toptropicals.com/catalog/uid/terminalia_kaernbachii.htm. [Accessed 1 Mar 2023]	"It promises abundance with high quality edible nuts and needs a bit of sunshine for full growth." ... "Being a tree native to Papua New Guinea, Terminalia kaernbachii prefers sunny areas and plenty of water, however it is also quite resilient when it comes to its growing conditions and can flourish in locations ranging from sea-level to an altitude of 1100m."
	Tropical Plants Database, Ken Fern. (2023). Terminalia kaernbachii. https://tropical.theferns.info. [Accessed 1 Mar 2023]	"Succeeds in any moderately fertile, well-drained soil in a sunny position"

410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	
	Source(s)	**Notes**
	CABI. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.53161. [Accessed 1 Mar 2023]	"It is tolerant of poorly drained soils and grows in areas with a wide range of annual rainfall (2000-7000 mm) but is less common in regions where rainfall exceeds 7000 mm per year (Bourke, 1996)."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"It tolerates poorly drained soils."
	Tropical Plants Database, Ken Fern. (2023). Terminalia kaernbachii. https://tropical.theferns.info. [Accessed 1 Mar 2023]	"Succeeds in any moderately fertile, well-drained soil in a sunny position"

411	**Climbing or smothering growth habit**	**n**
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"Okari is a small, mid-canopy, tree 20–30 m tall, with a spreading crown, straight and cylindrical trunk and grey bark."

412	**Forms dense thickets**	**n**
	Source(s)	**Notes**
	Bourke, R. M. & Harwood, T. (2009). Food and Agriculture in Papua New Guinea. ANU E Press, Canberra, ACT	[No evidence] "Okari was domesticated in New Guinea. Over the past 50 years the tree has been introduced to other locations in PNG, including East New Britain and New Ireland. It grows from sea level to 1100 m altitude. The species is uncommon near the ocean in its natural range in southern New Guinea, although it does bear near the ocean at, for example, Keravat on New Britain and Kavieng on New Ireland."

Qsn #	Question	Answer
	PNG Forest Industries Association. (2006). Nursery Techniques and Seed Handling of PNG'S Tree Species. PNG Forest Industries Association, Waigani	[No evidence] "Terininalia kaernbachii is native to rainforest in Aru and Papuasia from sea level to 1000 m altitude. In Papua New Guinea (PNG) it is very common from the West Papua border in the west to Mt Dayman in the east, at altitudes of up to 1000 m. It also occurs in a few inland locations on the northern side of the main ranges and in West New Britain between the Aria River and Cape Gloucester. T. kaernbachii is known from the Morobe district (south of the Markham Valley), and from the Western, Gulf, Central and Northern districts. Locally, okari nut occurs in lowland forests associated with flat or gently sloping terrain in rainforest or in ravines. It is commonly planted close to villages for the purpose of producing the edible nut which is highly prized."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	[Scattered] "Okari occurs scattered in lowland rainforest and riverine forest, in areas with a wide range of rainfall of 2,000–7,000 mm per annum."

501	Aquatic	n
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	[Terrestrial] "Okari occurs scattered in lowland rainforest and riverine forest, in areas with a wide range of rainfall of 2,000–7,000 mm per annum."

502	Grass	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2023). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 27 Feb 2023]	Family: Combretaceae Subfamily: Combretoideae Tribe: Combreteae Subtribe: Terminaliinae

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2023). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 27 Feb 2023]	Family: Combretaceae Subfamily: Combretoideae Tribe: Combreteae Subtribe: Terminaliinae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"Okari is a small, mid-canopy, tree 20–30 m tall, with a spreading crown, straight and cylindrical trunk and grey bark."

601	Evidence of substantial reproductive failure in native habitat	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	PNG Forest Industries Association. (2006). Nursery Techniques and Seed Handling of PNG'S Tree Species. PNG Forest Industries Association, Waigani	[No evidence] "Terininalia kaernbachii is native to rainforest in Aru and Papuasia from sea level to 1000 m altitude. In Papua New Guinea (PNG) it is very common from the West Papua border in the west to Mt Dayman in the east, at altitudes of up to 1000 m. It also occurs in a few inland locations on the northern side of the main ranges and in West New Britain between the Aria River and Cape Gloucester. T. kaernbachii is known from the Morobe district (south of the Markham Valley), and from the Western, Gulf, Central and Northern districts."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	[No evidence] "The species is indigenous to Indonesian Irian Jaya (West Papua), the Aru Islands, Papua New Guinea (Madang, Morobe, Western, Gulf, Central, Northern and Bougainville) and the Solomon Islands. It was introduced to Queensland (Australia)."

602	**Produces viable seed**	**y**
	Source(s)	**Notes**
	CABI. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.53161. [Accessed 1 Mar 2023]	"It is normally raised from seed."
	PNG Forest Industries Association. (2006). Nursery Techniques and Seed Handling of PNG'S Tree Species. PNG Forest Industries Association, Waigani	"Nursery techniqnes The nut is either directly sown into polybags or in prepared nursery beds. Seed germinates 15—60 days after sowing. Germination is 5—25% after 4 months, with sporadic germination expected beyond that period. After the seedling has completed shedding the outer nut, the seedlings from beds are potted into polybags. They are of plantable size when they have 3 or 4 pairs of leaves."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"Tree propagation is by seeds."

603	**Hybridizes naturally**	
	Source(s)	**Notes**
	WRA Specialist. (2023). Personal Communication	Unknown. No evidence found

604	**Self-compatible or apomictic**	
	Source(s)	**Notes**
	Kubitzki, K., Bayer, C. & Stevens, P.F. (2007). The Families and Genera of Vascular Plan&s: Volume IX. Flowering Plants. Eudicots. Springer-Verlag, Berlin, Heidelberg, New York	"In India, Srivastava (1993) found that four species of Terminalia were self-incompatible, and were visited by these orders of insects for both pollen and nectar." [Unknown for Terminalia kaernbachii]

605	**Requires specialist pollinators**	**n**
	Source(s)	**Notes**
	PNG Forest Industries Association. (2006). Nursery Techniques and Seed Handling of PNG'S Tree Species. PNG Forest Industries Association, Waigani	"The flowers are pollinated by insects."

Qsn #	Question	Answer
	Kubitzki, K., Bayer, C. & Stevens, P.F. (2007). The Families and Genera of Vascular Plan&s: Volume IX. Flowering Plants. Eudicots. Springer-Verlag, Berlin, Heidelberg, New York	[Generic description] "Secondly, small whitish or pale fragrant flowers are the commonest situation throughout the family, and are pollinated by a wide range of insects, including beetles, flies, bees and butterflies. They usually have very well-developed nectaries inside the hypanthium, and are frequently grouped into larger clusters. In India, Srivastava (1993) found that four species of Terminalia were self-incompatible, and were visited by these orders of insects for both pollen and nectar."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	[Presumably No. Flowers not specialized, and tree widely cultivated with no seed set limitations] "Inflorescences are axillary with flowers on unbranched axis. Flowers are unisexual and bisexual, unisexual with male and female flowers on the same plant, stalked, 10 mm across; outer perianth triangular and hairy; inner perianth 5 and pale green, some partly joined; stamens 10, free and attached to the perianth; ovary inferior, carpels joined (when more than one), locule 1; style solitary, 20 mm long." ... "Tree propagation is by seeds."

606	Reproduction by vegetative fragmentation	n
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"Tree propagation is by seeds."
	PNG Forest Industries Association. (2006). Nursery Techniques and Seed Handling of PNG'S Tree Species. PNG Forest Industries Association, Waigani	[Requires rooting hormone. No evidence of natural vegetative spread] "Vegetative propagation In trials conducted at PNG Forest Research Institute (FRI), material 10 cm in length dipped in a rooting hormone gel (Clonex© purple 0.3 % a.i IBA) gave about 10% strike (the fraction of cuttings to produce roots). This result should be bettered using a more species-specific technique."

607	Minimum generative time (years)	>3
	Source(s)	**Notes**
	CABI. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.53161. [Accessed 27 Feb 2023]	"Although trees grow quickly, they often take 20 years to start producing nuts (French, 2004). The production of nuts occurs regularly throughout the year and is independent of rainfall seasonality. Flowering is thought to be daylength sensitive as fruiting occurs later at locations further south from the equator: in March-April at locations 3° to 4° S and in June-July at 8° to 9° S. However, flowering could also be related to seasonal temperature changes (Bourke, 1996; Bourke and Allen, 2009)."

Qsn #	Question	Answer
701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**n**
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	[No evidence. Fruit & seeds large and lack means of attachment] "Fruit is a large, ellipsoid, slightly flattened convex, simple, indehiscent, drupe, up to 9–11 cm long by 6–8 cm wide and 5–6 cm thick, covered with short reddish-brown hairs, green when young turning red (Plates 3 – 4), fleshy, and glabrous when ripe, containing a massive woody stone (nut) with large edible, white to creamy-white kernel, reaching 7–8 cm long by 3–4 cm wide, and covered by a thin, brown layer of skin (Plates 5 – 6)."

702	**Propagules dispersed intentionally by people**	**y**
	Source(s)	**Notes**
	CABI. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.53161. [Accessed 1 Mar 2023]	"It has also been introduced more recently to Queensland, Australia and Sri Lanka (Bourke, 2010; Lim, 2012). It is considered domesticated in Papua New Guinea (Bourke and Allen (2009)."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"It was introduced to Queensland (Australia)."

703	**Propagules likely to disperse as a produce contaminant**	**n**
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"Fruit is a large, ellipsoid, slightly flattened convex, simple, indehiscent, drupe, up to 9–11 cm long by 6–8 cm wide and 5–6 cm thick, covered with short reddish-brown hairs, green when young turning red (Plates 3 – 4), fleshy, and glabrous when ripe, containing a massive woody stone (nut) with large edible, white to creamy-white kernel, reaching 7–8 cm long by 3–4 cm wide, and covered by a thin, brown layer of skin (Plates 5 – 6)." [No evidence. Unlikely. Fruit and seeds large]

704	**Propagules adapted to wind dispersal**	**n**
	Source(s)	**Notes**
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"Fruit is a large, ellipsoid, slightly flattened convex, simple, indehiscent, drupe, up to 9–11 cm long by 6–8 cm wide and 5–6 cm thick, covered with short reddish-brown hairs, green when young turning red (Plates 3 – 4), fleshy, and glabrous when ripe, containing a massive woody stone (nut) with large edible, white to creamy-white kernel, reaching 7–8 cm long by 3–4 cm wide, and covered by a thin, brown layer of skin (Plates 5 – 6)." [No adaptations for wind dispersal]
	CABI. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.53161. [Accessed 1 Mar 2023]	"Seeds are reported to be dispersed by the Northern Cassowary (Casuarius unappendiculatus) in north-east Papua (formerly Irian Jaya), Indonesia (Pangau-Adam and Mühlenberg, 2014).

705	**Propagules water dispersed**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	CABI. (2022). Terminalia kaernbachii (okari nut). https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.53161. [Accessed 1 Mar 2023]	"Seeds are reported to be dispersed by the Northern Cassowary (Casuarius unappendiculatus) in north-east Papua (formerly Irian Jaya), Indonesia (Pangau-Adam and Mühlenberg, 2014)."

706	**Propagules bird dispersed**	
	Source(s)	**Notes**
	Pangau-Adam, M., & Mühlenberg, M. (2014). Dispersal of Terminalia seeds by the Northern Cassowary in the lowland forest of Papua, Indonesia. Asian Journal of Conservation Biology, 3(2): 115-119	[Dispersed by large, flightless birds. Unknown if pheasants could serve as a surrogate for dispersal in the Hawaiian Islands] "This species has the largest seeds (length = 80-90 mm; D = 55-65 mm) compared to other Terminalia seeds found during the study. A total of 48 seeds were dispersed by the Northern Cassowary in all habitat types except in forest garden. T kaernbachii is endemic to New Guinea and Aru Island, where it is often cultivated (Coode, 1978). The kernels are edible, known as okari nut and common in local market in Papua New Guinea during the fruiting season (Evans, 1999). Although it is not found in the market around Nimbokrang, the local peo-ple usually consume the kernels during their activities of gathering non timber forest products (Figure 3)."
	Filardi, C. E., & Tewksbury, J. (2005). Ground-Foraging Palm Cockatoos (Probosciger aterrimus) in Lowland New Guinea: Fruit Flesh as a Directed Deterrent to Seed Predation? Journal of Tropical Ecology, 21(4),355–361	[Flesh deters cockatoo predation] "The incidence of fruit flesh functioning as a deterrent to seed predation may be more common than has been appreciated to date. Even within relatively poorly known New Guinean systems, at least two other fruits appear to show defensive adaptations to cockatoo predation (Terminalia kaernbachii (CEF pers. obs.) and Cerbera floribunda (Mack& Wright 1996))."

708	**Propagules survive passage through the gut**	**y**
	Source(s)	**Notes**
	Pangau-Adam, M., & Mühlenberg, M. (2014). Dispersal of Terminalia seeds by the Northern Cassowary in the lowland forest of Papua, Indonesia. Asian Journal of Conservation Biology, 3(2): 115-119	[Survives gut passage in Cassowaries. Pigs, and possibly pheasants, could serve as dispersers in the Hawaiian Islands] "This species has the largest seeds (length = 80-90 mm; D = 55-65 mm) compared to other Terminalia seeds found during the study. A total of 48 seeds were dispersed by the Northern Cassowary in all habitat types except in forest garden. T kaernbachii is endemic to New Guinea and Aru Island, where it is often cultivated (Coode, 1978). The kernels are edible, known as okari nut and common in local market in Papua New Guinea during the fruiting season (Evans, 1999). Although it is not found in the market around Nimbokrang, the local people usually consume the kernels during their activities of gathering non timber forest products (Figure 3)." ... "Although the trees of Terminalia complanata and T. kaernbachii were absent in logged forest, their seeds were found in cassowary droppings collected from this habitat. The movement of cassowary from other habitats may apparently facilitate the seed dispersal process of these species."

801	**Prolific seed production (>1000/m2)**	

Qsn #	Question	Answer
	Source(s)	**Notes**
	PNG Forest Industries Association. (2006). Nursery Techniques and Seed Handling of PNG'S Tree Species. PNG Forest Industries Association, Waigani	[Numbers unknown, but relatively large, and unlikely to be produced in excess of 1000/m2] "Flowering, fruiting and seed set Okari nut trees appear to flower fairly regularly every year between December and March. In Madang, however, it is recorded as flowering in September. Fruit matures April—November. Seed is reported to be collected June—August in Lae, Oomsis and Bulolo areas. It would be useful to compare these times with availability of okari nuts in markets. Seed collection and processing The fruit is collected from beneath the tree, or picked from the trees when ripe. The fruit turns red in colour when mature, at which time it is shed. The fruit is the stored unit and therefore does not require processing."

802	**Evidence that a persistent propagule bank is formed (>1 yr)**	
	Source(s)	**Notes**
	PNG Forest Industries Association. (2006). Nursery Techniques and Seed Handling of PNG'S Tree Species. PNG Forest Industries Association, Waigani	"Storage and viability Storage behaviour is unknown, but is likely to be recalcitrant. Moisture content is 55% (based on seed bought from food markets). T. kaernbachii is stored as fruit."

803	**Well controlled by herbicides**	
	Source(s)	**Notes**
	Langeland, K.A.& Stocker, R.K. (2001). Control of Non-native Plants in Natural Areas of Florida. SP 242. Institute of Food & Agricultural Sciences, University of Florida, Gainesville, FL	[Possibly. Herbicides used to control other Terminalia species] "Treatment: Basal bark application of 10% Garlon 4 or cut-stump treatment with 50% Garlon 3A."

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	
	Source(s)	**Notes**
	WRA Specialist. (2023). Personal Communication	Unknown. No evidence found, but other Terminalia species reported to sucker, coppice or pollard

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	WRA Specialist. (2023). Personal Communication	Unknown

Summary of Risk Traits:

This is a tree commonly cultivated within its native range, and has been introduced to Queensland, Australia, and Sri Lanka, as well as on a limited basis in the Hawaiian Islands. There are currently no reports of naturalization, invasiveness, or negative impacts where cultivated, and its relatively large seeds, lack of effective dispersers, and long time to reproductive maturity suggest this tree will pose low risk of invasiveness in the Hawaiian Islands.

High Risk / Undesirable Traits
• Thrives in tropical climates (where it could potentially spread)
• Other Terminalia species are invasive weeds.
• Reproduces by seeds.
• Self-fertile
• Seeds dispersed by cassowaries, and possibly other large, frugivorous animals (e.g. pigs), and intentionally cultivated.

Low Risk Traits
• Cultivated for its edible nuts, with no evidence of naturalization or detrimental impacts reported.
• Unarmed (no spines, thorns, or burrs).
• Non-toxic
• Grows best in high light environments (dense shade may inhibit spread).
• Large-seeded, and unlikely to be accidentally dispersed.