

Taxon: <i>Garcinia livingstonei</i> T. Anderson	Family: Clusiaceae
Common Name(s): African mangosteen lowveld mangosteen veld mangosteen wild mangosteen wild plum	Synonym(s): <i>Garcinia angolensis</i> Vesque <i>Garcinia baikieana</i> Vesque <i>Garcinia bussei</i> Engl. <i>Garcinia ferrandii</i> Chiov. <i>Garcinia pallidinervis</i> Engl. <i>Garcinia pendula</i> Engl.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 3 Jun 2022
WRA Score: -1.0	Designation: L	Rating: Low Risk

Keywords: Tropical Tree, Possibly Naturalized (Australia), Edible Fruit, Slow-Growing, Animal-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	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		
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		
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	y=1, n=-1	n
405	Toxic to animals		
406	Host for recognized pests and pathogens		

Qsn #	Question	Answer Option	Answer
407	Causes allergies or is otherwise toxic to humans		
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		
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	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		
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
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		
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
	Ruffo, C.K., Birnie, A. & Tengnäs, B. (2002). Edible Wild Plants of Tanzania. RELMA Technical Handbook Series 27. Regional Land Management Unit (RELMA), Swedish International Development Cooperation Agency (Sida), Nairobi, Kenya	[No evidence of domestication] "Management: Collected from the wild, not cultivated. Can be propagated by fresh seed."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2022). 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 native to a broad area of tropical Africa: from Natal (Zululand), Swaziland and Transvaal to Kenya, Uganda and Somalia Zanzibar; westward to Bechuanaland Protectorate, Southwest Africa (Caprivi Strip), Angola, Northern Rhodesia and Belgian Congo (Katanga). It also occurs from French Guinea to Nigeria."

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 native to a broad area of tropical Africa: from Natal (Zululand), Swaziland and Transvaal to Kenya, Uganda and Somalia Zanzibar; westward to Bechuanaland Protectorate, Southwest Africa (Caprivi Strip), Angola, Northern Rhodesia and Belgian Congo (Katanga). It also occurs from French Guinea to Nigeria."

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes

Qsn #	Question	Answer
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"Imbe thrives in a climate of warm winters and hot summers and is found from sea level to 1,050 m elevation. It naturally occurs where mean annual temperature is 20–22.5°C and frost never occurs but the tree has been reported to withstand brief periods of light frost without serious injury. It is found in areas with rainfall ranging from 200 to above 1,000 mm. Imbe is quite tolerant of drought, bush fi res and heavy rain. It has been reported to withstand dry periods of up to 5 months."
	Glen, H.F. (2007). <i>Garcinia livingstonei</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/garcinia-livingstonei . [Accessed 2 Jun 2022]	"The African mangosteen is widespread in the warmer parts of Africa, from just north of Durban as far as Somalia and Guinea. In southern Africa it spreads quite far up the Limpopo and Zambezi Valleys. In this range it encounters widely varying rainfall (from about 200 to 1000 mm a year) and soil types. However, the temperature is a unifying feature: winters (as far as they exist) are warm and summers are hot to very hot. These trees are notably sensitive to cold, though quite hardy to both drought and heavy rain."
	Ruffo, C.K., Birnie, A. & Tengnäs, B. (2002). Edible Wild Plants of Tanzania. RELMA Technical Handbook Series 27. Regional Land Management Unit (RELMA), Swedish International Development Cooperation Agency (Sida), Nairobi, Kenya	[Elevation range >1000 m] "Ecology: This tree is widespread in riverine forest, grassland, thickets and in open woodland in tropical Africa, often under larger trees, 0-1,800 m; rainfall 800-1,800 mm. Prefers sandy loam."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Cooper, W. E. (2013). A taxonomic revision of <i>Garcinia</i> L. (Clusiaceae) in Australia, including four new species from tropical Queensland. <i>Austrobaileya</i> , 9(1), 1-29	" <i>Garcinia livingstonei</i> is a native of Africa with a widespread distribution, occurring on the mainland from West Africa (including Senegal, Mali, Nigeria and Cameroon) through to Somalia and East Africa (including Kenya and Tanzania) and south to Zimbabwe, Angola and South Africa; as well as the Comoros islands. In Australia it has been cultivated and a recent record (Jago s.n. & Wannan CNS) from Trevethan Creek near Cooktown indicates possible naturalization"
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"The species is native to a broad area of tropical Africa: from Natal (Zululand), Swaziland and Transvaal to Kenya, Uganda and Somalia Zanzibar; westward to Bechuanaland Protectorate, Southwest Africa (Caprivi Strip), Angola, Northern Rhodesia and Belgian Congo (Katanga). It also occurs from French Guinea to Nigeria."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Cooper, W. E. (2013). A taxonomic revision of <i>Garcinia</i> L. (Clusiaceae) in Australia, including four new species from tropical Queensland. <i>Austrobaileya</i> , 9(1), 1-29	"In Australia it has been cultivated and a recent record (Jago s.n. & Wannan CNS) from Trevethan Creek near Cooktown indicates possible naturalization"
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"It has been introduced for trial purposes in Indonesia, India, Singapore, northern Australia and elsewhere in the tropics."

Qsn #	Question	Answer
301	Naturalized beyond native range	
	Source(s)	Notes
	Cooper, W. E. (2013). A taxonomic revision of <i>Garcinia</i> L. (Clusiaceae) in Australia, including four new species from tropical Queensland. <i>Austrobaileya</i> , 9(1), 1-29	"In Australia it has been cultivated and a recent record (Jago s.n. & Wannan CNS) from Trevethan Creek near Cooktown indicates possible naturalization"
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	No evidence

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	CABI. (2022). <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	No evidence
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
	CABI. (2022). <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	No evidence

304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
	CABI. (2022). <i>Invasive Species Compendium</i> . Wallingford, UK: CAB International. www.cabi.org/isc	No evidence

305	Congeneric weed	
	Source(s)	Notes
	Maui Invasive Species Committee. (2010). Quarterly Report to the MISC Committee FY 2010, Fourth Quarter April 1 to June 30, 2010. http://mauiinvasive.org/ . [Accessed 3 Jun 2022]	"Gourka (<i>Garcinia xanthochymus</i>): an early detection control of five juvenile and 20 mature gourka (false mangosteen) was completed. The trees were detected during a Hälawa Valley survey for gooseberry. A specimen was sent to and identified by Bishop Museum." [Controlled as an early detection target. Impacts unspecified]
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	<i>Garcinia cowa</i> , <i>Garcinia dulcis</i> , <i>Garcinia ferrea</i> , <i>Garcinia hanburyi</i> , <i>Garcinia madruno</i> , <i>Garcinia mangostana</i> , <i>Garcinia morella</i> , <i>Garcinia polyantha</i> , <i>Garcinia ponapensis</i> , and <i>Garcinia xanthochymus</i> listed as naturalized or weeds of unspecified impacts

401	Produces spines, thorns or burrs	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Cooper, W. E. (2013). A taxonomic revision of <i>Garcinia</i> L. (Clusiaceae) in Australia, including four new species from tropical Queensland. <i>Austrobaileya</i> , 9(1), 1-29	[No evidence] "Shrub or tree to 18 m, monoecious; exudate yellow or reddish; bark grey and rough with numerous vertical fissures; branches terete, arching. Leaves discolorous, opposite or 3–4-whorled, coriaceous, glabrous; petioles 2–7 mm long, channelled, ligulate; lamina oblong, elliptical or oblanceolate, 35–110 mm long, 20–55 mm wide; base cuneate, rounded or cordate; apex acute, rounded, emarginate or apiculate; margin crenate or entire, recurved; venation brochidodromous, primary vein raised in a groove adaxially and distinctly raised abaxially; secondary veins 9–15 pairs, pale yellow, raised on both surfaces, angle of divergence from primary vein 60–70°; intramarginal vein merges with margin; exudate-containing canals on upperside are numerous branched lines + parallel to secondary veins, on the lower side they are branched lines running at angles between the primary vein and margin."

402	Allelopathic	n
	Source(s)	Notes
	Fujii, Y., Parvez, S. S., Parvez, M., Ohmae, Y., & Iida, O. (2003). Screening of 239 medicinal plant species for allelopathic activity using the sandwich method. <i>Weed Biology and Management</i> , 3(4): 233-241	"Table 1. Screening of leaf litter of 239 medicinal plant species under different families using the sandwich method" [Unknown. <i>Garcinia xanthochymus</i> was tested and did not show significant inhibitory effects]

403	Parasitic	n
	Source(s)	Notes
	Lim, T.K. (2012). <i>Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits</i> . Springer, New York	"It is an evergreen, glabrous, dioecious (male and female tree), much-branched tree, growing to 4.5–18 m tall, with rough, grey-brown, scaly bark" [Clusiaceae / Guttiferae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	FAO (1988). <i>Traditional Food Plants: A Resource Book for Promoting the Exploitation & Consumption of Food Plants in Arid, Semi-arid & Sub-humid Lands of Eastern Africa</i> . Food & Nutrition Paper 42. FAO, Rome, Italy	"Leaves and young shoot - Browse"
	Moe, S. R., Rutina, L. P., Hytteborn, H., & du Toit, J. T. (2009). What Controls Woodland Regeneration after Elephants Have Killed the Big Trees? <i>Journal of Applied Ecology</i> , 46(1), 223–230	[Browsed by elephants] "The proportion of surviving seedlings that were twig-browsed peaked in June-September and <i>Croton megalobotrys</i> was browsed significantly less than the other species (LSD, $P < 0.05$ in all cases), except in September (Fig. 3). <i>F. albida</i> was browsed more than the other species in April and May (Fig. 3). July had the highest proportion of browsed seedling for <i>Combretum mossambicense</i> , <i>F. albida</i> and <i>Garcinia livingstonei</i> "

405	Toxic to animals	n

Qsn #	Question	Answer
	Source(s)	Notes
	Schmidt, E., Lötter, M. & McClelland, W. (2002). Trees and shrubs of Mpumalanga and Kruger National Park. Jacana Media, Johannesburg, South Africa	"General: Fruit tasty, sweet, eaten by humans and animals"
	FAO (1988). Traditional Food Plants: A Resource Book for Promoting the Exploitation & Consumption of Food Plants in Arid, Semi-arid & Sub-humid Lands of Eastern Africa. Food & Nutrition Paper 42. FAO, Rome, Italy	"Leaves and young shoot - Browse" [No evidence]
	CGIAR Research Program - Forests, Trees and Agroforestry (2022). <i>Garcinia livingstonei</i> L. African mangosteen. https://www.foreststreesagroforestry.org/tree/garcinia-livingstonei-l/ . [Accessed 3 Jun 2022]	"the yellowish tree sap is poisonous and has been used by indigenous communities to tip their hunting arrows." [Possibly, but no evidence found of toxicity to browsing animals]

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	CABI. (2022). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Minor host of: <i>Anastrepha suspensa</i> (Caribbean fruit fly) Wild host of: <i>Ceratitis capitata</i> (Mediterranean fruit fly) Host of (source - data mining): <i>Ceratitis rosa</i> (Natal fruit fly)"
	Department of Agriculture, Forestry and Fisheries. (2016). Production Guideline. African Mangosteen. <i>Garcinia livingstonei</i> . Agriculture, Forestry and Fisheries, Republic of South Africa	"Pest and diseases control -There are few pests of diseases of <i>G. livingstonei</i> ; however, during the period of fruit ripening, fruit flies may become a problem in some years. The wood is susceptible to borers Leaf caterpillar - Larval stage feeds on young leaves and shoots. These pests affect the trees at a young stage and in high populated case the caterpillar may eat all the leaves and the tree, in most cases, dies-off. Application of registered insecticide at an interval of two weeks may control these insects. Leaf miner - Leaf miner larvae feed on young shoots. The larvae tunnels in the epidermis, causing the tree to die. These can be controlled by registered insecticides that contain <i>Bacillus thuringiensis</i> . Fruit borer - Larvae burrow into the fruit from mature to ripe stage. The borer feeds into mesocarp, aril and seeds. Larvae move out of the fruit and pupate into the soil to become beetle. These can be controlled by destroying all the affected fruits. Stem canker - The disease infects branches and stems. The leaves of the infected trees wilt and drop; causing the tree to die-off. Infected trees can be controlled by eradication and burned to stop the spread of the disease. Sooty mould - The disease affects the branches, which causes the leaves to wilt. Affected branches turn reddish in colour. These can be controlled by improving aeration and sunlight penetration; this can be done by pruning overlapping branches."

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	Notes
	CGIAR Research Program - Forests, Trees and Agroforestry (2022). <i>Garcinia livingstonei</i> L. African mangosteen. https://www.foreststreesagroforestry.org/tree/garcinia-livingstonei-l/ . [Accessed 3 Jun 2022]	" <i>G. livingstonei</i> is a hardwood tree, commonly used to build fence posts, tool handles and wooden spoons. The timber is also popular for firewood and charcoal production. In addition, the yellowish tree sap is poisonous and has been used by indigenous communities to tip their hunting arrows."

Qsn #	Question	Answer
	Quattrocchi, U. (2012). CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"Yellow oily sap used in the manufacture of arrow poison."
	WRA Specialist. (2022). Personal Communication	Unknown. Sap reported to be toxic and used in arrow poisons, but reports of accidental poisoning of or toxicity to humans were not found

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	National Research Council. (2008). Lost Crops of Africa. Volume III: Fruits. The National Academies Press, Washington, D.C.	"Although many grow beside rivers, on floodplains, or other locations with high watertables, others grow in fairly arid locales. It tolerates dry seasons as long as 5 months with ease and withstands fire as well. Like many arid and fire-resistant trees, these robust plants have a bulbous base underground. At the same time, the species grows satisfactorily in most soils"
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"Imbe is quite tolerant of drought, bush fires and heavy rain."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Glen, H.F. (2007). <i>Garcinia livingstonei</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/garcinia-livingstonei . [Accessed 3 Jun 2022]	"Aspect: Full Sun, Morning Sun (Semi Shade)"
	Flora Fauna Web. (2022). <i>Garcinia livingstonei</i> . https://www.nparks.gov.sg/florafaunaweb/flora/4/0/4018 . [Accessed 3 Jun 2022]	"Light Preference - Full Sun"
	Tropical Plants Database, Ken Fern. (2022). <i>Garcinia livingstonei</i> . http://tropical.theferns.info . [Accessed 3 Jun 2022]	"Succeeds in both full sun and partial shade"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"Imbe occurs on a wide range of soil types from acid sandy maritime soils, alluvial soils along riverbanks to alkaline and rocky soils."
	Glen, H.F. (2007). <i>Garcinia livingstonei</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/garcinia-livingstonei . [Accessed 2 Jun 2022]	"In southern Africa it spreads quite far up the Limpopo and Zambezi Valleys. In this range it encounters widely varying rainfall (from about 200 to 1000 mm a year) and soil types."

Qsn #	Question	Answer
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	"It is an evergreen, glabrous, dioecious (male and female tree), much-branched tree, growing to 4.5–18 m tall, with rough, grey-brown, scaly bark (Plates 1– 2 , 5) and a dense spreading crown."

412	Forms dense thickets	n
	Source(s)	Notes
	Glen, H.F. (2007). <i>Garcinia livingstonei</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/garcinia-livingstonei . [Accessed 3 Jun 2022]	"The African mangosteen is widespread in the warmer parts of Africa, from just north of Durban as far as Somalia and Guinea. In southern Africa it spreads quite far up the Limpopo and Zambezi Valleys." [No evidence]
	Ruffo, C.K., Birnie, A. & Tengnäs, B. (2002). Edible Wild Plants of Tanzania. RELMA Technical Handbook Series 27. Regional Land Management Unit (RELMA), Swedish International Development Cooperation Agency (Sida), Nairobi, Kenya	"This tree is widespread in riverine forest, grassland, thickets and in open woodland in tropical Africa, often under larger trees, 0-1,800 m" [A component of thicket vegetation. No evidence of that this tree forms dense stands or monotypic thickets]
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	[No evidence] "Imbe occurs on a wide range of soil types from acid sandy maritime soils, alluvial soils along riverbanks to alkaline and rocky soils. It grows in open coastal and riverine forests and in South Africa veld and frequently in riparian and munga, mopane woodland and termite mounds in Zambia."

501	Aquatic	n
	Source(s)	Notes
	Ruffo, C.K., Birnie, A. & Tengnäs, B. (2002). Edible Wild Plants of Tanzania. RELMA Technical Handbook Series 27. Regional Land Management Unit (RELMA), Swedish International Development Cooperation Agency (Sida), Nairobi, Kenya	[Terrestrial] "This tree is widespread in riverine forest, grassland, thickets and in open woodland in tropical Africa, often under larger trees, 0-1,800 m"

502	Grass	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 3 Jun 2022]	"Family: Clusiaceae (alt. Guttiferae)"

Qsn #	Question	Answer
503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, Agricultural Research Service, National Plant Germplasm System. (2022). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/ . [Accessed 3 Jun 2022]	"Family: Clusiaceae (alt. Guttiferae)"

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Schmidt, E., Lötter, M. & McClelland, W. (2002). Trees and shrubs of Mpumalanga and Kruger National Park. Jacana Media, Johannesburg, South Africa	"Small to medium-sized open-crowned tree to 12 m; on sandveld, on alluvial soil along rivers, and in rocky gorges."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Williams, V.L., Raimondo, D., Crouch, N.R., Cunningham, A.B., Scott-Shaw, C.R., Lötter, M. & Ngwenya, A.M. (2008). <i>Garcinia livingstonei</i> T.Anderson. National Assessment: Red List of South African Plants version 2020.1. http://redlist.sanbi.org/species.php?species=2572-2 . [Accessed 3 Jun 2022]	"Status and Criteria Least Concern"

602	Produces viable seed	y
	Source(s)	Notes
	Schmidt, E., Lötter, M. & McClelland, W. (2002). Trees and shrubs of Mpumalanga and Kruger National Park. Jacana Media, Johannesburg, South Africa	"Easily grown from seed."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"The species is propagated by seed, air layering or grafting."
	National Research Council. (2008). Lost Crops of Africa. Volume III: Fruits. The National Academies Press, Washington, D.C.	"There is also, however, the possibility that imbe is one of those rare plants that can clone itself through its own seeds (a process known in botany as apomixis). In various places several generations of trees grown from seed have yielded plants exactly like their parents..with no apparent variation among all the progeny. Also, it is said that female flowers that have been bagged (to keep all pollen out) can produce normal fruits and set viable seed."

603	Hybridizes naturally	
	Source(s)	Notes
	Cooper, W. E. (2013). A taxonomic revision of <i>Garcinia</i> L. (Clusiaceae) in Australia, including four new species from tropical Queensland. <i>Austrobaileya</i> , 9(1), 1-29	[Unknown. No evidence for <i>Garcinia livingstonei</i>] " <i>Garcinia mangostana</i> is thought to be a hybrid of multiple origins (Richards 1990b)."

Qsn #	Question	Answer
	Kubitzki, K., Bayer, C. 7 Stevens, P.F. (2007). The Families and Genera of Vascular Plants: Volume IX. Flowering Plants. Eudicots. Springer-Verlag, Berlin, Heidelberg, New York	[Unknown] "There is little information about hybridization in Clusiaceae (for Calophyllum, see Stevens 1980); fairly extensive artificial crosses have been made in Clusia (V. Bittrich, pers. comm.)."

604	Self-compatible or apomictic	
	Source(s)	Notes
	National Research Council. (2008). Lost Crops of Africa. Volume III: Fruits. The National Academies Press, Washington, D.C.	[Possibly Yes] "There is also, however, the possibility that imbe is one of those rare plants that can clone itself through its own seeds (a process known in botany as apomixis). In various places several generations of trees grown from seed have yielded plants exactly like their parents...with no apparent variation among all the progeny. Also, it is said that female flowers that have been bagged (to keep all pollen out) can produce normal fruits and set viable seed."
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	[Reportedly dioecious, in contrast to Cooper (2013)] "It is an evergreen, glabrous, dioecious (male and female tree), much-branched tree, growing to 4.5–18 m tall"
	Martin, F.W., Campbell, C.W. & Puberté, R.M. (1987). Perennial Edible Fruits of the Tropics: An Inventory. Agriculture Handbook No. 642. U.S. Department of Agriculture, Washington, DC	[Reportedly dioecious, in contrast to Cooper (2013)] "Tree to 6 m. Propagation by seed, grafting. Fruit production in 4-6 years from seed, 2-3 years from grafts. Flowers February-April, August-September (Florida). Dioecious."
	Cooper, W. E. (2013). A taxonomic revision of <i>Garcinia</i> L. (Clusiaceae) in Australia, including four new species from tropical Queensland. <i>Austrobaileya</i> , 9(1), 1-29	[Reportedly monoecious, in contrast to Lim (2012) and other references] "Shrub or tree to 18 m, monoecious; exudate yellow or reddish; bark grey and rough with numerous vertical fissures; branches terete, arching."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Glen, H.F. (2007). <i>Garcinia livingstonei</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/garcinia-livingstonei . [Accessed 2 Jun 2022]	"The flowers are full of nectar, which attracts many kinds of insects that pollinate them."

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Ruffo, C.K., Birnie, A. & Tengnäs, B. (2002). Edible Wild Plants of Tanzania. RELMA Technical Handbook Series 27. Regional Land Management Unit (RELMA), Swedish International Development Cooperation Agency (Sida), Nairobi, Kenya	"Can be propagated by fresh seed."
	Cooper, W. E. (2013). A taxonomic revision of <i>Garcinia</i> L. (Clusiaceae) in Australia, including four new species from tropical Queensland. <i>Austrobaileya</i> , 9(1), 1-29	"Cultivated plants of <i>Garcinia livingstonei</i> in Cooktown, which had been poisoned, were sprouting vigorous suckers from the base of otherwise dead trees." [Suckering apparently a response to cutting]
	Department of Agriculture, Forestry and Fisheries. (2016). Production Guideline. African Mangosteen. <i>Garcinia livingstonei</i> . Agriculture, Forestry and Fisheries, Republic of South Africa	"Trees are easily propagated by seed, but because of the slow growth, often is less than a foot high even after one year's growth. It usually takes five to six years to reach fruiting age."

Qsn #	Question	Answer
607	Minimum generative time (years)	>3
	Source(s)	Notes
	Martin, F.W., Campbell, C.W. & Puberté, R.M. (1987). Perennial Edible Fruits of the Tropics: An Inventory. Agriculture Handbook No. 642. U.S. Department of Agriculture, Washington, DC	"Tree to 6 m. Propagation by seed, grafting. Fruit production in 4-6 years from seed, 2-3 years from grafts."

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	"Berry is obovoid to globose, 2.5–3 cm. in diameter, green turning to orange-yellow, orange to reddish-orange (Plates 4– 6), 1–2 seeded and thin skin filled with yellow latex. Seeds are cylindric or plano-ovoid, 1.5–2 cm. long surrounded by acid-sweet, juicy orange pulp." [Unlikely. Fruits & seeds lack means of external attachment]

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"It has been introduced for trial purposes in Indonesia, India, Singapore, northern Australia and elsewhere in the tropics."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Cooper, W. E. (2013). A taxonomic revision of <i>Garcinia</i> L. (Clusiaceae) in Australia, including four new species from tropical Queensland. <i>Austrobaileya</i> , 9(1), 1-29	"fruit (not seen for Australian material) a fleshy berry, globular or obovoid, 10–30 mm long, 10–30 mm wide, orange or reddish-orange; seeds 1 or 2, cylindrical, 8–20 mm long; aril fleshy, orange." [No evidence. Unlikely given size of fruit and seeds and time to maturity]

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Yamashina, C. (2014). Importance of bird seed dispersal in the development of characteristic vegetation on termite mounds in north-eastern Namibia. <i>Tropics</i> , 23(1), 33-44	"Dispersal agent = bird/mammal"
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	[No adaptations for wind dispersed] "Berry is obovoid to globose, 2.5–3 cm. in diameter, green turning to orange-yellow, orange to reddish-orange (Plates 4– 6), 1–2 seeded and thin skin filled with yellow latex. Seeds are cylindric or plano-ovoid, 1.5–2 cm. long surrounded by acid-sweet, juicy orange pulp."

Qsn #	Question	Answer
705	Propagules water dispersed	
	Source(s)	Notes
	National Research Council. (2008). Lost Crops of Africa. Volume III: Fruits. The National Academies Press, Washington, D.C.	"Although many grow beside rivers, on floodplains, or other locations with high watertables, others grow in fairly arid locales." [Distribution suggests bird and mammal dispersed seeds are probably secondarily dispersed by water]

706	Propagules bird dispersed	y
	Source(s)	Notes
	Yamashina, C. (2014). Importance of bird seed dispersal in the development of characteristic vegetation on termite mounds in north-eastern Namibia. <i>Tropics</i> , 23(1), 33-44	"Table 2. Tree density per 100 m ² (mean±SD) on active/inactive mounds and in off-mound areas. Seed dispersal agents of each species in north-eastern Namibia are also provided" [Garcinia livingstonei - Dispersal agent = bird/mammal]

707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Glen, H.F. (2007). <i>Garcinia livingstonei</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/garcinia-livingstonei . [Accessed]	"The delicious fruits are sought after by animals, which disperse the seeds. The seeds, in turn, are enclosed in a hard coat, well suited to protecting the delicate embryo on its journey through the digestive system of the animal that ate the fruit."

708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Kimuyu, D. M., Wahungu, G. M., & Otieno, D. O. (2012). Seed dispersal by Tana River mangabeys in fragmented gallery forests. <i>Open Journal of Ecology</i> 2(1): 12-20	"Data collected on a free ranging group of Tana River mangabeys (<i>Cercocebus galerritus</i>) indicates that this endangered primate species, which has previously been regarded as a seed predator, plays an important role in seed dispersal and do contribute to the regeneration of a highly fragmented gallery forest." ... "Table 1. Plant species, fruit type, number of intact seeds, and number of seedlings that germinated after one month of rain. Note: seed size alone is not an indicator for the condition and almost all seeds of fleshy fruits were intact." [Garcinia livingstonei - Total number of seeds extracted from dung = 3]
	Glen, H.F. (2007). <i>Garcinia livingstonei</i> . PlantZAfrica. SANBI. http://pza.sanbi.org/garcinia-livingstonei . [Accessed 3 Jun 2022]	"The delicious fruits are sought after by animals, which disperse the seeds. The seeds, in turn, are enclosed in a hard coat, well suited to protecting the delicate embryo on its journey through the digestive system of the animal that ate the fruit."

801	Prolific seed production (>1000/m ²)	n
	Source(s)	Notes
	National Research Council. (2008). Lost Crops of Africa. Volume III: Fruits. The National Academies Press, Washington, D.C.	"On the downside, these seeds are about the size of small dates and are quite large in proportion to the overall fruit, making the pulp correspondingly thin. Also, the pulp clings to those stones in the center."

Qsn #	Question	Answer
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	[No evidence. Few seeded fruit] "Berry is obovoid to globose, 2.5–3 cm. in diameter, green turning to orange-yellow, orange to reddish-orange (Plates 4 – 6), 1–2 seeded and thin skin filled with yellow latex. Seeds are cylindric or plano-ovoid, 1.5–2 cm. long surrounded by acid-sweet, juicy orange pulp."

802	Evidence that a persistent propagule bank is formed (>1 yr)	n
	Source(s)	Notes
	Makhathini, A. P. (2017). Effects of antifungal treatments on some recalcitrant seeds (Doctoral dissertation). University of KwaZulu-Natal, Westville campus, South Africa	"Recalcitrant seeds cannot be stored under normal storage conditions and are characterized by not undergoing dehydration, sensitivity to desiccation, high susceptibility to desiccation injury, and the fact that they are shed at relatively high moisture content leading to early germination. The storage of these seeds for seed banks and conservation programmes is an important aspect of seed conservation strategies. One of the major problems restricting storage lifespan of these seeds is the presence and proliferation of microorganisms. The purpose of this study was to develop treatment protocols, evaluate the impact of fungicides by performing seed vigour and germination tests, isolation and identification of fungi in recalcitrant seeds proliferating in tissue culture stage and lastly to assess developed protocols under pot trials conditions. Plant germplasm selected for seed harvest was that of <i>Trichilia dregeana</i> , <i>Protorhus longifolia</i> and <i>Garcinia livingstonei</i> ."
	Mmusi, M., Tseboeng, G., Teketay, D., Murray-Hudson, M., Kashe, K., & Madome, J. (2021). Species richness, diversity, density and spatial distribution of soil seed banks in the riparian woodland along the Thamalakane River of the Okavango Delta, northern Botswana. <i>Trees, Forests and People</i> , 6, 100160	"Table 1 List of woody plant species identified along the Thamalakane River in Botswana, and the species that germinated from the soil seed banks." [<i>Garcinia livingstonei</i> recorded as present in the Above ground vegetation but absent from Soil the seed bank]
	Department of Agriculture, Forestry and Fisheries. (2016). Production Guideline. African Mangosteen. <i>Garcinia livingstonei</i> . Agriculture, Forestry and Fisheries, Republic of South Africa	"The seeds germinate readily (almost 100 %) if they are fresh and are kept moist and warm."

803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Lim, T.K. (2012). Edible Medicinal and Non-Medicinal Plants. Volume 2, Fruits. Springer, New York	"Imbe is quite tolerant of drought, bush fires and heavy rain."
	Cooper, W. E. (2013). A taxonomic revision of <i>Garcinia</i> L. (Clusiaceae) in Australia, including four new species from tropical Queensland. <i>Austrobaileya</i> , 9(1), 1-29	"Notes: Cultivated plants of <i>Garcinia livingstonei</i> in Cooktown, which had been poisoned, were sprouting vigorous suckers from the base of otherwise dead trees."

Qsn #	Question	Answer
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2022). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Broad elevation range in regions with tropical climates
- Thrives and could spread in regions with tropical climates
- Possibly naturalized in Australia (but no evidence in the Hawaiian Islands to date)
- Tolerates many soil types
- Reproduces by seeds
- Possibly able to produce seeds via apomixis
- Seeds dispersed by fruit eating birds and mammals, and through intentional cultivation
- Distribution along rivers suggests water may also disperse seeds
- Tolerates cutting and fires

Low Risk Traits

- No reports of invasiveness or negative impacts where cultivated
- Unarmed (no spines, thorns, or burrs)
- Edible fruit
- Palatable foliage
- Reported to grow in high light environments (dense shade may inhibit spread)
- Reaches maturity in 4-6 years or longer
- Not reported to spread vegetatively
- Fruit and seeds relatively large and unlikely to be accidentally dispersed
- Seeds lose viability quickly (unlikely to form persistent seed bank)