

Taxon: Willughbeia coriacea Wall.	Family: Apocynaceae
Common Name(s): Borneo-rubber	Synonym(s): Ancylocladus firmus (Blume) Kuntze Willughbeia firma Blume

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 4 Mar 2016
WRA Score: 0.0	Designation: L	Rating: Low Risk

Keywords: Tropical, Liana, Unarmed, Edible Fruit, Zoochorous

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)		
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	n
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)	n
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
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		

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		
411	Climbing or smothering growth habit	y=1, n=0	y
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)		
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		
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/m ²)		
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
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	No evidence of domestication

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2016. 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
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	"Distribution - Southern Thailand, Malay Peninsula, Sumatra, Java, Borneo."

202	Quality of climate match data	High
	Source(s)	Notes
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	

203	Broad climate suitability (environmental versatility)	
	Source(s)	Notes
	Lim, T.K. 2012. <i>Edible Medicinal and Non-Medicinal Plants. Volume 1, Fruits.</i> Springer, New York	"A strictly tropical species, common in mixed dipterocarp or riverine forests in its native range."
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	"Ecology - Climber in primary or secondary forest to 1600 m." [Elevation range may exceed 1000 m]

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Lim, T.K. 2012. <i>Edible Medicinal and Non-Medicinal Plants. Volume 1, Fruits.</i> Springer, New York	"A strictly tropical species, common in mixed dipterocarp or riverine forests in its native range."
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	"Distribution - Southern Thailand, Malay Peninsula, Sumatra, Java, Borneo."

Qsn #	Question	Answer
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 3 Mar 2016]	"Native: Asia-Tropical Indo-China: Laos; Thailand Malesia: Brunei; Indonesia - Kalimantan, - Java, - Sumatra; Malaysia; Singapore"

205	Does the species have a history of repeated introductions outside its natural range?	n
	Source(s)	Notes
	Lim, T.K. 2012. Edible Medicinal and Non-Medicinal Plants. Volume 1, Fruits. Springer, New York	"The species is native to Peninsular Thailand to West Malesia. It is cultivated in Java and Sumatra."

301	Naturalized beyond native range	n
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence
	Wagner, W.L., Herbst, D.R.& Lorence, D.H. 2016. Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm . [Accessed 4 Mar 2016]	No evidence

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

305	Congeneric weed	n
	Source(s)	Notes

Qsn #	Question	Answer
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Lim, T.K. 2012. Edible Medicinal and Non-Medicinal Plants. Volume 1, Fruits. Springer, New York	[No evidence] "A perennial, evergreen woody climber with branches bearing tendrils formed from modified inflorescences. Leaves are opposite, distichous on short petioles, lamina ovate-lanceolate, apex acute to acuminate, base obtuse ovate, coriaceous and penninerve with a distinct midrib"

402	Allelopathic	n
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	Unknown

403	Parasitic	n
	Source(s)	Notes
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	"Large climber to 30 m." [Apocynaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Corlett, R. T., & Lucas, P. W. (1990). Alternative seed-handling strategies in primates: seed-spitting by long-tailed macaques (<i>Macaca fascicularis</i>). <i>Oecologia</i> , 82(2), 166-171	"In addition, some large fruits, including <i>Artocarpus</i> spp., <i>Mangifera indica</i> and <i>Willughbeia coriacea</i> were sometimes carried similar distances in the hand before they were processed and the seeds spat or dropped." [Fruit palatable. Palatability of foliage unknown]

405	Toxic to animals	n
	Source(s)	Notes
	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
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	n
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	Unknown

Qsn #	Question	Answer
407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Useful Tropical Plants Database. 2016. <i>Willughbeia coriacea</i> . http://tropical.theferns.info/viewtropical.php?id=Willughbeia+coriacea . [Accessed 4 Mar 2016]	"Known Hazards: None known"
	Lim, T.K. 2012. <i>Edible Medicinal and Non-Medicinal Plants</i> . Volume 1, Fruits. Springer, New York	"The flesh of the ripe fruit is sweet and eaten fresh." [No evidence]
	Quattrocchi, U. 2012. <i>CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology</i> . CRC Press, Boca Raton, FL	No evidence
408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Lim, T.K. 2012. <i>Edible Medicinal and Non-Medicinal Plants</i> . Volume 1, Fruits. Springer, New York	[No evidence. Unlikely given wet forest habitat] "A strictly tropical species, common in mixed dipterocarp or riverine forests in its native range."
409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	Lim, T.K. 2012. <i>Edible Medicinal and Non-Medicinal Plants</i> . Volume 1, Fruits. Springer, New York	"A strictly tropical species, common in mixed dipterocarp or riverine forests in its native range." [Light requirements unknown]
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	Source(s)	Notes
	NParks Flora&FaunaWeb. 2013. <i>Willughbeia edulis</i> . https://florafauanaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=1534 . [Accessed 4 Mar 2016]	"Plant & Rootzone Preference/Tolerance : Moist Soils, Well-Drained Soils, Fertile Loamy Soils" [Unknown, but may have soil preferences similar to related taxon]
411	Climbing or smothering growth habit	y
	Source(s)	Notes
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	"Large climber to 30 m."
	Lim, T.K. 2012. <i>Edible Medicinal and Non-Medicinal Plants</i> . Volume 1, Fruits. Springer, New York	"The plant is a large, evergreen, perennial, woody climber with tendrils modified from the peduncle."
412	Forms dense thickets	n
	Source(s)	Notes
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	"Climber in primary or secondary forest to 1600 m." [Climbing & potentially smothering habit]
501	Aquatic	n

Qsn #	Question	Answer
	Source(s)	Notes
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	"Ecology - Climber in primary or secondary forest to 1600 m."
502	Grass	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 4 Mar 2016]	"Family: Apocynaceae Subfamily: Rauvolfioideae Tribe: Willughbeieae"
503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Lim, T.K. 2012. Edible Medicinal and Non-Medicinal Plants. Volume 1, Fruits. Springer, New York	"The plant is a large, evergreen, perennial, woody climber with tendrils modified from the peduncle." [Apocyanaceae. No evidence]
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	"Large climber to 30 m. Branches mostly glabrous, very rarely puberulent; lenticillate"
601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Lim, T.K. 2012. Edible Medicinal and Non-Medicinal Plants. Volume 1, Fruits. Springer, New York	"The species is native to Peninsular Thailand to West Malesia. It is cultivated in Java and Sumatra." [No evidence]
602	Produces viable seed	y
	Source(s)	Notes
	Lim, T.K. 2012. Edible Medicinal and Non-Medicinal Plants. Volume 1, Fruits. Springer, New York	"Fruit has a few to many seeds. Seeds are compressed ovoid smooth, with a very thin endosperm and thick horny cotyledons and embedded in mucilaginous orangey-yellow pulp"
	Useful Tropical Plants Database. 2016. <i>Willughbeia coriacea</i> . http://tropical.theferns.info/viewtropical.php?id=Willughbeia+coriacea . [Accessed 4 Mar 2016]	"Propagation: Seed "
603	Hybridizes naturally	
	Source(s)	Notes
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	Unknown. No hybrids documented

Qsn #	Question	Answer
604	Self-compatible or apomictic	
	Source(s)	Notes
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	[Unknown. Perfect flowers] "Inflorescence axillary, very rarely terminal; axis usually shorter than the subtending petiole, very rarely longer, to 3 cm long; 3-25 flowers per inflorescence; axes mostly glabrous, rarely minutely and sparsely puberulent; pedicel 0-5.3 cm long. Sepals oblong or ovate, apex rounded or obtuse; 1.5-4 mm long, lobes 0.8—3.3 x 0.6—1.9 mm, 1.1-2.5 x as long as wide; glabrous, ciliate. Corolla white or yellow, rarely tinged with red; tube cylindrical, 3.5-8 mm long, outside glabrous, inside puberulent; lobes oblong, 4-10 mm long, ciliate or not. Stamens inserted at 1.5-2.7 mm from base, 0.31-0.51 of tube length; filaments 0.4-0.7 mm long; anthers 2-4 x as long as wide, 0.8-1.2 x 0.2-0.5 mm; lanceolate."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Lim, T.K. 2012. <i>Edible Medicinal and Non-Medicinal Plants</i> . Volume 1, Fruits. Springer, New York	"Inflorescences are sessile in axillary, glabrous, puberulent cymes. Flowers are white, pentamerous and actinomorphic, calyx lobes ovate-oblong, >1 x as long as wide, corolla tube cylindrical, inflated only around stamens, >3 mm long inserted near base of corolla tube; ovary, unilocular with parietal placentation and numerous ovules, style glabrous, and stigma not collared."
	NParks Flora&FaunaWeb. 2013. <i>Willughbeia edulis</i> . https://florafaunaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=1534 . [Accessed 4 Mar 2016]	"Its flowers are insect-pollinated." [Related taxon]

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Useful Tropical Plants Database. 2016. <i>Willughbeia coriacea</i> . http://tropical.theferns.info/viewtropical.php?id=Willughbeia+coriacea . [Accessed 4 Mar 2016]	"Propagation. Seed"

607	Minimum generative time (years)	n
	Source(s)	Notes
	NParks Flora&FaunaWeb. 2013. <i>Willughbeia edulis</i> . https://florafaunaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=1534 . [Accessed 4 Mar 2016]	[Unknown. Information for related taxon provided] "Plant Growth Rate : Moderate"

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	"Fruit spherical, pear shaped, oblong or ellipsoid; 2.6-12 cm long, 1.7-7 cm wide; green, yellow or orange. Seed 1.3-1.8 x 0.7-1.3 x 0.7-1.1 cm." [Fruits & seeds relatively large & lack means of external attachment]

Qsn #	Question	Answer
702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Hanelt, P. (ed.). 2001. Mansfeld's Encyclopedia of Agricultural and Horticultural Crops, Volume 4. Springer-Verlag, Berlin, Heidelberg, New York	"In Sumatra and Java cultivated."
	rarepalmseeds.com. 2016. <i>Willughbeia coriacea</i> . http://www.rarepalmseeds.com/pix/WilCor.shtml . [Accessed 4 Mar 2016]	[Commercially available at times] "An extremely rare and little known jungle liana, <i>Willughbeia coriacea</i> has light orange fruits similar in appearance to those of <i>W. angustifolia</i> . The pulp is slightly smaller than in the latter, but nevertheless very pleasant, like orange sherbet. The plant is very productive and vines will sometimes hold hundreds of fruits at various stages of development."
703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	"Fruit spherical, pear shaped, oblong or ellipsoid; 2.6-12 cm long, 1.7-7 cm wide; green, yellow or orange. Seed 1.3-1.8 x 0.7-1.3 x 0.7-1.1 cm." [Unlikely. Fruits & seeds relatively large]
704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	"Fruit spherical, pear shaped, oblong or ellipsoid; 2.6-12 cm long, 1.7-7 cm wide; green, yellow or orange. Seed 1.3-1.8 x 0.7-1.3 x 0.7-1.1 cm."
705	Propagules water dispersed	
	Source(s)	Notes
	Lim, T.K. 2012. <i>Edible Medicinal and Non-Medicinal Plants</i> . Volume 1, Fruits. Springer, New York	"A strictly tropical species, common in mixed dipterocarp or riverine forests in its native range." [Buoyancy of fruit unknown. Possible if growing in riparian areas]
706	Propagules bird dispersed	
	Source(s)	Notes
	Middleton, D. J. (1993). A taxonomic revision of <i>Willughbeia</i> Roxb (Apocynaceae). <i>Blumea</i> , 38(1), 1-24	[Possibly. Fleshy-fruited, but fruit & seeds relatively large] "Fruit spherical, pear shaped, oblong or ellipsoid; 2.6-12 cm long, 1.7-7 cm wide; green, yellow or orange. Seed 1.3-1.8 x 0.7-1.3 x 0.7-1.1 cm."

Qsn #	Question	Answer
707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Corlett, R. T., & Lucas, P. W. (1990). Alternative seed-handling strategies in primates: seed-spitting by long-tailed macaques (<i>Macaca fascicularis</i>). <i>Oecologia</i> , 82(2), 166-171	"In addition, some large fruits, including <i>Artocarpus</i> spp., <i>Mangifera indica</i> and <i>Willughbeia coriacea</i> were sometimes carried similar distances in the hand before they were processed and the seeds spat or dropped." [Fruits & seeds lack means of external attachment. In native range, may be carried externally by primates before consumption of pulp]
708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Lucas, P. W., & Corlett, R. T. (1998). Seed dispersal by long-tailed macaques. <i>American Journal of Primatology</i> , 45(1), 29-44	"TABLE I. Mean Seed Sizes, the Characteristics of Fruits That House Them, the Frequency of These Fruits in the Diet of Long-Tailed Macaques at Bukit Timah, and Seed Fates" [Seeds of <i>Willughbeia coriacea</i> are spat out. Presumably could be internally dispersed if consumed by feral pigs in the Hawaiian Islands]
801	Prolific seed production (>1000/m²)	
	Source(s)	Notes
	Lim, T.K. 2012. <i>Edible Medicinal and Non-Medicinal Plants. Volume 1, Fruits</i> . Springer, New York	[Unknown] "Fruit is an indehiscent, pear-shaped, ellipsoid, glabrous hard-walled, berry (Plates 1 and 2), golden-yellow, orange to dull red when ripe, up to 10 cm in diameter. Seeds a few to many, compressed, embedded in white or orange-coloured, sweet, mucilaginous pulp"
802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Royal Botanic Gardens Kew. (2016) Seed Information Database (SID). Version 7.1. http://data.kew.org/sid/ . [Accessed 4 Mar 2016]	[Unknown] "Storage Behaviour: No data available for species or genus. Of 182 known taxa of family APOCYNACEAE, 95.60% Orthodox(p/?), 1.65% Recalcitrant(?), 2.75% Uncertain"
803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species
804	Tolerates, or benefits from, mutilation, cultivation, or fire	
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	Unknown
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	

Qsn #	Question	Answer
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Thrives in tropical climates
- Climbing, & potentially smothering, growth habit
- Reproduces by seed
- Seeds dispersed by mammals & intentionally by people
- Seeds dispersed by birds & intentionally by people
- Limited ecological information reduces accuracy of risk prediction

Low Risk Traits

- No reports of invasiveness or naturalization, but no evidence of widespread introduction outside native range
- Unarmed (no spines, thorns or burrs)
- Edible fruit
- Medicinal uses
- Fruit relatively large & unlikely to be accidentally dispersed