

Taxon: <i>Dillenia suffruticosa</i>	Family: Dilleniaceae
Common Name(s): shrubby dillenia shrubby simpoh simpoh air simpoh ayer	Synonym(s): <i>Wormia suffruticosa</i> Griff. ex Hook. f.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 22 Jun 2015
WRA Score: 11.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Tropical Shrub, Environmental Weed, Thicket-forming, Bird-dispersed, Coppices

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

Qsn #	Question	Answer Option	Answer
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic		
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
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	y
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	No evidence of domestication
102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	NA
103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	NA
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 12 Jun 2015]	"Native: ASIA-TROPICAL Malesia: Indonesia - Kalimantan, Sumatra; Malaysia; Singapore"
202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 12 Jun 2015]	
203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes
	Plant This. 2015. <i>Dillenia suffruticosa</i> . http://www.plantthis.com.au/plant-information.asp?gardener=12866&plantSpot=4 . [Accessed 22 Jun 2015]	"Hardiness zones: 10-13"
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	[Occurs in tropical climates <500 m elevation]]"Distr. Malaysia: Sumatra (Palembang), Malay Peninsula, Riouw- and Lingga-Archipelagos, Natuna, Banka, Billiton, W. Java, and Borneo." ... "Ecol. In marshes, along streams, and on the margin of forests, often forming thickets, from sea-level up to 500 m."

Qsn #	Question	Answer
204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 21 Jun 2015]	"Native: ASIA-TROPICAL Malesia: Indonesia - Kalimantan, Sumatra; Malaysia; Singapore"

Qsn #	Question	Answer
205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 22 Jun 2015]	"Naturalized: ASIA-TROPICAL Indian Subcontinent: Sri Lanka Malesia: Indonesia - Java SOUTHERN AMERICA Caribbean: Jamaica Cultivated: cultivated "

Qsn #	Question	Answer
301	Naturalized beyond native range	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R. & Lorence, D.H. 2015. Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm . [Accessed 21 Jun 2015]	" <i>Dillenia suffruticosa</i> (Griff.) Martelli Status: Naturalized Distribution: O (Ko: Waihe`e)"
	Pelser, P.B., J.F. Barcelona & D.L. Nickrent (eds.). 2011 onwards. Co's Digital Flora of the Philippines. www.philippineplants.org	" <i>Dillenia suffruticosa</i> ... Widespread in Malesia from Sumatra to the Philippines. But indigenous only from Sumatra to Borneo. Naturalized in the Philippines and Java where it is cultivated as an ornamental treelet."
	Wickramathilake, B. A. K., Weerasinghe, T. K., & Ranwala, S. M. W. (2013). Impacts of woody invader <i>Dillenia suffruticosa</i> (Griff.) Martelli on physio-chemical properties of soil and, below and above ground flora. <i>Journal of Tropical Forestry and Environment</i> , 3(2): 66-75	" <i>Dillenia suffruticosa</i> , native to East Asia, was introduced to Sri Lanka as an ornamental plant to Royal Botanical Gardens in 1882 from Boneo. It is a light demanding woody shrub that could grow up to 6m tall in open lands in moist soil, thus proliferated fast as dense stands in the wet-low country of Sri Lanka inhabiting many marshy/semi- marshy areas (including abandoned paddy fields) in Kalutara, Galle and Ratnapura districts, posing a threat to native biota."
	Kueffer, C. & Vos, P. 2004. Case Studies on the Status of invasive Woody Plant Species in the Western Indian Ocean: 5. Seychelles. Forest Health & Biosecurity Working Papers FBS/4-5E. FAO Forestry Dept., Rome, Italy	"In recent years, an expansion in the range of four bird-dispersed shrubs or small trees has been observed: <i>Ardisia crenata</i> (first introduced in 1960; Robertson 1989), <i>Clidemia hirta</i> (1987, Robertson 1989) and <i>Dillenia suffruticosa</i> (1960s–70s; Bailey 1971), and <i>Memecylon caeruleum</i> (1931; Gerlach 1996b)." ... "Some exotic species are currently seen to be expanding their range on the granitic islands: <i>Ardisia crenata</i> , <i>Ardisia elliptica</i> , <i>Clidemia hirta</i> , <i>Dillenia suffruticosa</i> and <i>Memecylon caeruleum</i> ."

Qsn #	Question	Answer
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 21 Jun 2015]	"Naturalized: ASIA-TROPICAL Indian Subcontinent: Sri Lanka Malesia: Indonesia - Java SOUTHERN AMERICA Caribbean: Jamaica"

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Nayanakantha, N.M.C. 2007. Alien invasive plants and their potential threat to biodiversity in rubber plantations. Bulletin of the Rubber Research Institute of Sri Lanka 48: 61-66	"This distinctive shrubby tree grows vigorously in shade on eroded and infertile soils, wasteland, forest edges and swampy areas and can live for 50-100 years (Davies and Semui, 2006)."
	Nevill, J. 2009. Mainstreaming Prevention and Control Measures for Invasive Alien Species into Trade, Transport and Travel across the Production Landscape. National IAS Baseline Report. GOS - UNDP - GEF	[A pioneer tree of disturbed habitats that has negative environmental impacts] "An invader of mid-altitude forest it is now frequently found in secondary vegetation along major roads. It has also however started to naturalise in closed canopy forests e.g. Mare aux Cochons area."

303	Agricultural/forestry/horticultural weed	
	Source(s)	Notes
	Nayanakantha, N.M.C. 2007. Alien invasive plants and their potential threat to biodiversity in rubber plantations. Bulletin of the Rubber Research Institute of Sri Lanka 48: 61-66	[Potential weed of rubber plantations] "Except <i>Lantana camara</i> , other leading invasive plants, such as <i>Weddelia trilobata</i> , <i>Clidemia hirta</i> and <i>Dillenia suffruticosa</i> are found in rubber plantations especially in the Wet Zone of Sri Lanka as noxious weeds," ... "This is a pioneer species which can establish in bear lands and therefore there is a potential to invade it in to young rubber plantations as well."

304	Environmental weed	y
	Source(s)	Notes
	Wickramathilake, B. A. K., Weerasinghe, T. K., & Ranwala, S. M. W. (2013). Impacts of woody invader <i>Dillenia suffruticosa</i> (Griff.) Martelli on physio-chemical properties of soil and, below and above ground flora. <i>Journal of Tropical Forestry and Environment</i> , 3(2): 66-75	" <i>Dillenia suffruticosa</i> , native to East Asia, was introduced to Sri Lanka as an ornamental plant to Royal Botanical Gardens in 1882 from Boneo. It is a light demanding woody shrub that could grow up to 6m tall in open lands in moist soil, thus proliferated fast as dense stands in the wet low country of Sri Lanka inhabiting many marshy/semi- marshy areas (including abandoned paddy fields) in Kalutara, Galle and Ratnapura districts, posing a threat to native biota. Shade provided by its large leaves hinder undergrowth and accumulation of litter created a favourable habitat for mosquitoes, thus raising human health issues in the surroundings. When growing in riparian habitats it influenced sedimentation rates (Ranwala, 2011). These impacts listed <i>D. suffruticosa</i> as a nationally important IAS over the last ten years (Wijesundara, 1999, 2010). It was also recognized as an alternate host for Oil palm nettle caterpillar <i>Setoranitens</i> in Malaysia (Lim et al., 2001)."

Qsn #	Question	Answer
	Nevill, J. 2009. Mainstreaming Prevention and Control Measures for Invasive Alien Species into Trade, Transport and Travel across the Production Landscape. National IAS Baseline Report. GOS - UNDP - GEF	"Impacts. In Seychelles this seed propagated and bird dispersed species has been listed by Kuffer (2006) as one of the 9 main woody invasive species in semi-natural to natural inland habitats of the granitic Seychelles. <i>D. suffruticosa</i> can form dense stands to the exclusion of native vegetation. An invader of mid-altitude forest it is now frequently found in secondary vegetation along major roads. It has also however started to naturalise in closed canopy forests e.g. Mare aux Cochons area." ... "Concerns. Capacity to invade closed-canopy forest suggests the species may pose significant threat to biodiversity."

305	Congeneric weed	
	Source(s)	Notes
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[<i>Dillenia indica</i> listed as naturalized & weedy. Impacts unspecified] " <i>Dillenia indica</i> L. Dilleniaceae Cultivated, Forestry, Crop Refs: 7 1157-CN, 1099-nc, 943-nc, 760-W, 742-N, 230-N, 101-N"

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Jakarta	[No evidence] "Large shrub, up to 10 m high. Leaves elliptic to obovate, ca 12-20-nerved, ca 15-25 by 8-12 cm, blade with ± obtuse apex and base and entire to dentate margin, glabrous above or sometimes slightly woolly on young leaves, beneath slightly to densely woolly on the lateral nerves, on both sides of the central nerve (continuing on the petiole), and along the line which delimits the bud-enclosing part of the leaf-basis. Petiole ca 2-6 cm long with up to \ 112cm broad, usually persistent wings."

402	Allelopathic	
	Source(s)	Notes
	Wickramathilake, B. A. K., Weerasinghe, T. K., & Ranwala, S. M. W. (2013). Impacts of woody invader <i>Dillenia suffruticosa</i> (Griff.) Martelli on physio-chemical properties of soil and, below and above ground flora. <i>Journal of Tropical Forestry and Environment</i> , 3(2): 66-75	"...changes in above ground vegetation and soil properties due to the invasion were identified and further studies are needed for determining the degree of soil deterioration due to the invasive behavior of <i>D. suffruticosa</i> ."

403	Parasitic	n
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Jakarta	"Large shrub, up to 10 m high." [Dilleniaceae. No evidence]

404	Unpalatable to grazing animals	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Agoramoorthy, G., Alagappasamy, C., & Hsu, M. J. (2004). Can proboscis monkeys be successfully maintained in captivity? A case of swings and roundabouts. <i>Zoo Biology</i> , 23(6), 533-544	[Flowers, buds, seeds, and fleshy stems palatable to proboscis monkeys] "A total of 20 plant species were provided along with a staple diet of at least seven different species on a daily basis (Table 3). Monkeys belonging to different age classes such as juvenile, sub-adults, and adults preferred to eat mainly young leaves. In addition, they ate the fruit of <i>Morus alba</i> , the fruits and stems of <i>Terminalia catappa</i> , and the flowers, buds, seeds, and fleshy stems of <i>Leucaena leucocephala</i> , <i>Dillenia suffruticosa</i> , and <i>Adenanthera pavonina</i> (Table 3)."
	Ismail, D., & Jiwan, D. (2015). Browsing preference and ecological carrying capacity of sambar deer (<i>Cervus unicolor brookei</i>) on secondary vegetation in forest plantation. <i>Animal Science Journal</i> , 86(2), 225-237	[Palatable to deer] "The browsing preference and ecological carrying capacity (ECC) of sambar deer (<i>Cervus unicolor brookei</i>) in acacia plantations for management and conservation of the ecosystem were investigated at Sabal Forest Reserve in Sarawak, Malaysia. The identification of the species browsed by the sambar deer was based on an observation of the plant parts consumed. ECC estimation was based on body weight (BW) and the physiological stages of animals browsed in six fenced 4-ha paddocks. Sambar deer were found foraging on only 29 out of 42 species of secondary vegetation in the acacia plantation. The remaining species are too high for the deer to reach. Planted species, <i>Shorea macrophylla</i> are not palatable to the deer. This augurs well for the integration of sambar deer into shorea plantations. The most frequently exploited plants were <i>Ficus</i> spp. Sambar deer preferred woody species more than non-woody species and they are browser animals. By producing metabolizable energy of 19 000 to 27 000 MJ/ha, the ECC was five head/ha to 5.25 head/ha. Given its contribution to the conservation of wildlife and its capacity to sustain the ecosystem, the sambar deer integrated farming system offers a promising strategy for the future of tropical forestry management."

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

406	Host for recognized pests and pathogens	y
	Source(s)	Notes
	Wickramathilake, B. A. K., Weerasinghe, T. K., & Ranwala, S. M. W. (2013). Impacts of woody invader <i>Dillenia suffruticosa</i> (Griff.) Martelli on physio-chemical properties of soil and, below and above ground flora. <i>Journal of Tropical Forestry and Environment</i> , 3(2): 66-75	"It was also recognized as an alternate host for Oil palm nettle caterpillar <i>Setoranitens</i> in Malaysia (Lim et al., 2001)."

Qsn #	Question	Answer
407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	NParks Flora&FaunaWeb. 2013. <i>Dillenia suffruticosa</i> . https://florafaunaweb.nparks.gov.sg/Special-Pages/plant-detail.aspx?id=2847 . [Accessed 21 Jun 2015]	"Ethnobotanical Uses : Edible Plant Parts ((Edible Leaves)) Food ((Fruit & Vegetable: Its young shoots and leaves are edible.)) Medicinal [Others]: The large leaves are also used to wrap food such as tempeh, or formed into shallow cones to contain traditional 'fast food' such as rojak."
	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] "Young leaves made into a paste applied to wounds; eat the young leaves with the young leaves of <i>Melastoma borneense</i> for stomachache."

408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Unlikely given wet habitats] "In the wild, <i>D. suffruticosa</i> grows in marshy places and along watercourses and forest margins; in Hawaii it thrives in cool, moist valleys."
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	[Unlikely given wetter habitats, although thickets may be able to carry fire] "Ecol. In marshes, along streams, and on the margin of forests, often forming thickets, from sea-level up to 500 m."

Qsn #	Question	Answer
409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Lau, A. 2015. Oahu Early Detection Botanist. Pers. Comm. 04 June	"I have definitely seen it growing in somewhat shaded areas. It seems like the thicket forming it does tends to occur in open areas, but individuals are more than capable of surviving and reaching maturity in shady understory areas. "
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"In the wild, <i>D. suffruticosa</i> grows in marshy places and along watercourses and forest margins; in Hawaii it thrives in cool, moist valleys."
	Nayanakantha, N.M.C. 2007. Alien invasive plants and their potential threat to biodiversity in rubber plantations. Bulletin of the Rubber Research Institute of Sri Lanka 48: 61-66	"This distinctive shrubby tree grows vigorously in shade on eroded and infertile soils, wasteland, forest edges and swampy areas and can live for 50-100 years (Davies and Semui, 2006)."
	Nevill, J. 2009. Mainstreaming Prevention and Control Measures for Invasive Alien Species into Trade, Transport and Travel across the Production Landscape. National IAS Baseline Report. GOS - UNDP - GEF	[Invades closed canopy forest in the Seychelles] "An invader of mid-altitude forest it is now frequently found in secondary vegetation along major roads. It has also however started to naturalise in closed canopy forests e.g. Mare aux Cochons area." ... "Concerns. Capacity to invade closed-canopy forest suggests the species may pose significant threat to biodiversity."
	Wickramathilake, B. A. K., Weerasinghe, T. K., & Ranwala, S. M. W. (2013). Impacts of woody invader <i>Dillenia suffruticosa</i> (Griff.) Martelli on physio-chemical properties of soil and, below and above ground flora. Journal of Tropical Forestry and Environment, 3(2): 66-75	[Light demanding] " <i>Dillenia suffruticosa</i> , native to East Asia, was introduced to Sri Lanka as an ornamental plant to Royal Botanical Gardens in 1882 from Boneo. It is a light demanding woody shrub that could grow up to 6m tall in open lands in moist soil,"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	NParks Flora&FaunaWeb. 2013. <i>Dillenia suffruticosa</i> . https://florafaunaweb.nparks.gov.sg/Special-Pages/plant-detail.aspx?id=2847 . [Accessed 22 Jun 2015]	"In Singapore, it is one of the key species found in <i>adinandra belukar</i> (secondary forest on degraded soil) and other secondary forests." ... "Plant & Rootzone Preference/Tolerance : Moist Soils, Waterlogged Soils (Drains Site), Easy to Grow"
	Nevill, J. 2009. Mainstreaming Prevention and Control Measures for Invasive Alien Species into Trade, Transport and Travel across the Production Landscape. National IAS Baseline Report. GOS - UNDP - GEF	"shrub/tree of moist forests known to be tolerant of degraded/infertile soils."
	Plant This. 2015. <i>Dillenia suffruticosa</i> . http://www.plantthis.com.au/plant-information.asp?gardener=12866&plantSpot=4 . [Accessed 22 Jun 2015]	"Soil: ordinary soil, enriched soil, mildly acidic to mildly alkaline"

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Stenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	"Large shrub, up to 10 m high."

412	Forms dense thickets	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	"Ecol. In marshes, along streams, and on the margin of forests, often forming thickets, from sea-level up to 500 m."
	Chua, S. C., Ramage, B. S., Ngo, K. M., Potts, M. D., & Lum, S. K. (2013). Slow recovery of a secondary tropical forest in Southeast Asia. <i>Forest Ecology and Management</i> , 308, 153-160	"In addition, all of the above species coppice readily (pers. obs), allowing them to spread rapidly and compete strongly for resources. <i>D. suffruticosa</i> in particular forms dense thickets by producing new plants from adventitious roots when mature (Corlett, 1991a)."
	Wickramathilake, B. A. K., Weerasinghe, T. K., & Ranwala, S. M. W. (2013). Impacts of woody invader <i>Dillenia suffruticosa</i> (Griff.) Martelli on physio-chemical properties of soil and, below and above ground flora. <i>Journal of Tropical Forestry and Environment</i> , 3(2): 66-75	"It is a light demanding woody shrub that could grow up to 6m tall in open lands in moist soil, thus proliferated fast as dense stands in the wet-low country of Sri Lanka inhabiting many marshy/semi-marshy areas (including abandoned paddy fields) in Kalutara, Galle and Ratnapura districts, posing a threat to native biota. Shade provided by its large leaves hinder undergrowth and accumulation of litter created a favourable habitat for mosquitoes, thus raising human health issues in the surroundings."
	Lau, A. 2015. Oahu Early Detection Botanist. Pers. Comm. 04 June	"It most definitely is capable of forming dense thickets, as it does on some of the lower ridges in windward O'ahu, including Waihee. These thickets tend to have very little or no understory (or overstory" ... "It seems like the thicket forming it does tends to occur in open areas, but individuals are more than capable of surviving and reaching maturity in shady understory areas."

501	Aquatic	n
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	[Terrestrial] "Ecol. In marshes, along streams, and on the margin of forests"

502	Grass	n
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/ . [Accessed 22 Jun 2015]	"Family: Dilleniaceae"

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	[No evidence] "Family: Dilleniaceae"

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	"Large shrub, up to 10 m high."

Qsn #	Question	Answer
601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Hoogland, R. D., & Wadhwa, B. M. (1996). Proposal to conserve the name <i>Wormia suffruticosa</i> against <i>Wormia subsessilis</i> (Dilleniaceae). <i>Taxon</i> , 45(1): 130	" <i>Dillenia suffruticosa</i> (Hook. f. & Thomson) Martelli (in <i>Malesia</i> 3: 163. 1886) is a species native to the Malay Peninsula, Sumatra and Borneo and introduced (cultivated and naturalised) elsewhere, e.g. in Sri Lanka, Jamaica and Java. It is particularly common in certain parts of the Malay Peninsula and Singapore where it, at times, constitutes a significant element in secondary vegetation (belukar)."

602	Produces viable seed	y
	Source(s)	Notes
	Tokumoto, Y., Sakai, S., Matsushita, M., Ohkubo, T., & Nakagawa, M. (2014). Spatiotemporal Variability in the Reproductive Success of the Continually Flowering Shrub <i>Dillenia suffruticosa</i> in Borneo. <i>Biotropica</i> , 46(5), 583-590	"Continually flowering plants bloom continuously throughout the year, as often seen in plants distributed along the roadsides or in the understory layers in Southeast Asia's tropical rain forests. <i>Dillenia suffruticosa</i> (Griff. ex Hook. f. & Thomson) Martelli (Dilleniaceae) is one such continually flowering shrub that flowers during periods of community-wide mass flowering, general flowering (GF), and non-GF. During irregularly occurring GF periods, when species of all forest layers flower synchronously for several months, some pollinators migrate to the canopy layer, where GF promotes the pollination success of participating plants. Continually flowering plants share the available pollinator community with GF plants, and the reproductive success of continually flowering plants may be affected during the GF period. To assess the effects of GF on the reproductive success of a diverse range of continually flowering plants, we examined the differences in pollinator density and reproductive success between GF and non-GF periods in <i>D. suffruticosa</i> at four different research sites. Although the seed set differed among the four research sites, pollinator density and fruit set did not differ between GF and non-GF periods or research sites. Our results suggest that the reproductive success of <i>D. suffruticosa</i> was maintained at an approximately constant level, regardless of the flowering phenology of the canopy layer or other vegetation components."
	NParks Flora&FaunaWeb. 2013. <i>Dillenia suffruticosa</i> . https://florafaunaweb.nparks.gov.sg/Special-Pages/plant-detail.aspx?id=2847 . [Accessed 21 Jun 2015]	"Cultivation: It can be grown from seed or stem cutting."

603	Hybridizes naturally	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	Unknown

Qsn #	Question	Answer
604	Self-compatible or apomictic	
	Source(s)	Notes
	Tokumoto, Y., Sakai, S., Matsushita, M., Ohkubo, T., & Nakagawa, M. (2014). Spatiotemporal Variability in the Reproductive Success of the Continually Flowering Shrub <i>Dillenia suffruticosa</i> in Borneo. <i>Biotropica</i> , 46(5), 583-590	"As artificial pollination using pollen taken from the same individual only slightly decreased the fruit set of <i>D. suffruticosa</i> , the species might possess weak self-incompatibility (Y. Tokumoto, unpubl. data)."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Tokumoto, Y., Itioka, T., Ohkubo, T., Tadauchi, O., & Nakagawa, M. (2013). Assemblage of flower visitors to <i>Dillenia suffruticosa</i> and possible negative effects of disturbances in Sarawak, Malaysia. <i>Entomological Science</i> , 16(3), 341-351	" <i>Dillenia suffruticosa</i> (Dilleniaceae), a common pioneer shrub in Southeast Asia, is broadly distributed along roadsides. This species flowers throughout the year and is thought to be a keystone species for maintaining populations of flower visitors. To examine the flower visitors of this species, we conducted field surveys and described the behaviors of each flower visitor species within four different research sites: Primary Forests 1 and 2, Secondary Forest, and Mixed Vegetation. We caught 1087 individuals belonging to 51 species from 11 insect families and one species of arachnid. Most flower visitors belonged to Hymenoptera (98.6% of individuals); <i>Trigona</i> spp. and <i>Xylocopa</i> spp. (Apidae) accounted for 64.0% and 20.0%, respectively, of all caught individuals. According to observations of behavior by each species, effective pollinators may include <i>Xylocopa</i> spp. and <i>Amegilla</i> spp. (Apidae)."

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Chua, S. C., Ramage, B. S., Ngo, K. M., Potts, M. D., & Lum, S. K. (2013). Slow recovery of a secondary tropical forest in Southeast Asia. <i>Forest Ecology and Management</i> , 308, 153-160	[Spreads vegetatively via adventitious roots] "In addition, all of the above species coppice readily (pers. obs), allowing them to spread rapidly and compete strongly for resources. <i>D. suffruticosa</i> in particular forms dense thickets by producing new plants from adventitious roots when mature (Corlett, 1991a)."

607	Minimum generative time (years)	3
	Source(s)	Notes
	Top Tropicals. 2015. <i>Dillenia suffruticosa</i> , <i>Wormia suffruticosa</i> . https://toptropicals.com/catalog/uid/Dillenia_suffruticosa.htm . [Accessed 22 Jun 2015]	"The plant blooms from age 3-4 and can live for 50-100 years!"

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. <i>Flora Malesiana. Series I, Spermatophyta: Volume 4.</i> Noordhoff-Kolff N.V., Djakarta	[Bird-dispersed. Fruit & seeds lack means of external attachment] "Fruit dehiscent. Carpels red, ca 20-25 by 10-16 mm, each 1-4-seeded. Seeds brown or black, with a membranaceous, scarlet aril."

Qsn #	Question	Answer
702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"D. suffruticosa is native to the Malay Peninsula, Sumatra and small islands in the vicinity, and Borneo and is widely introduced as a cultivated ornamental (e.g., in western Java, Jamaica, and other tropical places); it escapes readily from cultivation and has become naturalized and common in Jamaica. Locally, it is adventive in Ho'omaluhia Botanical Garden, and in 1997 a population was discovered outside cultivation on windward Oahu."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	[No evidence. A tree cultivated as an ornamental. Unlikely to become a contaminant of produce] "Fruit dehiscent. Carpels red, ca 20-25 by 10-16 mm, each 1-4- seeded. Seeds brown or black, with a membranaceous, scarlet aril."

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	"Fruit dehiscent. Carpels red, ca 20-25 by 10-16 mm, each 1-4- seeded. Seeds brown or black, with a membranaceous, scarlet aril."

705	Propagules water dispersed	
	Source(s)	Notes
	NParks Flora&FaunaWeb. 2013. <i>Dillenia suffruticosa</i> . https://florafaunaweb.nparks.gov.sg/Special-Pages/plant-detail.aspx?id=2847 . [Accessed 21 Jun 2015]	[Common along streams. Bird-dispersed, but water may provide some secondary dispersal] "It grows along forest edges, streams, and in marshes, secondary forests, and swampy grounds, up to 500 m altitude. In Singapore, it is one of the key species found in adinandra belukar (secondary forest on degraded soil) and other secondary forests."

706	Propagules bird dispersed	y
	Source(s)	Notes
	Chan, E. & Tettoni, L. I. 2003. Handy Pocket Guide to Tropical Plants. Periplus Editions (HK) Ltd., Singapore	"In <i>D. suffruticosa</i> the fruit is a capsule that opens to reveal red seeds in a red aril, attractive to birds."
	Kueffer, C. & Vos, P. 2004. Case Studies on the Status of invasive Woody Plant Species in the Western Indian Ocean: 5. Seychelles. Forest Health & Biosecurity Working Papers FBS/4-5E. FAO Forestry Dept., Rome, Italy	"In recent years, an expansion in the range of four bird-dispersed shrubs or small trees has been observed: <i>Ardisia crenata</i> (first introduced in 1960; Robertson 1989), <i>Clidemia hirta</i> (1987, Robertson 1989) and <i>Dillenia suffruticosa</i> (1960s–70s; Bailey 1971), and <i>Memecylon caeruleum</i> (1931; Gerlach 1996b)."

Qsn #	Question	Answer
	Bird Ecology Study Group. 2009. Birds and <i>Dillenia suffruticosa</i> . http://www.besgroup.org/2009/01/26/birds-and-dillenia-suffruticosa/ . [Accessed 21 Jun 2015]	"Mark Chua a.k.a. Cajuca was at the Sungei Buloh Wetland Reserve on the morning of 20th January 2009 when he came across the Pink-necked Green Pigeon (<i>Treron vernans</i>) feasting on the seeds of <i>dillenia</i> or simpoh air (<i>Dillenia suffruticosa</i>) (left). The ripe fruit, when it splits open in the early morning to expose the succulent red seeds, attracts plenty of birds. It is indeed the "early bird that gets the worm" as the seeds do not remain on the fruit for long. By late morning only the "shell" of the fruit is left. The four red "buds" below the fruit are actually developing fruits, easily mistaken for flower buds. The persistent sepals that enclose the developing fruits will eventually unfold when the fruits mature, to display the red seeds." ... "Subsequently, Mark photographed the Yellow-vented Bulbul (<i>Pycnonotus goiavier</i>) (below left), Brown-throated Sunbird (<i>Anthreptes malacensis</i>) (below centre) and Purple throated Sunbird (<i>Nectariniua sperata</i>) (below right) also relishing the seeds."

707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	[No evidence. Fruit & seeds lack means of external attachment] "Fruit dehiscent. Carpels red, ca 20-25 by 10-16 mm, each 1-4-seeded. Seeds brown or black, with a membranaceous, scarlet aril."

708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	[Presumably Yes] "Fruit ripe after 36 days (Corner, 1940); seeds eaten by birds."

801	Prolific seed production (>1000/m2)	y
	Source(s)	Notes
	Steenis, C.G.G.J. van (ed.). 1954. Flora Malesiana. Series I, Spermatophyta: Volume 4. Noordhoff-Kolff N.V., Djakarta	"Carpels 5-8, usually 7, ca 5 by 2 mm, with yellowish white, ca 1 cm long styles, each with 7-10 ovules. Fruit dehiscent. Carpels red, ca 20-25 by 10-16 mm, each 1-4-seeded. Seeds brown or black, with a membranaceous, scarlet aril." ... "Flowering continuously, each flower open for one day only, between 2 flowers of the same raceme a difference of ca 3-4 days."
	Pacific Island Ecosystems at Risk (PIER). 2013. <i>Dillenia suffruticosa</i> . http://www.hear.org/Pier/species/dillenia_suffruticosa.htm . [Accessed 22 Jun 2015]	"Flowers in up to 18-flowered terminal simple or compound racemose inflorescences, 8-12 cm across. Pedicel 1-3 cm. Sepals obovate, 15-22 by 8-12 mm. Petals yellow, 40-50 by 25-30 mm. Staminodes ca 100, 4-6 mm long, outside stamens. Stamens ca 175, outer ones curved, inner ones reflexed at apex, from 8 (outermost) to 13 (innermost) mm long. Carpels 5-8, ca 5 by 2 mm with 10 mm long style; each with 7-10 ovules. Fruit dehiscent, sepals reflexed, carpels spreading, red, ca 20-25 by 10-16 mm." [up to 80 seeds per fruit (if all ovules within each carpel become seeds), need 12-13 flowers (less than 1 florescence) to reach 1000 seeds per square meter]

Qsn #	Question	Answer
802	Evidence that a persistent propagule bank is formed (>1 yr)	n
	Source(s)	Notes
	Australian Native Plant Society. 2007. <i>Dillenia alata</i> . http://anpsa.org.au/d-ala.html . [Accessed 22 Jun 2015]	"Propagation is best from fresh seed." <i>Dillenia alata</i> -- a related wetland species from Australia]
	Tiansawat, P., & Dalling, J. W. (2013). Differential seed germination responses to the ratio of red to far-red light in temperate and tropical species. <i>Plant Ecology</i> , 214(5), 751-764	"Table 1 Summary information of 72 species used in this study" [Dillenia suffruticosa - Dormancy = ND non-dormant]

803	Well controlled by herbicides	y
	Source(s)	Notes
	Kaiser-Bunbury, C. N., Mougai, J., Valentin, T., Gabriel, R., & Blüthgen, N. (2015). Herbicide application as a habitat restoration tool: impact on native island plant communities. <i>Applied Vegetation Science</i> . doi: 10.1111/avsc.12183	"We conducted two field experiments. First, to test the effects of four IAP control methods (cut, 5%, 10%, 15% Tordon 101 herbicide concentration) on ten woody IAP species, we treated a total of 320 adults and monitored mortality for 18 wk." ... "Table 1. Percentage resprout of invasive alien plant species used to test the effect of 5%, 10% and 15% herbicide concentration and the cut treatment on survival of target plants. Asterisks annotate significance levels between all herbicide treatments pooled and cut treatment." [Dillenia suffruticosa was among the 10 species treated with herbicide. No herbicide treated plants resprouted, but 37.5% resprouted in September 2011, and 75% resprouted in September 2011]

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Chua, S. C., Ramage, B. S., Ngo, K. M., Potts, M. D., & Lum, S. K. (2013). Slow recovery of a secondary tropical forest in Southeast Asia. <i>Forest Ecology and Management</i> , 308, 153-160	[Readily coppices] "In fact, aside from <i>D. suffruticosa</i> , a secondary forest shrub species which made up the top 20% of the sapling population in the secondary forest plot, the next most abundant sapling species included a mix of species found in mature secondary to primary forests." ... "this was especially notable as the high number of sapling-sized <i>D. suffruticosa</i> was probably inflated due to coppices that could not be easily differentiated from parent trees. However, aside from <i>D. suffruticosa</i> , most of the saplings were located near the primary forest"
	Plant This. 2015. <i>Dillenia suffruticosa</i> . http://www.plantthis.com.au/plant-information.asp?gardener=12866&plantSpot=4 . [Accessed 22 Jun 2015]	[Tolerates regular pruning] "Pruning: Retain only one main trunk for a tree or tip prune regularly from a young age for a shrub."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	Unknown. No native members of Dilleniaceae in the Hawaiian Islands

Summary of Risk Traits:

High Risk / Undesirable Traits

- Thrives in tropical climates
- Naturalized on Oahu, Hawaiian Islands, Sri Lanka, Java, Jamaica
- A pioneer species capable of invading disturbed habitats
- An environmental weed of Sri Lanka & the Seychelles
- Alternate host for oil palm nettle caterpillar
- A light demanding pioneer species capable of establishing in shade
- Tolerates many soil types
- Forms dense thickets
- Reproduces by seed & vegetatively by adventitious roots
- Capable of reaching maturity in 3-4 years
- Seeds dispersed by birds, possibly by water & intentionally by people
- Prolific seed production
- Able to coppice & resprout after cutting

Low Risk Traits

- Unarmed (no spines, thorns or burrs)
- Palatable to animals
- Non-toxic
- Ornamental & medicinal uses
- Seeds lack dormancy & may not form a long-lived seed bank
- Herbicides may provide effective control