Taxon: Cyathea arborea (L.) Sm. **Family:** Cyatheaceae

Common Name(s): Puerto Rican tree fern
West Indian tree fern

Synonym(s): Polypodium arboreum L.

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 8 Apr 2020

WRA Score: 9.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Tree Fern, Pioneer, Fast Growing, Self-Fertile, Wind-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	n
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	n
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle		

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	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)		
601	Evidence of substantial reproductive failure in native habitat		
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally	y=1, n=-1	y
604	Self-compatible or apomictic	y=1, n=-1	y
605	Requires specialist pollinators		
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	2
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)	y=1, n=-1	y
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**
	Tryon, R. (1976). A revision of the genus Cyathea. Contributions from the Gray Herbarium of Harvard University, 206: 19-98	[No evidence] "Greater Antilles and Lesser Antilles south to Grenada. Cyathea arborea typically grows in montane forests, in humid ravines, along water courses and on mountain slopes, from sea level to 1200 m, usually from 500-800 m. It frequently persists in cutover land, along forest borders and in forest clearings. It is successful as a pioneer species, often becoming established in disturbed habitats such as landslides, road cuts and spills and on abandoned land. Stem to 10 m tall; leaves to 4 m long."

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. (2020). 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, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 6 Apr 2020]	"Native Southern America CARIBBEAN: Barbados, Dominica, Grenada, Guadeloupe, Jamaica, Martinique, Montserrat, St. Vincent and Grenadines, United States [Puerto Rico] NORTHERN SOUTH AMERICA: Venezuela"

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 6 Apr 2020]	

Qsn #	Question	Answer
203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**
	Tryon, R. (1976). A revision of the genus Cyathea. Contributions from the Gray Herbarium of Harvard University, 206: 19-98	[Elevation range exceeds 1000 m, demonstrating environmental versatility] "Cyathea arborea typically grows in montane forests, in humid ravines, along water courses and on mountain slopes, from sea level to 1200 m, usually from 500-800 m."

204	**Native or naturalized in regions with tropical or subtropical climates**	**y**
	Source(s)	**Notes**
	Tryon, R. (1976). A revision of the genus Cyathea. Contributions from the Gray Herbarium of Harvard University, 206: 19-98	"Greater Antilles and Lesser Antilles south to Grenada. Cyathea arborea typically grows in montane forests, in humid ravines, along water courses and on mountain slopes, from sea level to 1200 m, usually from 500-800 m. It frequently persists in cutover land, along forest borders and in forest clearings."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 6 Apr 2020]	"Native Southern America CARIBBEAN: Barbados, Dominica, Grenada, Guadeloupe, Jamaica, Martinique, Montserrat, St. Vincent and Grenadines, United States [Puerto Rico] NORTHERN SOUTH AMERICA: Venezuela"

205	**Does the species have a history of repeated introductions outside its natural range?**	**n**
	Source(s)	**Notes**
	Imada, C.T., Staples, G.W. & Herbst, D.R. 2005. Annotated Checklist of Cultivated Plants of Hawai'i. http://www2.bishopmuseum.org/HBS/botany/cultivatedplants/. [Accessed 7 Apr 2020]	"First Collected: 1990 Locations: Ho'omaluhia Botanical Garden"
	Jones, D. L. 1987. Encyclopedia of Ferns. Timber Press, Portland, OR	"Plants grow easily with warmth, moisture and bright light (partial to filtered sun)." [May be sparingly cultivated]
	Bezona, N., Rauch, F. D., & Iwata, R. Y. 1994. Tree ferns for Hawai'i gardens. Research Extension Series 144. CTAHR,, Univiersity of Hawaii, Honolulu, HI	"This fern will tolerate full sun in cool, wet areas or filtered shade in warm, dry areas with sufficient irrigation." [Promoted for cultivation in the Hawaiian Islands]
	Little, Jr. E.L. & Wadsworth , F.H. (1964). Common trees of Puerto Rico and the Virgin Islands. Agriculture Handbook No. 249. USDA Forest Service, Washington, D.C	[Rarely cultivated] "Though very ornamental in their native mountains, tree-ferns seldom are cultivated in Puerto Rico."

301	**Naturalized beyond native range**	**n**
	Source(s)	**Notes**
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	No evidence to date
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence to date

Qsn #	Question	Answer
302	**Garden/amenity/disturbance weed**	
	Source(s)	**Notes**
	Tryon, R. (1976). A revision of the genus Cyathea. Contributions from the Gray Herbarium of Harvard University, 206: 19-98	[Disturbance-adapted pioneer species. May become weedy in disturbed habitats if introduced widely outside native range] "It is successful as a pioneer species, often becoming established in disturbed habitats such as landslides, road cuts and spills and on abandoned land."

303	**Agricultural/forestry/horticultural weed**	**n**
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

304	**Environmental weed**	**n**
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

305	**Congeneric weed**	**y**
	Source(s)	**Notes**
	Medeiros, A.C., Loope, L.L., & Anderson, S. 1993. Differential colonization by epiphytes on native (Cibotium spp.) and alien (Cyathea cooperi) tree ferns in a Hawaiian rain forest. Selbyana 14: 71–74	"Cyathea cooperi, though undocumented until recently as invasive, is an aggressive species that has established in native forests on several islands in the 1970's and is rapidly spreading (Medeiros et al. 1992). In addition to impacts such as aggressive competition for space and light, the evidence presented here demonstrates that the alien tree fern supports fewer epiphytes than the two native Cibotium tree ferns."
	Medeiros, A. C., Loope, L. L., Flynn, T., Anderson, S. J., Cuddihy, L. W., & Wilson, K. A. 1992. Notes on the status on an invasive Australian tree fern (Cyathea cooperi) in Hawaiian rain forests. American Fern Journal, 82(1): 27-33.	[Cyathea cooperi] "The densest stands of Cyathea in the Kipahulu Valley population were conspicuously lacking in understory species diversity and biomass. This may be due to the thick layer of fibrous roots at the soil surface that surrounds individuals of Cyathea cooperi, extending up to 5 m from a large individual." … "Cyathea cooperi does not support the dense growth of epiphytic native species that typically occupies the trunks of native tree ferns in wet forests. Medeiros et al. (submitted) found more than ten times as many epiphyte individuals growing on trunks of native tree ferns (Cibotium spp.) as on trunks of Cyathea cooperi."

401	**Produces spines, thorns or burrs**	**n**
	Source(s)	**Notes**
	Little, Jr. E.L. & Wadsworth , F.H. (1964). Common trees of Puerto Rico and the Virgin Islands. Agriculture Handbook No. 249. USDA Forest Service, Washington, D.C	[No evidence] "This species is spineless throughout., though certain kinds have spiny trunks and leaf axes."

402	**Allelopathic**	

Qsn #	Question	Answer
	Source(s)	**Notes**
	Brock, J. M., Perry, G. L., Lee, W. G., & Burns, B. R. (2016). Tree fern ecology in New Zealand: A model for southern temperate rainforests. Forest Ecology and Management, 375, 112-126	[Unknown. No evidence found for C. arborea] "Froude (1980) showed that aqueous extracts from green frond material of tree ferns (C. medullaris, C. smithii, D. squarrosa) stunted the radicle development of salad cress (Lepidium sativum); and C. medullaris extract caused stunting in kakabeak (Clianthus puniceus) radicle growth. Froude observed similar inhibitory effects of the leachates of the three tree fern species on the seedling germination and growth of W. racemosa. Although not conclusive, Froude's studies suggested that tree ferns may influence species establishment through the presence of alkaloid phytochemicals in their fronds and trunks. In general little is known about allelopathy in New Zealand forests (but see Michel et al. (2011), Morales (2015)) and therefore any comment on the relative importance of any possible allelopathic effects of tree ferns on the forest community remains speculative at this point."

403	Parasitic	n
	Source(s)	**Notes**
	Tryon, R. (1976). A revision of the genus Cyathea. Contributions from the Gray Herbarium of Harvard University, 206: 19-98	Cyatheaceae [No evidence]

404	Unpalatable to grazing animals	
	Source(s)	**Notes**
	Brock, J. M., Perry, G. L., Lee, W. G., & Burns, B. R. (2016). Tree fern ecology in New Zealand: A model for southern temperate rainforests. Forest Ecology and Management, 375, 112-126	[Unknown. Some other Cyathea species are browsed by animals] "However, tree ferns are browsed by several introduced vertebrate herbivore species that affect their abundance locally (Mark et al., 1991; Nugent et al., 2002; Smale et al., 2008). C. medullaris, and to a lesser extent C. smithii and D. squarrosa are palatable and susceptible to brushtail possum (Trichosurus vulpecula) feeding (Ogden and Buddenhagen, 1994; Nugent et al., 2002). Direc browsing is less important that the indirect effect of competitive release of C. dealbata and C. smithii in the Orongorongo Valley (Fig. 1), the frequency of these species increased after brushtail possum browse removed dominance of more palatable species in the canopy (Campbell, 1990). Continued presence of brushtail possums in the area would transition the forest assemblage into a tree fern-shrub community (Campbell, 1990; Richardson et al., 2014). C. colensoi and D. squarrosa are susceptible to browsing by ungulates, and where these herbivores are abundant, tree ferns may die off (Veblen and Stewart, 1980; Mark et al., 1991; Wardle, 1991)."

405	Toxic to animals	n
	Source(s)	**Notes**
	Dave's Garden. (2020). Cyathea Species, West Indian Tree Fern - Cyathea arborea. https://davesgarden.com/guides/pf/go/160611/. [Accessed 7 Apr 2020]	"Danger: N/A"

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	No evidence

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	Unknown. No evidence found

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	**Notes**
	Dave's Garden. (2020). Cyathea Species, West Indian Tree Fern - Cyathea arborea. https://davesgarden.com/guides/pf/go/160611/. [Accessed 7 Apr 2020]	"Danger: N/A"
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	**Notes**
	Tryon, R. (1976). A revision of the genus Cyathea. Contributions from the Gray Herbarium of Harvard University, 206: 19-98	"Cyathea arborea is a pioneer species, invading landslides where it frequently establishes handsome colonies. It also invades artificial barren sites, such as road cuts and road fills. Since the many cloud forest species usually grow on steep mountain slopes, they probably also grow in landslide areas." [No evidence that fire risk is increased within its native range]

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	**Notes**
	Maxon, W. R. (1912). The Tree Ferns of North America. The Smithsonian Report for 1911: 463-491. Smithsonian Institution, Washington, D.C.	"At least one species, Cyathea arborea, flourishes in open situations, commonly in very large colonies. Jenman has described it in Jamaica as "gregarious, often covering acres on fully exposed slopes, everywhere shunning shade."
	Bezona, N., Rauch, F. D., & Iwata, R. Y. 1994. Tree ferns for Hawai'i gardens. Research Extension Series 144. CTAHR,, Univiersity of Hawaii, Honolulu, HI	"This fern will tolerate full sun in cool, wet areas or filtered shade in warm, dry areas with sufficient irrigation."
	Little, Jr. E.L. & Wadsworth , F.H. (1964). Common trees of Puerto Rico and the Virgin Islands. Agriculture Handbook No. 249. USDA Forest Service, Washington, D.C	[Able to grow in the understory, suggesting shade tolerance, although also grows in open, high light areas] "'In lower and upper mountain forests of Puerto Rico growing as a small understory tree and especially common in open areas such as ravines, banks, and roadsides."

Qsn #	Question	Answer
	Tryon, R. (1976). A revision of the genus Cyathea. Contributions from the Gray Herbarium of Harvard University, 206: 19-98	[Frequently occurs in high light environments] "Cyathea arborea typically grows in montane forests, in humid ravines, along water courses and on mountain slopes, from sea level to 1200 m, usually from 500-800 m. It frequently persists in cutover land, along forest borders and in forest clearings. It is successful as a pioneer species, often becoming established in disturbed habitats such as landslides, road cuts and spills and on abandoned land."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	Source(s)	**Notes**
	Tryon, R. (1976). A revision of the genus Cyathea. Contributions from the Gray Herbarium of Harvard University, 206: 19-98	[Soil requirements unknown, but ecology suggests this species is not substrate limited] "Cyathea arborea typically grows in montane forests, in humid ravines, along water courses and on mountain slopes, from sea level to 1200 m, usually from 500-800 m. It frequently persists in cutover land, along forest borders and in forest clearings. It is successful as a pioneer species, often becoming established in disturbed habitats such as landslides, road cuts and spills and on abandoned land."

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Little, Jr. E.L. & Wadsworth , F.H. (1964). Common trees of Puerto Rico and the Virgin Islands. Agriculture Handbook No. 249. USDA Forest Service, Washington, D.C	"A very handsome small evergreen tree to 30 feet or more in height, with trunk 3-5 inches in diame-ter and stately crown of graceful leaves, ovate in general outline."

412	Forms dense thickets	y
	Source(s)	**Notes**
	Maxon, W. R. (1912). The Tree Ferns of North America. The Smithsonian Report for 1911: 463-491. Smithsonian Institution, Washington, D.C.	"At least one species, Cyathea arborea, flourishes in open situations, commonly in very large colonies. Jenman has described it in Jamaica as "gregarious, often covering acres on fully exposed slopes, everywhere shunning shade." Perhaps on the latter account, and also because of its ubiquity, it is found more commonly than any other about dwellings and plantations, its huge, lacelike fronds lending an unusual decorative charm to scenes already novel and interesting to northern eyes."
	Walker, L. R., Landau, F. H., Velazquez, E., Shiels, A. B., & Sparrow, A. D. (2010). Early successional woody plants facilitate and ferns inhibit forest development on Puerto Rican landslides. Journal of Ecology, 98(3), 625-635	[Forms dominant stands in early succession of landslides] "Although Cyathea dominated in terms of removal biomass and frequency, both the scrambling ferns and Cyathea were a minor part of the final biomass in the controls (< 1% and 7.7±2.5%, respectively); therefore, this experiment was essentially the removal of early successional woody plants." … "We removed Cyathea tree ferns from the two landslides with stands of Cyathea that were suitably large (> 1 ha), dense (> 80% cover) and tall (3–8 m) but not too steep (< 60□ slope"

501	Aquatic	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	Tryon, R. (1976). A revision of the genus Cyathea. Contributions from the Gray Herbarium of Harvard University, 206: 19-98	[Terrestrial, but grows close to riparian areas] "Cyathea arborea typically grows in montane forests, in humid ravines, along water courses and on mountain slopes, from sea level to 1200 m, usually from 500-800 m."

502	Grass	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 7 Apr 2020]	Family: Cyatheaceae

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 7 Apr 2020]	Family: Cyatheaceae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	
	Source(s)	**Notes**
	Little, Jr. E.L. & Wadsworth , F.H. (1964). Common trees of Puerto Rico and the Virgin Islands. Agriculture Handbook No. 249. USDA Forest Service, Washington, D.C	

602	Produces viable seed	y
	Source(s)	**Notes**
	Tryon, R. M., & Tryon, A. F. (1982). Ferns and Allied Plants: With Special Reference to Tropical America. Springer-Verlag, New York	"Studies on Cyathea arborea by Conant (1976) give evidence for spore production of 1,250,000,000,000 during the life of one plant. The enormous spore production ensures the establishment of new plants and is of special interest in relation to energy allocation."

603	Hybridizes naturally	y
	Source(s)	**Notes**
	Tryon, R. M., & Tryon, A. F. (1982). Ferns and Allied Plants: With Special Reference to Tropical America. Springer-Verlag, New York	"Hybrids between Cnemidaria horrida and Cyathea arborea, crosses between very distinctive species, demonstrate that genetic barriers to crossing have not evolved concomitantly with morphological divergence."

604	Self-compatible or apomictic	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Mehltreter, K., Walker, L.R. & Sharpe, J.M. 2010. Fern Ecology. Cambridge University Press, Cambridge, UK	"Coupled with gametophytic selfing, C. arborea is well adapted to colonize forest gaps and landslides in the Puerto Rican rain forest (Conant, 1976, 1978)."

606	Reproduction by vegetative fragmentation	n
	Source(s)	**Notes**
	Tryon, R. M., & Tryon, A. F. (1982). Ferns and Allied Plants: With Special Reference to Tropical America. Springer-Verlag, New York	"Reproduction of the Cyatheaceae is almost wholly dependent on reproduction by spores; vegetative reproduction is rare and not effective for dispersal."

607	Minimum generative time (years)	2
	Source(s)	**Notes**
	Walker, L. R., & Sharpe, J. M. (2010). Ferns, disturbance and succession. Pp. 177-219 In: Mehltreter K., Walker L. R., & Sharpe, J. M. (eds.). Fern Ecology. Cambridge University Press, New York	"Cyathea arborea sporophytes can produce spores when they reach about 1m in height or 2 years of age (Conant, 1976) …"
	Tryon, R. M., & Tryon, A. F. (1982). Ferns and Allied Plants: With Special Reference to Tropical America. Springer-Verlag, New York	"The stem of Cyathea arborea, a pioneer species in open sites, grows rapidly at a rate of about 30 cm a year and plants live for about 30-35 years."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	Source(s)	**Notes**
	Tryon, R. (1976). A revision of the genus Cyathea. Contributions from the Gray Herbarium of Harvard University, 206: 19-98	"Cyathea arborea is a pioneer species, invading landslides where it frequently establishes handsome colonies. It also invades artificial barren sites, such as road cuts and road fills." [Possibly. Prolific spore production, and presence in heavily trafficked areas could possibly result in accidental dispersal through attachment to clothing, or equipment]

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	Jones, D. L. 1987. Encyclopedia of Ferns. Timber Press, Portland, OR	"Plants grow easily with warmth, moisture and bright light (partial to filtered sun)." [Promoted for cultivation]
	Bezona, N., Rauch, F. D., & Iwata, R. Y. 1994. Tree ferns for Hawai'i gardens. Research Extension Series 144. CTAHR,, Univiersity of Hawaii, Honolulu, HI	"This fern will tolerate full sun in cool, wet areas or filtered shade in warm, dry areas with sufficient irrigation." [Promoted for cultivation in the Hawaiian Islands]

703	Propagules likely to disperse as a produce contaminant	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Tryon, R. M., & Tryon, A. F. (1982). Ferns and Allied Plants: With Special Reference to Tropical America. Springer-Verlag, New York	"Studies on Cyathea arborea by Conant (1976) give evidence for spore production of 1,250,000,000,000 during the life of one plant. The enormous spore production ensures the establishment of new plants and is of special interest in relation to energy allocation." [Not documented, but prolific production of wind-dispersed spores may allow for spore contamination of planting media or soil of plants grown in their vicinity]

704	Propagules adapted to wind dispersal	y
	Source(s)	**Notes**
	Gordon, D. R., Mitterdorfer, B., Pheloung, P. C., Ansari, S., Buddenhagen, C., Chimera, C., ... & Williams, P. A. 2010). Guidance for addressing the Australian Weed Risk Assessment questions. Plant Protection Quarterly, 25(2): 56-74	"Assume 'yes' for fern taxa unless contradictory evidence exists."
	Tryon, R. M., & Tryon, A. F. (1982). Ferns and Allied Plants: With Special Reference to Tropical America. Springer-Verlag, New York	"Studies on Cyathea arborea by Conant (1976) give evidence for spore production of 1,250,000,000,000 during the life of one plant. The enormous spore production ensures the establishment of new plants and is of special interest in relation to energy allocation."

705	Propagules water dispersed	y
	Source(s)	**Notes**
	Tryon, R. M., & Tryon, A. F. (1982). Ferns and Allied Plants: With Special Reference to Tropical America. Springer-Verlag, New York	"Species mostly are tall and their crowns form part of the irregular canopy of cloud or montane forest; small ones such as C. decorata and C. parva (Maxon) Tryon are understory species. A few, such as Cyathea arborea, are pioneer species in landslide areas, road cuts, and slippage sites along stream banks." [Presence along streams indicates water, in addition to wind, transports spores]

706	Propagules bird dispersed	n
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	Although spores may adhere to birds, the likely vectors of dispersal for spores are wind, and possibly water.

707	Propagules dispersed by other animals (externally)	
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	Unknown. Possible that spores may adhere to fur or mud on animals

708	Propagules survive passage through the gut	n
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	Unlikely to be consumed and not adapted for internal dispersal

801	Prolific seed production (>1000/m2)	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Tryon, R. M., & Tryon, A. F. (1982). Ferns and Allied Plants: With Special Reference to Tropical America. Springer-Verlag, New York	"Studies on Cyathea arborea by Conant (1976) give evidence for spore production of 1,250,000,000,000 during the life of one plant. The enormous spore production ensures the establishment of new plants and is of special interest in relation to energy allocation."

802	**Evidence that a persistent propagule bank is formed (>1 yr)**	
	Source(s)	**Notes**
	Overdyck, E., & Clarkson, B. D. (2012). Seed rain and soil seed banks limit native regeneration within urban forest restoration plantings in Hamilton City, New Zealand. New Zealand Journal of Ecology, 36(2): 177-190	"In total 65 exotic and 39 native species were present at greater density (>10 individuals) in the soil seed bank than in the annual seed rain input, suggesting that for these species some seeds persist in the soil from year to year (Appendix 2)." [Unknown. Cyathea dealbata listed as having persistent spores]
	Berry, K. (2019). Fern spore viability considered in relation to the duration of the Cretaceous-Paleogene (K-Pg) impact winter. A contribution to the discussion. Acta Palaeobotanica, 59(1), 19-25	[Probably not. Spores of Cyathea species lose viability quickly under natural conditions] "It is well known that Cyathea Smith spores can remain viable for more than a year in cold storage, although these spores completely lose viability by three years (Fig. 1A; Simabukuro et al. 1998a). Therefore, under natural conditions the viability of Cyathea spores in the soil bank is typically measured on the order of weeks or months rather than years (Page 1979, Mehra & Gupta 1986, Simabukuro et al. 1998a, b, 2000, Ford & Fay 1999, Goller & Rybczyński 2007, Marcon et al. 2014)."

803	**Well controlled by herbicides**	
	Source(s)	**Notes**
	CABI. (2020). Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Unknown. Methods to control Cyathea cooperi may be effective if needed] "In Hawaii, the herbicide Garlon was used for terrestrial and aerial spraying (Chau et al., 2012). However, this herbicide was found to be relatively ineffective and so The Nature Conservancy switched to using Habitat (Imazapyr) in Kauai. Preliminary analysis has shown Habitat (Imazapyr) to have a success rate of over 95% and combined with using a high-precision, helicopter borne applicator, The Nature Conservancy are currently using a fraction of the herbicide they were using with Garlon (T. Menard, The Nature Conservancy, Kauai, USA, personal communication, 2013)."

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	
	Source(s)	**Notes**
	Medeiros, A. C., Loope, L. L., Flynn, T., Anderson, S. J., Cuddihy, L. W., & Wilson, K. A. 1992. Notes on the status on an invasive Australian tree fern (Cyathea cooperi) in Hawaiian rain forests. American Fern Journal, 82(1): 27-33.	[Unknown. Cyathea cooperi can be killed mechanically if the growing tips removed] "Within Haleakala National Park, an attempt is being made to control Cyathea cooperi before it becomes established even more extensively. Larger individuals of this species are being felled and their growing tips severed, while smaller plants are removed entirely."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	

Qsn #	Question	Answer
	Source(s)	**Notes**
	WRA Specialist. (2020). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits
• Elevation range exceeds 1000 m, demonstrating environmental versatility
• Thrives in tropical climates
• A fast-growing, pioneer species, capable of rapidly colonizes landslides and cleared areas
• Other Cyathea species are invasive
• Forms dense cover within native range
• Reproduces by millions of wind-dispersed spores
• Hybridizes with other species
• Self-fertile gametophytes
• Spores dispersed by wind and water, and intentionally cultivated

Low Risk Traits
• No reports of invasiveness or naturalization, but no evidence of widespread introduction outside native range
• Unarmed (no spines, thorns, or burrs)
• Non-toxic
• Not reported to spread vegetatively
• Chemical and mechanical control of other invasive Cyathea species may be effective if needed to control C. arborea