Family: ***Equisetaceae***

Taxon: ***Equisetum ramosissimum***

Synonym: *Equisetum debile Roxb. ex Vaucher*

Common Name: branched horsetail
branched scouringrush

Questionaire : current 20090513 **Assessor:** Assessor **Designation:** H(HPWRA)
Status: Assessor Approved **Data Entry Person:** Assessor **WRA Score 14**

101	**Is the species highly domesticated?**	**y=-3, n=0**	**n**
102	**Has the species become naturalized where grown?**	**y=1, n=-1**	
103	**Does the species have weedy races?**	**y=1, n=-1**	
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)**	**Intermediate**
202	**Quality of climate match data**	**(0-low; 1-intermediate; 2-high) (See Appendix 2)**	**High**
203	**Broad climate suitability (environmental versatility)**	**y=1, n=0**	**y**
204	**Native or naturalized in regions with tropical or subtropical climates**	**y=1, n=0**	**y**
205	**Does the species have a history of repeated introductions outside its natural range?**	**y=-2, ?=-1, n=0**	**y**
301	**Naturalized beyond native range**	**y = 1*multiplier (see Appendix 2), n= question 205**	**y**
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)**	**y**
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**	**y=1, n=0**	
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**	**y**
406	**Host for recognized pests and pathogens**	**y=1, n=0**	
407	**Causes allergies or is otherwise toxic to humans**	**y=1, n=0**	
408	**Creates a fire hazard in natural ecosystems**	**y=1, n=0**	**n**
409	**Is a shade tolerant plant at some stage of its life cycle**	**y=1, n=0**	**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**	**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**	**y=1, n=-1**	**y**
604	**Self-compatible or apomictic**	**y=1, n=-1**	
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**	
701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**y=1, n=-1**	
702	**Propagules dispersed intentionally by people**	**y=1, n=-1**	**y**
703	**Propagules likely to disperse as a produce contaminant**	**y=1, n=-1**	
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**	
707	**Propagules dispersed by other animals (externally)**	**y=1, n=-1**	
708	**Propagules survive passage through the gut**	**y=1, n=-1**	
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)**	**y=-1, n=1**	

Designation: H(HPWRA) **WRA Score** **14**

Supporting Data:

101	2013. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Is the species highly domesticated? No] No evidence
102	2014. WRA Specialist. Personal Communication.	NA
103	2014. WRA Specialist. Personal Communication.	NA
201	2014. USDA ARS National Genetic Resources Program. Germplasm Resources Information Network - (GRIN). http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Species suited to tropical or subtropical climate(s) 2-High] "Native: AFRICA Northern Africa: Algeria; Egypt; Libya; Morocco; Tunisia Northeast Tropical Africa: Ethiopia; Somalia East Tropical Africa: Kenya; Tanzania; Uganda South Tropical Africa: Angola; Malawi; Mozambique; Zambia; Zimbabwe Southern Africa: Lesotho; Namibia; South Africa - Cape Province, Free State, KwaZulu-Natal, Transvaal; Swaziland Western Indian Ocean: Madagascar; Mauritius ASIA-TEMPERATE Western Asia: Cyprus; Egypt - Sinai; Israel; Jordan; Lebanon; Syria; Turkey Caucasus: Azerbaijan; Georgia; Russian Federation - Ciscaucasia, Dagestan Siberia: Russian Federation - Western Siberia Middle Asia: Kazakhstan; Kyrgyzstan; Tajikistan; Turkmenistan; Uzbekistan China: China - Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Monggol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xizang, Yunnan, Zhejiang Eastern Asia: Japan - Honshu, Kyushu, Ryukyu Islands, Shikoku; Korea; Taiwan ASIA-TROPICAL Indian Subcontinent: India; Sri Lanka Malesia: Philippines EUROPE Middle Europe: Austria; Czechoslovakia; Germany; Hungary; Netherlands; Poland; Switzerland East Europe: Estonia; Latvia; Lithuania; Russian Federation - European part; Ukraine [incl. Krym] Southeastern Europe: Albania; Bulgaria; Former Yugoslavia; Greece [incl. Crete]; Italy [incl. Sardinia, Sicily]; Romania Southwestern Europe: France [incl. Corsica]; Portugal; Spain"
202	2014. USDA ARS National Genetic Resources Program. Germplasm Resources Information Network - (GRIN). http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Quality of climate match data 2-High]
203	2013. Husby, C.. Biology and Functional Ecology of Equisetum with Emphasis on the Giant Horsetails. The Botanical Review. 79(2): 147-177.	[Broad climate suitability (environmental versatility)? Yes] "The Old World species E. ramosissimum, which ranges from 60º North latitude to 30º South latitude, has the widest latitudinal range of any Equisetum species (Schaffner, 1930)."
203	2013. Tropical Species Database. Equisetum ramosissimum. http://theferns.info/tropical/viewtropical.php?id=Equisetum%20ramosissimum [Accessed 29 Jan 2014]	[Broad climate suitability (environmental versatility)? Yes] "A plant with a very wide range, found from temperate Europe and Asia through to the tropics of Africa and Asia."
203	2013. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Broad climate suitability (environmental versatility)? Yes] "Forests; 200–1600 m. Heilon gjiang, Jilin, Nei Mongol, Shandong, Xinjiang [Japan, Mongolia, Russia; C Asia, Europe, North America (including Greenland)]." [Elevation range exceeds 1000 m]
204	2001. Roux, J.P.. Conspectus of southern African Pteridophyta. Southern African Botanical Diversity Network Report No. 13. SABONET, Pretoria	[Native or naturalized in regions with tropical or subtropical climates? Yes] "Equisetum ramosissimum subsp. Ramosissimum" … "Distribution: Angola, Botswana, Burundi, Democratic Republic of the Congo, Egypt, Kenya, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Uganda, Zambia, Zanzibar and Zimbabwe. Also in the Madagascan region, Macaronesia, southern and central Europe and Asia, except Malaysia."
204	2014. USDA ARS National Genetic Resources Program. Germplasm Resources Information Network - (GRIN). http://www.ars-grin.gov/cgi-bin/npgs/html/index.pl	[Native or naturalized in regions with tropical or subtropical climates? Yes. Native range includes tropical climates] " ASIA-TROPICAL Indian Subcontinent: India; Sri Lanka Malesia: Philippines "

205	1993. Flora of North America Editorial Committee. Flora of North America: Volume 2: Pteridophytes and Gymnosperms. Oxford University Press, Oxford, UK	[Does the species have a history of repeated introductions outside its natural range? North America] "…apparently introduced from Europe with ballast (R.L. Hauke 1979)."
205	2003. Groves, R.H./Hosking, J.R./Batianoff, G.N. et al.. Weed categories for natural and agricultural ecosystem weed management. Bureau of Rural Sciences, Canberra	[Does the species have a history of repeated introductions outside its natural range? Australia]
205	2014. Online Atlas of the British and Irish flora. Equisetum ramosissimum (Branched Horsetail). http://www.brc.ac.uk/plantatlas/index.php?q=plant/equisetum-ramosissimum [Accessed 29 jan 2014]	[Does the species have a history of repeated introductions outside its natural range? England] "E. ramosissimum was once regarded as possibly native but is now considered to have been introduced. In N. Lincolnshire it was found in 1947 on a river bank that was straightened between 1880 and 1887 and it is thought to be a ballast alien. In N. Somerset it was not correctly identified until 1986, despite having been known at the site since 1963."
301	1999. Carter, R. J., Hosking, J. R., & Conn, B. J.. Strategies to manage new weed incursions–New South Wales. Pp. 12-16 in A.C Bishop et al. (eds.). 12th Australian Weeds Conference proceedings. Tasmanian Weed Society, Hobart, Australia	[Naturalized beyond native range?] "Table 1. Possible new weed incursions investigated under the NSW New Weed Incursions Strategy." … "Equisetum ramosissimum … Reason for investigation = Local Control Authority report"
301	2003. Groves, R.H./Hosking, J.R./Batianoff, G.N. et al.. Weed categories for natural and agricultural ecosystem weed management. Bureau of Rural Sciences, Canberra	[Naturalized beyond native range? Yes] "TABLE 8. The 27 naturalised non-native species in the Australian flora that are impacting agricultural ecosystems for which a national or State containment or eradication program is being implemented or is recommended (based on information available in 2001), together with their distribution by State or Territory." [Equisetum ramosissimum - Distribution = NSW]
302	2007. Northern Territory Government. Changes to the Declared Weeds List of the Northern Territory. Weed all about it newsletter. 2: 11.	[Garden/amenity/disturbance weed? Restricted plant] "Schedule Class C (Not to be introduced to the Territory) There are a number of additional weeds added to the Class C list. These include;" … [List includes Equisetum ramosissimum and Equisetum spp."
302	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Garden/amenity/disturbance weed? No. Agricultural weed]
303	1996. Stapleton, J. J.. Fumigation and solarization practice in plasticulture systems. HortTechnology. 6(3): 189-192.	[Agricultural/forestry/horticultural weed? Yes. Controlled as a weed of agriculture] "Summary. Soil disinfestation strategies for intensive vegetable crop production, which have relied heavily on chemical fumigants for the past 40 years, are now undergoing rapid change." … "Solarization can be combined with other chemical, physical, and biological methods for enhanced management of soil and root pests and diseases." … "Table 3. Susceptibility of perennial weed species to soil solarization" [Equisetum ramosissimum included in this table]
303	2001. Roux, J.P.. Conspectus of southern African Pteridophyta. Southern African Botanical Diversity Network Report No. 13. SABONET, Pretoria	[Agricultural/forestry/horticultural weed? Possibly Yes] "often invasive in cultivated fields" … "Equisetum is of economic importance to the stock farmer as it is poisonous when consumed in large quantities, the toxic principle probably being the enzyme thiaminase that destroys vitamin B1 (Pohl 1955)."
303	2003. Groves, R.H./Hosking, J.R./Batianoff, G.N. et al.. Weed categories for natural and agricultural ecosystem weed management. Bureau of Rural Sciences, Canberra	[Agricultural/forestry/horticultural weed? Yes. Impacting agriculture? Yes] "TABLE 8. The 27 naturalised non native species in the Australian flora that are impacting agricultural ecosystems for which a national or State containment or eradication program is being implemented or is recommended (based on information available in 2001), together with their distribution by State or Territory." [Equisetum ramosissimum - Distribution = NSW]
303	2014. Victorian Resources Online. Branched scouringrush (Equisetum ramosissimum). http://vro.depi.vic.gov.au/dpi/vro/vrosite.nsf/pages/weeds_herbs_perennial_branched_scouringrush [Accessed 29 Jan 2014]	[Agricultural/forestry/horticultural weed? Yes] "Branched scouringrush (Equisetum ramosissimum)" … "Status: State Prohibited weed. Listed as a weed of national significance (WoNS)." … " It is a weed of horticultural areas (vineyards and citrus orchards), lowland high-grass meadows, flood terraces and valleys (Babaev 1974, Maillet, 1980, Litvinova 1972, Protopapadakis 1985, Zaragoza and Maillet 1980)."
304	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Environmental weed? No. Agricultural weed]
305	2006. Ainsworth, N./Gunasekera, L./Bonillo, J.. Management of horsetail species using herbicides. Pp. 279-282 in Proceedings of the 15th Australian Weeds Conference.	[Congeneric weed? Yes] "All Equisetum spp. are now declared noxious weeds in all Australian states and territories except the Northern Territory…" … "Overseas, Equisetum species are also significant weeds of pastures, crops and gardens (Parsons and Cuthbertson 2001)."

401	2013. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Produces spines, thorns or burrs? No] "Plants large or medium-sized. Rhizome erect or creeping, blackish brown, nodes and roots with sparse long yellowish brown trichomes or glabrous. Aerial stem annual, dimorphic, fertile and sterile stems appearing simultaneously. Fertile stems reddish brown, sometimes straw colored, 20–30 cm tall, 2–2.5 mm in diam. at middle, branched eventually, 10–14-ridged; ridges glabrous; internodes 3–4 cm; sheath tubes reddish brown on upper portion, straw-colored in lower portion, 1.1–1.5 cm, with 3 or 4 broad sheath teeth; sheath teeth reddish brown, ovate-deltoid, 0.5–1.1 mm, membranous, with shallow grooves abaxially. Fertile stems remaining alive after spores shed. Sterile stems grayish green, 30–70 cm, 2.5–5.5 mm in diam. At middle, well branched in whorls, unbranched below middle, main stem 10–16-ridged; ridges edged abaxially and with bristle like protuberances on sides; each ridge often with a row of tubercles; internodes 4.5–6 cm; sheath tubes reddish brown on upper portion, grayish green on lower portion, ca. 6 mm, with 3 or 4 broad sheath teeth; sheath teeth reddish brown, ovate-deltoid, ca. 0.6 cm, membranous, persistent. Lateral branches slender, complanate, 3–8 ridged; ridges with spine shaped protuberances or glabrous abaxially; sheath teeth open. Strobilus terete, 1.5–2.5 cm, 5–7 mm in diam., apex blunt; stalk prolonged when mature and 3–4.5 cm. 2n = 216."
402	2013. Husby, C.. Biology and Functional Ecology of Equisetum with Emphasis on the Giant Horsetails. The Botanical Review. 79(2): 147-177.	[Allelopathic? Possibly] "Equisetum species, like many angiosperms, appear to exhibit allelopathy. Milton and Duckett (1985) found that sporophytes of E. sylvaticum inhibit gametophyte development of that species. Furthermore, the same investigators found that water extracts from several Equisetum species reduced the germination of grass seedlings. Two of the three species studied were members of the subgenus Equisetum (E. arvense and E. palustre) and one was a member of the subgenus Hippochaete (E. variegatum). The inhibitory effects of the members of the subgenus Equisetum were greater than that of E. variegatum. This suggests that members of the subgenus Hippochaete, and hence the giant equiseta, may be less allelopathic than members of the subgenus Equisetum."
403	2013. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Parasitic? No] "Plants large or medium-sized. Rhizome erect or creeping, blackish brown, nodes and roots with sparse long yellowish brown trichomes or glabrous."
404	1971. Jungius, H.. Studies on the food and feeding behaviour of the Reedbuck Redunca Arundinum Boddaert, 1785 in the Kruger National Park. Koedoe - African Protected Area Conservation and Science. 14(1): 65-98.	[Unpalatable to grazing animals? No] "Equisetum ramosissimum sprouts after the rains and is common in most rivers until August. Was grazed twice in June and August; each time two green shoots were taken. It is possibly of importance as a source of trace elements. The outer membranes of the stems and epidermis are particularly rich in silicic acid."
405	2001. Roux, J.P.. Conspectus of southern African Pteridophyta. Southern African Botanical Diversity Network Report No. 13. SABONET, Pretoria	[Toxic to animals? Yes] "Equisetum is of economic importance to the stock farmer as it is poisonous when consumed in large quantities, the toxic principle probably being the enzyme thiaminase that destroys vitamin B1 (Pohl 1955)."
406	2014. Gardening EU. branched scouringrush Equisetum ramosissimum Desf.. http://www.gardening.eu/arc/plants/Aquatic-plants/Equisetum-ramosissimum-Desf/25573/index_m.asp [Accessed 30 Jan 2014]	[Host for recognized pests and pathogens?] "The spring weather, with a high temperature swing between the day and night hours, and pretty frequent rains, can favour the development of fungus diseases, which should be treated pre-emptively with a systemic fungicide, to use before the gems grow excessively; at the end of the winter we also suggest a wide range insecticide to prevent the attack of aphids and cochineals. We should always remember to do these treatments when there aren't flowerings in the garden."
407	2001. Roux, J.P.. Conspectus of southern African Pteridophyta. Southern African Botanical Diversity Network Report No. 13. SABONET, Pretoria	[Causes allergies or is otherwise toxic to humans? Possibly if ingested] "Equisetum is of economic importance to the stock farmer as it is poisonous when consumed in large quantities, the toxic principle probably being the enzyme thiaminase that destroys vitamin B1 (Pohl 1955)."
408	1989. Berrie, A.. The ecology and distribution of pteridophytes of Zomba Mt., Malawi. The Fern Gazette. 13(5): 291-316.	[Creates a fire hazard in natural ecosystems? No evidence] "Terrestrial with spreading, deep underground rhizomes; along streambanks of lower mountain slopes; always in moist shady positions." [Unlikely, given habitat]
408	2001. Roux, J.P.. Conspectus of southern African Pteridophyta. Southern African Botanical Diversity Network Report No. 13. SABONET, Pretoria	[Creates a fire hazard in natural ecosystems? No evidence] "In permanently moist soil along perennial streams and rivers, in riverine forests and scrub, or in the open…" [Unlikely given habitat preference]
409	1989. Berrie, A.. The ecology and distribution of pteridophytes of Zomba Mt., Malawi. The Fern Gazette. 13(5): 291-316.	[Is a shade tolerant plant at some stage of its life cycle? Yes] "Terrestrial with spreading, deep underground rhizomes; along streambanks of lower mountain slopes; always in moist shady positions."
409	2014. Bingham, M.G., Willemen, A., Wursten, B.T., Ballings, P. and Hyde, M.A.. Flora of Zambia: Species information: Equisetum ramosissimum subsp. ramosissimum. http://www.zambiaflora.com/speciesdata/species.php?species_id=100210 [Accessed 30 Jan 2014]	[Is a shade tolerant plant at some stage of its life cycle? Yes] "...in dense to open shade."

410	2014. Shoot Gardening. Equisetum ramosissimum var. japonicum (Japanese horsetail). http://www.shootgardening.co.uk/plant/equisetum-ramosissimum-var-japonicum [Accessed 29 Jan 2014]	[Tolerates a wide range of soil conditions? Yes] "Soil type: Chalky, Clay, Loamy Soil drainage: Boggy damp conditions, Moist but well-drained, Moisture-retentive Soil pH: Acid, Alkaline, Neutral"
411	2013. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Climbing or smothering growth habit? No] "Plants large or medium-sized. Rhizome erect or creeping, blackish brown, nodes and roots with sparse long yellowish brown trichomes or glabrous. Aerial stem annual, dimorphic, fertile and sterile stems appearing simultaneously."
412	2003. Roux, J.P.. Swaziland ferns and fern allies. Southern African Botanical Diversity Network Report No. 19. SABONET, Pretoria	[Forms dense thickets? No evidence. Other species in this report are described as forming thickets, but not Equisetum ramosissimum]
412	2013. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Forms dense thickets? No evidence] "Forests, forest margins, under bushes, meadows, banks of rivers and streams; sea level to 3200 m."
501	2014. Bingham, M.G., Willemen, A., Wursten, B.T., Ballings, P. and Hyde, M.A.. Flora of Zambia: Species information: Equisetum ramosissimum subsp. ramosissimum. http://www.zambiaflora.com/speciesdata/species.php?species_id=100210 [Accessed 30 Jan 2014]	[Aquatic? No] "Terrestrial in moist areas, along perennial streams, in seasonally flooded areas and among grasses, in dense to open shade."
502	2013. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Grass? No] Equisetaceae
503	2013. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Nitrogen fixing woody plant? No] Equisetaceae
504	2010. Gordon, D.R./Mitterdorfer, B./Pheloung, P.C. et al.. Guidance for addressing the Australian Weed Risk Assessment questions. Plant Protection Quarterly. 25(2): 56-74.	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "This question addresses taxa that have specialized organs and should not include plants with just rhizomes/stolons"
504	2013. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No. Rhizomatous] "Plants large or medium-sized. Rhizome erect or creeping, blackish brown, nodes and roots with sparse long yellowish brown trichomes or glabrous."
601	2013. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). Flora of China. Vol. 2-3 (Lycopodiaceae through Polypodiaceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Evidence of substantial reproductive failure in native habitat? No evidence. Widespread] "Forests; 200–1600 m. Heilongjiang, Jilin, Nei Mongol, Shandong, Xinjiang [Japan, Mongolia, Russia; C Asia, Europe, North America (including Greenland)]."
601	2014. Bingham, M.G., Willemen, A., Wursten, B.T., Ballings, P. and Hyde, M.A.. Flora of Zambia: Species information: Equisetum ramosissimum subsp. ramosissimum. http://www.zambiaflora.com/speciesdata/species.php?species_id=100210 [Accessed 30 Jan 2014]	[Evidence of substantial reproductive failure in native habitat? No] "Equisetum ramosissimum Desf. subsp. Ramosissimum" … "Widespread in Africa, Madagascan region, Macaronesia, southern and central Europe, Asia (except Malaysia), south and central America."
602	2004 onwards. Watson, L./Dallwitz, M.J.. The Equisetum species (horsetails) of the British Isles. Version: 21st June 2009. http://delta-intkey.com	[Produces viable seed? Spores] "The cones 0.6–1.2 cm long; apiculate. Spores released May to August. "
603	2013. Husby, C.. Biology and Functional Ecology of Equisetum with Emphasis on the Giant Horsetails. The Botanical Review. 79(2): 147-177.	[Hybridizes naturally Yes] "Page (1997) discussed isolated colonies of the hybrid horsetail, Equisetum x moorei, on the southeast coast of Ireland. These colonies, which are the only known populations of this hybrid in the British Isles, are on dunes and grow quite near to the high tide line, suggesting considerable exposure to saline soil water and salt spray. Interestingly, only one parent, E. hyemale, of this hybrid is present in the British Isles. However, both the other parent, E. ramossisimum, and other populations of E. x moorei are present on the European mainland."
603	2013. Jepson, P., Lubienski, M., Llewellyn, P., & Viane, R.. Hybrids within Equisetum subgenus Hippochaete in England and Wales. New Journal of Botany. 3(1): 47-58.	[Hybridizes naturally? Yes] "Hybrid horsetails in Equisetum subgenus Hippochaete are superficially similar. Distinguishing the different taxa depends on the micromorphology of the stem ridges. In the case of the hybrids E. x trachyodon (E. hyemalex E. variegatum) and E. x meridionale (E. ramosissimum x E. variegatum) both inherit silica tubercles that run vertically along the stem ridges but only E. x meridionale has silica cross-bands on the stem ridges"

604	1990. Kramer, K.U./Green, P.S.. The Families and genera of vascular plants. Volume 1. Pteridophytes and gymnosperms. Springer-Verlag, Berlin, Heidelberg, New York	[Self-compatible or apomictic? Possibly Yes] "Although their spores are homosporous, the gametophytes are unisexual in most cases … The archegonial gametophyte, if unfertilized, commonly change over to antheridial, and during a short period may be functionally bisexual and self-fertile."
605	2013. Husby, C.. Biology and Functional Ecology of Equisetum with Emphasis on the Giant Horsetails. The Botanical Review. 79(2): 147-177.	[Requires specialist pollinators? No. But spores require bare soil to germinate and gametophytes require water for fertilization] "Equisetum gametophytes appear to require a substrate of recently exposed bare mud in order to become established (Duckett & Duckett, 1980)."
606	2013. Husby, C.. Biology and Functional Ecology of Equisetum with Emphasis on the Giant Horsetails. The Botanical Review. 79(2): 147-177.	[Reproduction by vegetative fragmentation? Yes] "Fragmentation of rhizomes and stems allows Equisetum to disperse readily in suitable habitats where there is sufficient moisture. Even the aerial stem fragments can sprout and form new colonies (Praeger, 1934; Schaffner, 1931; Wagner & Hammitt, 1970)."
606	2013. Tropical Species Database. Equisetum ramosissimum. http://theferns.info/tropical/viewtropical.php?id=Equisetum%20ramosissimum [Accessed 29 Jan 2014]	[Reproduction by vegetative fragmentation? Yes] "Propagation Spores - Division of the rhizomes. Even small sections will grow away so long as they have a node."
607	2013. Husby, C.. Biology and Functional Ecology of Equisetum with Emphasis on the Giant Horsetails. The Botanical Review. 79(2): 147-177.	[Minimum generative time (years)? Probably < 1 year for gametophyte generation. Probably > 1 year for sporophyte generation] "Like pioneer species, they rapidly attain sexual maturity and are adversely affected by competition from bryophytes and vascular plants (Duckett & Duckett, 1980; Duckett, 1985)."
701	2000. Nelson, G.. The ferns of Florida: a reference and field guide. Pineapple Press Inc, Sarasota, FL	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas) Possibly Yes] "Habitat: Railroad embankments, moist, sandy or clay areas."
702	2014. Shoot Gardening. Equisetum ramosissimum var. japonicum (Japanese horsetail). http://www.shootgardening.co.uk/plant/equisetum-ramosissimum-var-japonicum [Accessed 29 Jan 2014]	[Propagules dispersed intentionally by people? Yes. Certain varieties grown as ornamentals] "Plant in fertile, boggy soil in full sun. Can be planted in baskets of aquatic compost and used as a marginal plant."
703	2013. Husby, C.. Biology and Functional Ecology of Equisetum with Emphasis on the Giant Horsetails. The Botanical Review. 79(2): 147-177.	[Propagules likely to disperse as a produce contaminant? Unknown. No evidence, but potential exists if grown commercially, although short spore viability could limit spread] "Equisetum spores are short-lived and can germinate within 24 h of release from the cone. After 5–17 days, depending on humidity, they are no longer capable of germination"
704	2013. Husby, C.. Biology and Functional Ecology of Equisetum with Emphasis on the Giant Horsetails. The Botanical Review. 79(2): 147-177.	[Propagules adapted to wind dispersal? Yes] "As in other pteridophytes, sexual dispersal in Equisetum occurs by means of spores."
705	2001. Roux, J.P.. Conspectus of southern African Pteridophyta. Southern African Botanical Diversity Network Report No. 13. SABONET, Pretoria	[Propagules water dispersed? Yes] "subsp. ramosissimum" … "In permanently moist soil along perennial streams and rivers, in riverine forests and scrub, or in the open, often invasive in cultivated fields, 100–1 700 m." [Distribution suggests spores and/or rhizome fragments likely moved by water]
705	2003. Roux, J.P.. Swaziland ferns and fern allies. Southern African Botanical Diversity Network Report No. 19. SABONET, Pretoria	[Propagules water dispersed? Yes] "Terrestrial, generally in humid sand, gravel, mud or silt on floodplains and in stream and riverbeds." [Distribution suggests spores and/or rhizome fragments likely moved by water]
706	2003. Glisson, B.T.. Conservation Assessment of Variegated Scouring Rush in the Black Hills National Forest, South Dakota and Wyoming. USDA Forest Service Rocky Mountain Region, Custer, South Dakota	[Propagules bird dispersed? Unknown for Equisetum ramosissimum. Birds described as a potential vector for other Equisetum species] "Migratory birds or insects may represent another likely, but undocumented mode of transfer of spores and/or rhizome fragments." … "The present geographic isolation of Black Hills' variegated scouring rush populations from the nearest locations in Wyoming, Colorado, and Montana would appear to prohibit any interbreeding between them, although there is the possibility of spore or vegetative propagule transfer via birds or air masses."
707	2014. WRA Specialist. Personal Communication.	[Propagules dispersed by other animals (externally)? Unknown] Spores small enough that they could potentially adhere to animals
708	1971. Jungius, H.. Studies on the food and feeding behaviour of the Reedbuck Redunca Arundinum Boddaert, 1785 in the Kruger National Park. Koedoe - African Protected Area Conservation and Science. 14(1): 65-98.	[Propagules survive passage through the gut? Unknown if viable spores or rhizome fragments survive consumption and can pass through gut of herbivores]
801	2010. Gordon, D.R./Mitterdorfer, B./Pheloung, P.C. et al.. Guidance for addressing the Australian Weed Risk Assessment questions. Plant Protection Quarterly. 25(2): 56-74.	[Prolific seed production (>1000/m2)? Yes] "Assume 'yes' for fern taxa unless contradictory evidence exists."

802	2013. Husby, C.. Biology and Functional Ecology of Equisetum with Emphasis on the Giant Horsetails. The Botanical Review. 79(2): 147-177.	[Evidence that a persistent propagule bank is formed (>1 yr)? No] "Equisetum spores are short-lived and can germinate within 24 h of release from the cone. After 5–17 days, depending on humidity, they are no longer capable of germination (Hauke, 1963), although very cold storage temperatures can extend viability to 2 years or more (Ballesteros et al., 2011)."
803	2006. Ainsworth, N./Gunasekera, L./Bonillo, J.. Management of horsetail species using herbicides. Pp. 279-282 in Proceedings of the 15th Australian Weeds Conference.	[Well controlled by herbicides? Yes. Control on weedy Equisetum spp. Would presumably be effective for Equisetum variegatum] "Eleven herbicide treatments were tested on two species of horsetail Equisetum hyemale L. (scouring rush) and Equisetum arvense L. (field or common horsetail) to provide additional information on control options, in the context of ongoing efforts to eradicate early infestations." … "Results are discussed in relation to previous trials and to recent experiences in the eradication program for Equisetum spp. In Victoria. Glyphosate wiping, amitrole and MCPA all appear to be treatments that may be useful additions to current control practice in particular circumstances."
804	2013. Husby, C.. Biology and Functional Ecology of Equisetum with Emphasis on the Giant Horsetails. The Botanical Review. 79(2): 147-177.	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "The deep rhizome system of Equisetum also allows these plants to survive fire and rapidly recolonize burned over sites (Beasleigh & Yarranton, 1974). It is probable that the vigorous and extensive rhizomatous habit of Equisetum has been very important to the long term survival and spread of the genus (Hauke, 1969b)."
805	2014. WRA Specialist. Personal Communication.	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Unknown. No Equisetaceae native or known to be naturalized in the Hawaiian Islands]

Summary of Risk Traits

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m
- Naturalized
- Am agricultural weed
- Related Equisetum species have become invasive
- Toxic to cattle and other grazing animals
- Shade tolerant
- Tolerates many soil types
- May hybridize with other Equisetum species
- Spread by spores and vegetatively by rhizomes
- Can resprout if only aboveground vegetative material is removed

Low Risk Traits

- Unarmed (no spines, thorns, or burrs)
- Short-lived spores
- Herbicides may provide effective control