Keywords: High Risk, Fern Ally, Wind-Dispersed, Water-Dispersed, Vegetative Spread

Family: ***Equisetaceae***

Taxon: ***Equisetum variegatum***

Synonym: *Equisetum hyemale subsp. variegatum A. Bra*
Equisetum variegatum subsp. variegatum
Equisetum variegatum var. variegatum
Hippochaete variegata Bruhin

Common Name: variegated horsetail
variegated scouring rush

Questionaire : current 20090513 **Assessor:** Assessor **Designation:** H(HPWRA)
Status: Assessor Approved **Data Entry Person:** Assessor **WRA Score 6.5**

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)**	**Low**
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**	**n**
205	**Does the species have a history of repeated introductions outside its natural range?**	**y=-2, ?=-1, n=0**	**?**
301	**Naturalized beyond native range**	**y = 1*multiplier (see Appendix 2), n= question 205**	**n**
302	**Garden/amenity/disturbance weed**	**n=0, y = 1*multiplier (see Appendix 2)**	
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**	**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**	
406	**Host for recognized pests and pathogens**	**y=1, n=0**	**n**
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**	

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**	**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**	**2**
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**	
805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	**y=-1, n=1**	

Designation: H(HPWRA) **WRA Score** **6.5**

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	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	[Species suited to tropical or subtropical climate(s) 0-Low] "?Jilin, Liaoning, Nei Mongol, Sichuan, Xinjiang [Japan, Mongolia, Russia; SW Asia, Europe, North America (including Greenland)]."
202	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	[Quality of climate match data 2-High]
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, under bushes, valleys, meadows, roadsides; 100–3700 m." [Elevation range exceeds 1000 m, demonstrating environmental versatility]
203	2014. Dave's Garden. PlantFiles: Variegated Horsetail, Variegated Scouring Rush - Equisetum variegatum. http://davesgarden.com/guides/pf/go/58187/ [Accessed 22 Jan 2014]	[Broad climate suitability (environmental versatility)? Yes] "Hardiness: USDA Zone 1: below -45.6 °C (-55 °F) USDA Zone 2a: to -45.5 °C (-50 °F) USDA Zone 2b: to -42.7 °C (-45 °F) USDA Zone 3a: to -39.9 °C (-40 °F) USDA Zone 3b: to -37.2 °C (-35 °F) USDA Zone 4a: to -34.4 °C (-30 °F) USDA Zone 4b: to -31.6 °C (-25 °F) USDA Zone 5a: to -28.8 °C (-20 °F) USDA Zone 5b: to -26.1 °C (-15 °F) USDA Zone 6a: to -23.3 °C (-10 °F) USDA Zone 6b: to -20.5 °C (-5 °F) USDA Zone 7a: to -17.7 °C (0 °F) USDA Zone 7b: to -14.9 °C (5 °F) USDA Zone 8a: to -12.2 °C (10 °F) USDA Zone 8b: to -9.4 °C (15 °F)"
204	2004 onwards. Watson, L./Dallwitz, M.J.. The Equisetum species (horsetails) of the British Isles. Version: 21st June 2009. http://delta-intkey.com	[Native or naturalized in regions with tropical or subtropical climates? No evidence] "Arctic and north temperate regions of Europe, Asia and North America, extending from Greenland to the Pyrenees, northern Italy, Thrace, Caucasus, Mongolia, Connecticut and Oregon. Widespread in the British Isles, on dunes, river banks, wet ground on mountains, etc., ascending to about 500 m in Kerry (var. wilsonii in Kerry only, usually in shallow water)."
204	2004. Rook, E.S.. Equisetum variegatum. Variegated Scouring Rush. http://www.rook.org/earl/bwca/nature/ferns/equisetumvar.html [Accessed 22 Jan 2014]	[Native or naturalized in regions with tropical or subtropical climates? No evidence] "Circumpolar; Aleutians across the Canadian Arctic to Newfoundland and Greenland, south to Oregon, Utah, Colorado, South Dakota, Minnesota, Illinois, Indiana, and New York. Also Europe and northern Asia, east to Kamchatka."
205	2005. Staples, G.W./Herbst, D.R.. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Does the species have a history of repeated introductions outside its natural range? Hawaii] "…grown in a miniature water garden terrarium with wet soil and bright light, or as a potted plant." [Ornamental]
205	2014. WRA Specialist. Personal Communication.	[Does the species have a history of repeated introductions outside its natural range? Unknown. Widespread native range]
301	2004 onwards. Watson, L./Dallwitz, M.J.. The Equisetum species (horsetails) of the British Isles. Version: 21st June 2009. http://delta-intkey.com	[Naturalized beyond native range? No evidence, but widespread native distribution] "Arctic and north temperate regions of Europe, Asia and North America, extending from Greenland to the Pyrenees, northern Italy, Thrace, Caucasus, Mongolia, Connecticut and Oregon."
301	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	[Naturalized beyond native range? No evidence, but widespread native distribution "?Jilin, Liaoning, Nei Mongol, Sichuan, Xinjiang [Japan, Mongolia, Russia; SW Asia, Europe, North America (including Greenland)]."

302	2006. Ainsworth, N./Gunasekera, L./Bonillo, J.. Management of horsetail species using herbicides. Pp. 279-282 in Proceedings of the 15th Australian Weeds Conference.	[Garden/amenity/disturbance weed? No evidence for Equisetum variegatum specifically, but restricted as a noxious weed in Australia along with all Equisetum spp.] "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)."
302	2014. Plants for a Future. Equisetum variegatum. http://www.pfaf.org/user/Plant.aspx?LatinName=Equisetum+variegatum [Accessed 22 Jan 2014]	[Garden/amenity/disturbance weed? Potentially garden nuisance] "Plants have a deep and penetrating root system and can be invasive. If grown in the garden they are best kept in bounds by planting them in a large container which can be sunk into the ground[200]."
303	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Agricultural/forestry/horticultural weed? No evidence]
304	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Environmental weed? No evidence]
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 small to medium-sized. Rhizome erect and creeping, blackish brown, nodes and roots with long yellowish brown trichomes. Aerial stem perennial, monomorphic, green, 10–20 cm tall, 1–1.5 mm in diam. At middle, not branched; internodes 1.5–4 cm. Aerial stem 6–8 ridged, ridge abaxially nearly rectangular or arc-shaped, middle portion with or without shallow grooves, with 1 row of tubercles on each side; sheath ca. 0.2 cm, green but distal and middle portion with a blackish brown band; sheath teeth 6–8, usually spreading, deltoid, ca. 0.1 cm, teeth of middle portion blackish brown, white at margin, membranous, abaxially 4-ridged at base, apex acute and shortly aristate, persistent."
402	1994. Burrill, L.C./Parker, R.. Field Horsetail and Related Species Equisetaceae. PNW 105. Pacific Northwest Cooperative Extension, http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20760/pnw105.pdf?sequence=3	[Allelopathic? Unknown. E. arvense shows allelopathic properties] "Field horsetail may inhibit surrounding vegetation (allelopathy) because of its alkaloid content. Researchers in Russia studied the effects of water extracts taken from field horsetail on seed germination and early growth of meadow grasses. Of 13 species tested, field horsetail displayed the strongest inhibitory effect on seed germination and seedling vigor after it had been applied to 30 species of grasses."
402	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	[Allelopathic? Possibly] "Sporophytes are believed to be allelopathic, which may explain an apparent low incidence of gametophytes in existing sporophyte stands (Hauke 1963)."
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 small to medium-sized. Rhizome erect and creeping, blackish brown, nodes and roots with long yellowish brown trichomes." [Equisetaceae]
404	1981. Thomas, D.C./Kroeger, P.. Digestibility of Plants in Ruminai Fluids of Barren-Ground Caribou. Arctic. 34(4): 321-324..	[Unpalatable to grazing animals? Possibly palatable to caribou] "Comparisons based on the means of the 60 h and 63 h trials indicated that the green parts of Carex rostrata had the highest IVDMD value (65%), followed by dry stems of Equisetum variegatum (64% and 52%),…"
404	1993. Brackney, A.W./Hupp, J.W.. Autumn Diet of Lesser Snow Geese Staging in Northeastern Alaska. The Journal of Wildlife Management. 57(1): 55-61.	[Unpalatable to grazing animals? No] "The coastal plain of the Arctic National Wildlife Refuge (ANWR) is used by lesser snow geese (Chen caerulescens caerulescens) in autumn for premigratory staging. To better understand the potential impacts of human disturbance on lesser snow geese, we investigated species composition of, and temporal and age-related variation in, their diet during staging. Depending on age and time of collection, between 35.2 and 94.1% of the diet (aggregate percent wet mass, n = 75) consisted of 2 species of plants; underground stems of tall cotton-grass (Eriophorum angustifolium), and aerial shoots of northern scouring-rush (Equisetum variegatum)."
404	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	[Unpalatable to grazing animals? No] "Animal herbivores, including barren-ground caribou in the Northwest Territories of Canada (but not known from the Black Hills), may utilize variegated scouring rush (Thomas and Kroeger 1981)."

405	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	[Toxic to animals? Possibly Yes] "Many species of Equisetum are reportedly toxic to cattle (Walters and Keil 1996)."
405	2014. Plants for a Future. Equisetum variegatum. http://www.pfaf.org/user/Plant.aspx?LatinName=Equisetum+variegatum [Accessed 22 Jan 2014]	[Toxic to animals? Possibly Yes] "Large quantities of the plant can be toxic. This is because it contains the enzyme thiaminase[172], a substance that can rob the body of the vitamin B complex[65]. In small quantities this enzyme will do no harm to people eating an adequate diet that is rich in vitamin B, though large quantities can cause severe health problems. The enzyme is destroyed by heat or thorough drying, so cooking the plant will remove the thiaminase[172]. The plant also contains equisetic acid - see the notes on medicinal uses for more information[213]."
406	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	[Host for recognized pests and pathogens? No] "No diseases or parasites are known based on available literature."
407	2014. Plants for a Future. Equisetum variegatum. http://www.pfaf.org/user/Plant.aspx?LatinName=Equisetum+variegatum [Accessed 22 Jan 2014]	[Causes allergies or is otherwise toxic to humans? Potentially] "Large quantities of the plant can be toxic. This is because it contains the enzyme thiaminase[172], a substance that can rob the body of the vitamin B complex[65]. In small quantities this enzyme will do no harm to people eating an adequate diet that is rich in vitamin B, though large quantities can cause severe health problems. The enzyme is destroyed by heat or thorough drying, so cooking the plant will remove the thiaminase[172]. The plant also contains equisetic acid - see the notes on medicinal uses for more information[213]."
408	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	[Creates a fire hazard in natural ecosystems? No evidence. Unlikely given habitat preferences] "Variegated scouring rush's apparent affinity for cold, moist, sheltered sites possibly in association with limestone may be a major limiting factor…"
409	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	[Is a shade tolerant plant at some stage of its life cycle? Possibly Yes] "Variegated scouring rush remained a common understory component of late seral riparian forest communities (paper birch (Betula papyrifera) and white spruce (Picea glauca). This was apparently due to re-colonization of raw substrate exposed by periodic flooding events after later seral understory species were removed by scouring (Helms and Collins 1997). This suggests variegated scouring rush is shade tolerant, but a poor competitor, at least with certain other understory species. It also suggests that on-going recruitment of variegated scouring rush is dependent on physical disturbance."
409	2004. Rook, E.S.. Equisetum variegatum. Variegated Scouring Rush. http://www.rook.org/earl/bwca/nature/ferns/equisetumvar.html [Accessed 22 Jan 2014]	[Is a shade tolerant plant at some stage of its life cycle?] "Sun to part shade"
409	2014. Plants for a Future. Equisetum variegatum. http://www.pfaf.org/user/Plant.aspx?LatinName=Equisetum+variegatum [Accessed 22 Jan 2014]	[Is a shade tolerant plant at some stage of its life cycle? Possibly] " It can grow in semi-shade (light woodland) or no shade."
410	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	[Tolerates a wide range of soil conditions? Yes] "In Colorado, habitat preferences are listed as sandy soils ranging from neutral to slightly alkaline, in wet meadows, bogs, alluvial thickets, and sandy soil of riverbanks, ditches and lakes, at elevations from 9450 to 11200 feet, in (CNHP 2001)."
410	2014. Plants for a Future. Equisetum variegatum. http://www.pfaf.org/user/Plant.aspx?LatinName=Equisetum+variegatum [Accessed 22 Jan 2014]	[Tolerates a wide range of soil conditions ? Yes] "Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in nutritionally poor soil. Suitable pH: acid, neutral and basic (alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil."
411	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	[Climbing or smothering growth habit? No] "Variegated scouring rush is a rhizomatous, perennial, facultative wetland, herbaceous species associated with wetlands, streambanks, and lakeshores across its range (Hitchcock et al. 1969; Cronquist et al. 1986; USDI FWS 1988)."
412	1920. Standley, P.C.. Ferns of Glacier National Park, Montana. American Fern Journal. 10(4): 97-110.	[Forms dense thickets? Yes. Within native range] "Equisetum variegatum Schleich. Common, especially at middle altitudes and above timber line; about pools, on lake shores, along streams, and in wet meadows or thickets, often in sand or gravel. It is especially abundant in the meadows above or near timber line, and frequently forms dense, almost pure stands of decumbent or ascending stems."

501	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	[Aquatic? No, although may occur along aquatic habitats] "Variegated scouring rush is a facultative wetland species (USDA NRCS 2001) that occurs predominantly in boreal regions, where it occupies meadows, swamps, lakeshores, seeps, and stream banks at low to high elevations (Hitchcock et al. 1969; Welsh 1973; Great Plains Flora Association 1986; Rydberg 1965; Cronquist et al. 1986)."
501	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	[Aquatic? No] "Forests, under bushes, valleys, meadows, roadsides"
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 small to medium-sized. Rhizome erect and creeping, blackish brown, nodes and roots with long yellowish brown trichomes."
601	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	[Evidence of substantial reproductive failure in native habitat? No] "Variegated scouring rush is known from Alaska, south and east through the boreal forest and northern prairies of Canada and northern United States (Welsh 1973). The species is secure throughout its range with a G5 ranking, but infrequent across much of the U.S. with Region 2 state numerical rankings ranging from S1, critically imperiled; to S2S3, imperiled to vulnerable (NatureServe 2001)."
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, under bushes, valleys, meadows, roadsides; 100–3700 m. ?Jilin, Liaoning, Nei Mongol, Sichuan, Xinjiang [Japan, Mongolia, Russia; SW Asia, Europe, North America (including Greenland)]."
602	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	[Produces viable seed? Yes. Spores] "Variegated scouring rush may be propagated from rhizomes or spores, although the latter approach requires a narrower range of available conditions (Duckett and Duckett 1980)."
602	2014. Plants for a Future. Equisetum variegatum. http://www.pfaf.org/user/Plant.aspx?LatinName=Equisetum+variegatum [Accessed 22 Jan 2014]	[Produces viable seed? Yes. Spores] "Spores - best collected as soon as they are ripe in the spring and surface-sown immediately on a sterile compost. Keep moist and pot up as soon as the plants are large enough to handle. Very difficult[200]."
603	1981. Montgomery, J.D.. Equisetum variegatum and E. ×trachyodon in New Jersey. American Fern Journal. 71(1): 1-2.	[Hybridizes naturally? Yes] "A hybrid involving E. variegatum has been known from New Jersey since at least 1950: E. x trachyodon is the hybrid between E. variegatum and E. hyemale L. As far as is known from herbarium records, this hybrid was first collected by J. L. Edwards along the Delaware River, near Flatbrookville, Sussex Co., 28 October 1950 (CHRB, NY)."
603	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	[Hybridizes naturally? Yes] "Hybridization is common in some Equisetum species, and variegated scouring rush reportedly may form hybrids with two widespread species that also occur in Black Hills NF, E. laevigatum and E. hyemale (Marriott 1985). Neither of the resulting hybrids, E. x nelsonii (A. A. Eat.) or E. x trachyodon A., are known from South Dakota. Variegated scouring rush reportedly does not hybridize with E. scirpoides, even where the two species are sympatric (Hauke 1963). Equisetum hybrids are always infertile as a result of abortive spores (Hauke 1963)."
604	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	[Self-compatible or apomictic? Possibly] "According to Duckett and Duckett (1980), “the most critical factor for sexual reproduction in Equisetum appears to be the initial establishment of spores”. The high degree of heterogeneity indicates a high degree of out crossing during reproduction. In general, spores may be expected to be more effectively dispersed over wider ranges than fertilized archegonia (Duckett and Duckett 1980)."
605	2014. WRA Specialist. Personal Communication.	[Requires specialist pollinators? No, but requires water for fertilization]

606	2004. Rook, E.S.. Equisetum variegatum. Variegated Scouring Rush. http://www.rook.org/earl/bwca/nature/ferns/equisetumvar.html [Accessed 22 Jan 2014]	[Reproduction by vegetative fragmentation? Yes] "Reproduces by spores and vegetatively by rhizomes Primarily reproduces by vegetative means; the majority of shoots arising from rhizomes".
606	2014. Plants for a Future. Equisetum variegatum. http://www.pfaf.org/user/Plant.aspx?LatinName=Equisetum+variegatum [Accessed 22 Jan 2014]	[Reproduction by vegetative fragmentation? Yes] "Division. The plants usually spread very freely when well sited and should not really need any assistance."
607	2004. Rook, E.S.. Equisetum variegatum. Variegated Scouring Rush. http://www.rook.org/earl/bwca/nature/ferns/equisetumvar.html [Accessed 22 Jan 2014]	[Minimum generative time (years)? Potentially able to reproduce vegetatively within 1-2 years] "Reproduces by spores and vegetatively by rhizomes Primarily reproduces by vegetative means; the majority of shoots arising from rhizomes".
701	2013. NSW Department of Primary Industries. Weed Alert: Horsetails. http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles/horsetails [Accessed 07 Jan 2014]	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? Potentially Yes, but no evidence with E. variegatum to date] "New infestations can result when garden waste containing rhizomes is dumped or when plants are sold illegally for ornamental or medicinal purposes."
702	2005. Staples, G.W./Herbst, D.R.. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Propagules dispersed intentionally by people? Yes] "…grown in a miniature water garden terrarium with wet soil and bright light, or as a potted plant." [Ornamental]
703	2006. Large, M.F./Blanchon, D.J./Angus, M.L.. Devitalisation of imported horsetail (Equisetum hyemale). New Zealand Journal of Crop and Horticultural Science. 34(2): 151-153.	[Propagules likely to disperse as a produce contaminant? Unknown. No evidence, but potential exists if grown commercially] "The arrival of E. arvense in New Zealand, along with a second species E. hyemale L, has variously been attributed to spores or rhizome portions being attached to other plants, and to importation of material for garden cultivation."
704	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 adapted to wind dispersal? Yes. Spores] "The Black Hills populations of variegated scouring rush are over a hundred miles away from the nearest populations, which are in central Wyoming. Once airborne, variegated scouring rush spores may be expected to travel considerable distances, and natural transfer of spores from other variegated scouring rush populations is possible."
705	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 water dispersed? Probably Yes] "Water transport of spores and/or rhizome fragments is conceivable, although not documented, on a localized basis, but not likely as a means of long range transport, especially in the absence of direct transfer routes."
705	2004. Rook, E.S.. Equisetum variegatum. Variegated Scouring Rush. http://www.rook.org/earl/bwca/nature/ferns/equisetumvar.html [Accessed 22 Jan 2014]	[Propagules water dispersed? Yes] "Lakeshores, riverbanks, ditches, wet meadows, wet woods, marshes, calcareous sands, marly bogs, and tundra." [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] "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	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 dispersed by other animals (externally)? Unknown, but may be possible] "Direct physical disturbance and transport of noxious weed propagules by livestock may pose an additional risk to variegated scouring rush habitat, but may also serve to provide establishment sites through elimination of existing vegetation and possibly breaking of viable rhizome fragments that may be transported elsewhere, although this is not known."
708	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 survive passage through the gut? Unknown if viable spores or rhizome fragments survive consumption and cab pass through gut of herbivores] "Animal herbivores, including barren-ground caribou in the Northwest Territories of Canada (but not known from the Black Hills), may utilize variegated scouring rush (Thomas and Kroeger 1981)."
801	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	[Prolific seed production (>1000/m2)? Presumably Yes] "Variegated scouring rush may be propagated from rhizomes or spores…"
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	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	[Evidence that a persistent propagule bank is formed (>1 yr)? No] "Sporophytes produce numerous short lived spores, with two sets of thread like hygroscopic attachments, termed elators, believed to aid in dispersal (Hauke 1963). Spores may germinate within 24 hours if suitable conditions are available, but remain viable for 5 to 17 days, depending on humidity."
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	2004. Rook, E.S.. Equisetum variegatum. Variegated Scouring Rush. http://www.rook.org/earl/bwca/nature/ferns/equisetumvar.html [Accessed 22 Jan 2014]	[Tolerates, or benefits from, mutilation, cultivation, or fire? Possibly Yes] "Reproduces by spores and vegetatively by rhizomes Primarily reproduces by vegetative means; the majority of shoots arising from rhizomes". {May resprout from rhizomes if above ground vegetation is removed]
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
- Weedy and difficult to remove
- A potential garden weed
- Related Equisetum species have become invasive
- Possibly toxic to cattle and other grazing animals
- Tolerates many soil types
- Forms monocultures within native range
- 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

- Thrives in temperate climates, so may only threaten higher elevation ecosystems in the tropics
- Unarmed (no spines, thorns, or burrs)
- Short-lived spores
- Herbicides may provide effective control