

Taxon: *Festuca rubra* L. ssp. *arenaria* (Osbeck) F. Aresch.

Family: Poaceae

Common Name(s): creeping fescue
red fescue

Synonym(s):

Assessor: Chuck Chimera

Status: Assessor Approved

End Date: 7 Feb 2019

WRA Score: 19.0

Designation: H(HPWRA)

Rating: High Risk

Keywords: Perennial Grass, Naturalized, Palatable, Allergenic, Self-Incompatible

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)	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		
303	Agricultural/forestry/horticultural weed		
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
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	y
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals		
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	y
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
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	y
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	n
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	y
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	y
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)	y=1, n=-1	y
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	USDA NRCS Plant Materials Program. (2006). Plant Fact Sheet - <i>Festuca rubra</i> L. ssp. <i>arenaria</i> (Osbeck) F. Aesch. http://Plant-Materials.nrcs.usda.gov . [Accessed 4 Feb 2019]	"Cultivars, Improved, and Selected Materials (and area of origin) There are no particular cultivars recommended for conservation use. Creeping red fescue can be purchased at most commercial seed sources."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2019). 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"	Intermediate
	Source(s)	Notes

Qsn #	Question	Answer
	<p>USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 4 Feb 2019]</p>	<p>"Native</p> <p>Africa NORTHERN AFRICA: Algeria</p> <p>Asia-Temperate WESTERN ASIA: Cyprus, Iran CAUCASUS: Armenia, Azerbaijan, Russian Federation, [Dagestan] Russian Federation-Ciscaucasia [Ciscaucasia] SIBERIA: Russian Federation-Eastern Siberia, [Eastern Siberia] Russian Federation-Western Siberia [Western Siberia] MIDDLE ASIA: Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan MONGOLIA: Mongolia RUSSIAN FAR EAST: Russian Federation-Far East [Far East] CHINA: China EASTERN ASIA: Japan, Korea</p> <p>Asia-Tropical INDIAN SUBCONTINENT: Pakistan</p> <p>Europe NORTHERN EUROPE: Denmark, Faroe Islands, Finland, Iceland, Ireland, Norway, Svalbard and Jan Mayen, Sweden, United Kingdom MIDDLE EUROPE: Austria, Belgium, Czech Republic, Germany, Hungary, Netherlands, Poland, Slovakia, Switzerland EASTERN EUROPE: Belarus, Estonia, Latvia, Lithuania, Moldova, Russian Federation, [Saratov, Volgograd] Russian Federation-European part, [European part] Ukraine SOUTHEASTERN EUROPE: Albania, Bulgaria, Croatia, Greece, Italy (incl. Sardinia, Sicily), Montenegro, Romania, Serbia, Slovenia SOUTHWESTERN EUROPE: France (incl. Corsica), Portugal, Spain</p> <p>Northern America SUBARCTIC AMERICA: Canada, [Northwest Territory, Yukon Territory] Greenland EASTERN CANADA: Canada [New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, Quebec] WESTERN CANADA: Canada [Alberta, British Columbia, Manitoba, Saskatchewan] NORTHEASTERN U.S.A.: United States [Connecticut, Indiana, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Vermont] NORTH-CENTRAL U.S.A.: United States [Illinois, Iowa, Minnesota, Nebraska, Wisconsin] NORTHWESTERN U.S.A.: United States [Colorado, Idaho, Montana, Oregon, Washington, Wyoming] SOUTHEASTERN U.S.A.: United States [Delaware, Georgia (n.), Maryland, North Carolina, South Carolina, Tennessee (http://tenn.bio.utk.edu/vascular/database/vascular-database.asp?CategoryID=Monocots&FamilyID=Poaceae&GenusID=Festuca&SpeciesID=rubra), Virginia] SOUTHWESTERN U.S.A.: United States [Arizona, California, Nevada, Utah]"</p>

202	Quality of climate match data	High
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Qsn #	Question	Answer
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 4 Feb 2019]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	USDA NRCS Plant Materials Program. (2006). Plant Fact Sheet - <i>Festuca rubra</i> L. ssp. <i>arenaria</i> (Osbeck) F. Aresch. http://Plant-Materials.nrcs.usda.gov . [Accessed 5 Feb 2019]	"Creeping red fescue is climatically adapted to all of the major land resource regions that receive adequate moisture and have well-drained soils."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i sparingly naturalized in pastures and shrubland communities, 820-2,140 m" [Elevation range exceeds 1000 m, demonstrating environmental versatility]
	St. John, L., D. Tilley, P. Hunt, and S. Wright. 2012. Plant Guide for Red Fescue (<i>Festuca rubra</i>). USDA-Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho	"Red fescue inhabits a wide range of ecological sites and soils from sands and gravels and pebble beaches along sea coasts to moist meadows and disturbed soils from sea level to 11,000 ft (3350 m) elevation."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i sparingly naturalized in pastures and shrubland communities, 820-2,140 m, on Maui and Hawai'i."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	St. John, L., D. Tilley, P. Hunt, and S. Wright. 2012. Plant Guide for Red Fescue (<i>Festuca rubra</i>). USDA-Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho	"Red fescue is a morphologically diverse complex of sub species that is widely distributed in the arctic and temperate zones of Asia, Europe, and North America (Barkworth et al., 2007). Eurasian plants have been introduced to other parts of the world and hundreds of cultivars have been developed and widely distributed. It is native throughout the United States with the exception of the states of Arkansas, Florida, Kansas, Louisiana, Mississippi, and South Dakota and is native to all the provinces and territories in Canada (PLANTS Database). It is also found in Mexico, Europe, Asia, Africa, and New Zealand (Walsh, 1995)."

301	Naturalized beyond native range	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to Eurasia and North Africa, widely used as a pasture and turf grass; in Hawai'i sparingly naturalized in pastures and shrubland communities, 820-2,140 m, on Maui and Hawai'i. First collected on Hawai'i in 1929 (Lyman s.n., BISH)."

Qsn #	Question	Answer
	Starr, F. & Starr, K. 2011. New plant records from midway Atoll, Maui and Kaho'olawe. Bishop Museum Occasional Papers. 110: 23-35	"The following specimens were collected at an elevation of 10,000 ft [3050 m] at the Haleakalā observatories facility on Pu'u Kolekole, on the summit of East Maui. these new high elevation records extend the known altitudinal range of these species in Hawai'i. Previous high elevations are from Wagner et al., 1999." ... "Festuca rubra vel. aff. l. ... Prev. High Elev. = 7020 ft [2140 m]"

302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Csurhes, S. & Edwards, R. 1998. Potential environmental weeds in Australia: Candidate species for preventative control. Biodiversity Group, Environment Australia, Canberra, Australia	"In Victoria, it is widespread (medium to large populations) and is a threat to dry coastal vegetation, dry sclerophyll forest and woodland (Carr et al. 1992)." [Environmental weed]
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Cereals, Orchards & Plantations, Pome Fruits, Vegetables" [Unspecified impacts. Answered conservatively as a general weed]
	St. John, L., D. Tilley, P. Hunt, and S. Wright. 2012. Plant Guide for Red Fescue (<i>Festuca rubra</i>). USDA-Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho	[A disturbance adapted grass with potentially negative environmental impacts] "Red fescue can out-compete some native species on disturbed sites in temperate and arctic plant communities and may colonize disturbed areas naturally by spreading rhizomes. It does not generally develop a persistent seed bank in the soil. Root leachates from red fescue have been shown to inhibit shrub growth (Walsh, 1995). This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed."

303	Agricultural/forestry/horticultural weed	
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Cereals, Orchards & Plantations, Pome Fruits, Vegetables"
	WRA Specialist. (2019). Personal Communication	Identified as a weed of crops. A review of the cited literature suggests that the grass occurs with crops, but economic or other detrimental impacts are generally unspecified

304	Environmental weed	y
	Source(s)	Notes
	Howell, C. (2008). Consolidated list of environmental weeds in New Zealand. DOC Research & Development Series 292. Science & Technical Publishing Department of Conservation, Wellington, New Zealand	"Appendix 4 - Species recorded as Environmental weeds for the first time" ... "Festuca rubra ... Common pasture plant, displaces native tussock species. Controlled in Nelson Lakes Area. Also present on Subantarctic Islands (Campbell Island/Motu Ihupuku, Auckland Islands, Antipodes Islands)."
	Csurhes, S. & Edwards, R. 1998. Potential environmental weeds in Australia: Candidate species for preventative control. Biodiversity Group, Environment Australia, Canberra, Australia	"In Victoria, it is widespread (medium to large populations) and is a threat to dry coastal vegetation, dry sclerophyll forest and woodland (Carr et al. 1992)."

305	Congeneric weed	y

Qsn #	Question	Answer
	Source(s)	Notes
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CAB International, Wallingford, UK	"Festuca arundinacea ... Where invasive, tall fescue is a strong competitor to native species and forms dense stands displacing native vegetation." ... "Some studies have shown that the grass releases allelo-chemicals, preventing germination or retarding growth or a number of native species including shrubs and trees (Anderson et al, 1989; Batcher, 2014a)."

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	USDA NRCS Plant Materials Program. (2006). Plant Fact Sheet - <i>Festuca rubra</i> L. ssp. <i>arenaria</i> (Osbeck) F. Aresch. http://Plant-Materials.nrcs.usda.gov . [Accessed 26 Jan 2019]	[No evidence] " <i>Festuca rubra</i> ssp. <i>arenaria</i> , creeping red fescue, is a perennial with short rootstalks and few to many stems that are usually reddish at the base and 6 to 36 inches high, with smooth leaves and sheaths. The leaves are enfolding and narrow, more or less hairy, and shorter than the stems. Its seedhead is a dark green, reddish, or waxy cluster, 2 to 5 inches long, that has erect or ascending branches and is initially open but becomes contracted. Flower spikelets are 3, 8, or 10-flowered; the seed covering is indistinctly nerved, with a bristle half or less as long."

402	Allelopathic	y
	Source(s)	Notes
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 4 Feb 2019]	"Red fescue root leachates have been shown to inhibit root and shoot growth of shrubs [15]."
	Bostan, C., Butnariu, M., Butu, M., Ortan, A., Butu, A., Rodino, S., & Parvu, C. (2013). Allelopathic effect of <i>Festuca rubra</i> on perennial grasses. <i>Romanian Biotechnological Letters</i> , 18(2), 8190-8196	[Potentially Yes] "The allelopathy research can contribute to protecting the biodiversity and may develop new strategies for sustainable ecosystems controlled by allelochemicals. The present investigations have estimated the allelopathic features at <i>Festuca rubra</i> and the ability of the allelopathic compounds to affect the germination and the quality of perennial grasses (<i>Dactylis glomerata</i> , <i>Lolium perenne</i> and <i>Poa pratensis</i>). These perennial grasses were treated with alcoholic extracts obtained from dry aerial parts of <i>Festuca Rubra</i> . Were quantified and also physico-chemical characterized the polyphenolic compounds and the alkaloids from the chemical structure of plants. The extracted compounds from the dry aerial parts of <i>F. Rubra</i> were quantified using HPLC method. In the aqueous extracts were quantified the following alkaloids: N-formyl-loline (NFL), N-acetyl-loline (NAL) and ergovaline (EGV). The results of the research have showed that the effect of the alkaloids lead to modifications in the quality index by reducing of the crude protein content and thus lead to lower feed value of these plants."

403	Parasitic	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennials, occasionally producing short, delicate rhizomes" [Poaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	St. John, L., D. Tilley, P. Hunt, and S. Wright. 2012. Plant Guide for Red Fescue (<i>Festuca rubra</i>). USDA-Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho	"Crop: Red fescue is used for pasture but is not a recommended species for forage production. Palatability and nutritional value for livestock is rated as fair (Walsh, 1995). Some varieties contain endophytes that in high levels may be harmful to livestock (Yoder, 2000)."
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 26 Jan 2019]	"Red fescue is a valuable forage grass [74]." ... "In Alberta red fescue palatability is rated fair for livestock [71]. In Utah it is rated good for cattle and horses and fair for sheep [17]. Sheep on alpine range ate a diet composed of a large number of species. Red fescue and sheep fescue (<i>Festuca ovina</i>) were the preferred grass species, constituting 13 percent of diets [75]. In the Intermountain region red fescue is only moderately palatable during the summer, but because it maintains green leaves after frost it is a preferred grass in the fall [61]."
	USDA NRCS Plant Materials Program. (2006). Plant Fact Sheet - <i>Festuca rubra</i> L. ssp. <i>arenaria</i> (Osbeck) F. Aesch. http://Plant-Materials.nrcs.usda.gov . [Accessed 26 Jan 2019]	[Palatability decreases with age] "Livestock: In general, creeping red fescue has not been very important as forage, due to low palatability and productivity. While it withstands close grazing, it tends to become unpalatable if allowed to grow."

405	Toxic to animals	
	Source(s)	Notes
	St. John, L., D. Tilley, P. Hunt, and S. Wright. 2012. Plant Guide for Red Fescue (<i>Festuca rubra</i>). USDA-Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho	[Could be indirectly harmful to livestock] "Palatability and nutritional value for livestock is rated as fair (Walsh, 1995). Some varieties contain endophytes that in high levels may be harmful to livestock (Yoder, 2000)."

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	USDA NRCS Plant Materials Program. (2006). Plant Fact Sheet - <i>Festuca rubra</i> L. ssp. <i>arenaria</i> (Osbeck) F. Aesch. http://Plant-Materials.nrcs.usda.gov . [Accessed 4 Feb 2019]	"Pests and Potential Problems - There are no serious pests of creeping red fescue."
	St. John, L., D. Tilley, P. Hunt, and S. Wright. 2012. Plant Guide for Red Fescue (<i>Festuca rubra</i>). USDA-Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho	"Red fescue is most susceptible to billbugs (<i>Sphenophorus</i> spp.), white grubs (<i>Cyclocephala</i> spp.), and plant diseases including dollar spot (<i>Sclerotinia homeocarpa</i> , <i>Lanzia</i> spp., <i>Moellerodiscus</i> spp.), pythium blight (<i>Pythium</i> spp.), and red thread (<i>Laetisaria fuciformis</i>) (UC IPM Online). Many turf type cultivars have high endophyte levels that resist many of the common insect problems (Cook, 2011)."

407	Causes allergies or is otherwise toxic to humans	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Pollen Library. (2019). Red Fescue (<i>Festuca rubra</i>). http://www.pollenlibrary.com/Specie/Festuca+rubra/ . [Accessed 6 Feb 2019]	"Allergenicity: Red Fescue (<i>Festuca rubra</i>) is a severe allergen."
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 4 Feb 2019]	"Red fescue can cause hayfever [17]."

408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 6 Feb 2019]	[Not specifically identified as a fire hazard, although could contribute to fuel load in fire prone areas or after prolonged drought] "Red fescue seed-producing fields can be burned after harvest to kill weed seeds, discourage diseases and harmful insects, and prevent red fescue stands from becoming too thick [34]. For successful burning, soil and sod should be dry and the plants in semidormancy. Weather should be hot and dry, with enough wind to produce a quick, thorough fire. Flammable material should be well distributed to prevent hot spot fires. Burning should be done each year; old, thick sods burn slowly and with too much heat for plant survival [34,88]."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	USDA NRCS Plant Materials Program. (2006). Plant Fact Sheet - <i>Festuca rubra</i> L. ssp. <i>arenaria</i> (Osbeck) F. Aresch. http://Plant-Materials.nrcs.usda.gov . [Accessed 26 Jan 2019]	"It is particularly important in shaded locations and on sandy soils." ... "It thrives in sun or shade."
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 4 Feb 2019]	"Red fescue is not shade tolerant. It is a component of mountaintop vegetation in the Oregon Coast Ranges. Red fescue occurs in meadow stands, and its cover does not decline along the meadow edge of the tree border. However, its cover drops to zero within the 16 foot (5 m) wide ecocline of invading trees."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 4 Feb 2019]	"It can grow on clay, loam, and sandy soils provided moisture is adequate. It is also able to withstand some drought. It tolerates low fertility soils fairly well [71]. "

Qsn #	Question	Answer
	St. John, L., D. Tilley, P. Hunt, and S. Wright. 2012. Plant Guide for Red Fescue (<i>Festuca rubra</i>). USDA-Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho	"Red fescue is adapted to a wide range of soil textures, is somewhat tolerant of salinity, and requires at least 16 inches of annual precipitation or supplemental irrigation. It tolerates soils low in fertility, is somewhat shade tolerant, and may be susceptible to snow mold in areas that have extended snow cover (Ogle et al., 2011). It is tolerant of acid to slightly alkaline (pH 4.5-7.5) soils and can tolerate spring flooding and some poorly drained sites. It is somewhat tolerant of salt spray."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennials, occasionally producing short, delicate rhizomes"

412	Forms dense thickets	y
	Source(s)	Notes
	Csurhes, S. & Edwards, R. 1998. Potential environmental weeds in Australia: Candidate species for preventative control. Biodiversity Group, Environment Australia, Canberra, Australia	" <i>Festuca rubra</i> is a rhizomatous tufted perennial grass (Harden 1993). The long rhizomes form a loose, dense sward."
	St. John, L., D. Tilley, P. Hunt, and S. Wright. 2012. Plant Guide for Red Fescue (<i>Festuca rubra</i>). USDA-Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho	"Red fescue is an excellent soil stabilizer and is used extensively for stabilizing waterways, slopes, banks, cuts, and fills. Due to its sod-forming nature, invasion of undesirable shrub species is reduced, but species diversity can also be limited (Wright and Czaplá, 2011)."
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 4 Feb 2019]	"Red fescue is long lived in northern latitudes and at high elevations. It can form dense cover [83]."
	WRA Specialist. (2019). Personal Communication	Dense cover can exclude other vegetation and reduce diversity

501	Aquatic	n
	Source(s)	Notes
	USDA NRCS Plant Materials Program. (2006). Plant Fact Sheet - <i>Festuca rubra</i> L. ssp. <i>arenaria</i> (Osbeck) F. Aresch. http://Plant-Materials.nrcs.usda.gov . [Accessed]	[Terrestrial grass] "It can be grown as a dryland cover crop in coastal regions or other areas with average annual precipitation greater than 18 inches."

502	Grass	y
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 26 Jan 2019]	Family: Poaceae (alt.Gramineae) Subfamily: Pooideae Tribe: Poeae Subtribe: Loliinae

Qsn #	Question	Answer
503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 26 Jan 2019]	Family: Poaceae (alt.Gramineae) Subfamily: Pooideae Tribe: Poeae Subtribe: Loliinae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennials, occasionally producing short, delicate rhizomes; culms loosely tufted, red-tinged or purple-tinged at base, erect to ascending, 4.5-10 dm tall, glabrous."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 5 Feb 2019]	[No evidence] "Red fescue is distributed circumboreally [4,44,87]. It occurs throughout the United States, with the exception of the southeast from Louisiana to Florida [26,27,41,42,62]. Some authors consider red fescue to be native to the northern coastal areas of the United States [14,26,72]; some or all inland forms may be introduced [26,71]. Red fescue occurs in all provinces and territories of Canada [23,42,44,67]. It also occurs in Mexico [41], Europe [46,53], Africa [41,56], Asia [59,67], and New Zealand [41]."

602	Produces viable seed	y
	Source(s)	Notes
	USDA NRCS Plant Materials Program. (2006). Plant Fact Sheet - <i>Festuca rubra</i> L. ssp. <i>arenaria</i> (Osbeck) F. Aresch. http://Plant-Materials.nrcs.usda.gov . [Accessed 4 Feb 2019]	"Creeping red fescue is best seeded on a firm, weed-free, well-prepared seedbed following fertilization of the soil. Broadcasting on a freshly disturbed site is effective in cases where a proper seedbed cannot be prepared. The grass is usually seeded in a mixture with other species selected according to the purpose. Lawn seedings include 2 pounds per 1,000 square feet in a mixture with bentgrass or Kentucky bluegrass depending on whether the application is intended, respectively, for a moist coastal site or the drier interior. Shallow seeding with a drill is preferred for many seedings."
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 4 Feb 2019]	"Red fescue reproduces by seeds and spreads vegetatively [17]."

603	Hybridizes naturally	y
	Source(s)	Notes

Qsn #	Question	Answer
	Ainscough, M. M., Barker, C. M., & Stace, C. A. (1986). Natural hybrids between <i>Festuca</i> and species of <i>Vulpia</i> section <i>Vulpia</i> . <i>Watsonia</i> , 16(2), 143-151	"The occurrences and characteristics of the intergeneric hybrids between <i>Festuca rubra</i> L. agg. and <i>Vulpia bromoides</i> (L.) S. F. Gray and <i>V. myuros</i> (L.) C. C. Gmelin (Poaceae) are detailed. The hybrid of <i>V. bromoides</i> has been found on five occasions in three localities in England. involving both <i>F. rubra</i> and <i>F. nigrescens</i> as the other parent. The hybrid of <i>V. myuros</i> has been found on five occasions in four localities in England and Wales. and once in Holland, also involving both <i>F. rubra</i> and <i>F. nigrescens</i> as the other parent. Studies of meiosis in the hybrids show that the chromosomes of <i>F. rubra</i> can exchange genetic material with those of both <i>V. bromoides</i> and <i>V. myuros</i> , although both hybrids are very highly sterile. The significance of these facts to the evolution of <i>F. rubra</i> agg. is discussed."

604	Self-compatible or apomictic	n
	Source(s)	Notes
	Honnay, O., & Jacquemyn, H. (2008). A meta-analysis of the relation between mating system, growth form and genotypic diversity in clonal plant species. <i>Evolutionary Ecology</i> , 22(3), 299-312	"Appendix - Studies used in the meta-analysis. SI, self-incompatible; DC, self-compatible; G, guerilla habit; P, phalanx habit. The number of samples reflects the number of populations (or quadrats) where genotypic diversity was determined." [Festuca rubra - Mating system = SI, self-incompatible]
	Do Canto, J., Studer, B., & Lubberstedt, T. (2016). Overcoming self-incompatibility in grasses: a pathway to hybrid breeding. <i>Theoretical and Applied Genetics</i> , 129 (10), 1815-1829	"Table 1. Grass species characterized for SI and SF (Connor, 1979; Li et al., 1997; Baumann et al., 2000)." [Festuca rubra - SI: Self-incompatibility = Yes; GSI: gametophytic self-incompatibility = Yes]

605	Requires specialist pollinators	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Inflorescences paniculate, 3-20 cm long, usually narrow and contracted, with erect or ascending branches 2-4 mm long; spikelets usually pale green or glaucous, often purple-tinged, 4-7-flowered, 10 -15 mm long (including awns), rachilla scabrous; glumes attenuate, sparsely scabrous on upper 'h of keel, first glume 2.5-3 mm long;"
	Zomlefer, W.B. 1994. Guide to Flowering Plant Families. The University of North Carolina Press, Chapel Hill & London	"The reduced flowers are anemophilous, although pollen-gathering insects have been reported for some grass species" [Poaceae family description]

Qsn #	Question	Answer
606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	St. John, L., D. Tilley, P. Hunt, and S. Wright. 2012. Plant Guide for Red Fescue (<i>Festuca rubra</i>). USDA-Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho	"Red fescue is long-lived and spreads primarily by rhizomes. It is considered "weedy" by some and not so by others. It can spread into adjoining plant communities under ideal climatic and environmental conditions."
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 4 Feb 2019]	"Red fescue reproduces by seeds and spreads vegetatively [17]." ... "Red fescue can spread clonally by rhizomes [21]; it does not inhibit its own spread. The largest recorded single red fescue clone was 722 feet (220 m) in diameter and was estimated to be over 1,000 years old [13]."

607	Minimum generative time (years)	2
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennials, occasionally producing short, delicate rhizomes; culms loosely tufted, red-tinged" [Possibly <1 growing season, but answering conservatively. Perennial. Related species with generation time of 2 years]

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	Strykstra, R. J., Verweij, G. L., & Bakker, J. P. (1997). Seed dispersal by mowing machinery in a Dutch brook valley system. <i>Acta Botanica Neerlandica</i> , 46(4), 387-401	"A total of 52 species was recorded in the established vegetation in the fields of series A, 27 of which were found in the samples taken from the machinery (Tables 2, 3). Species that may reach dominance in advanced stages of the common hay-field succession in the Drentse A reserve were found on the machinery, for instance <i>Dactylus glomerata</i> . <i>Rhinanthus angustifolius</i> . <i>Anthoxanthum odoratum</i> . <i>Plantago lanceolata</i> , <i>Festuca rubra</i> , <i>Deschampsia cespitosa</i> and <i>Cynosurus cristatus</i> ."
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Flyers, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind"

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 4 Feb 2019]	"Creeping red fescue is used extensively for turf [29,71]. Red fescue can provide good ground cover. Because of limited top growth and heavy understorey growth some cultivars are used as a cover crop in orchards [88]."
	USDA NRCS Plant Materials Program. (2006). Plant Fact Sheet - <i>Festuca rubra</i> L. ssp. <i>arenaria</i> (Osbeck) F. Aresch. http://Plant-Materials.nrcs.usda.gov . [Accessed 26 Jan 2019]	"Erosion control: Creeping red fescue has a wide range when used for erosion control along roads and highways; cuts, fills, and other disturbed areas; and for stream and channel bank stabilization. Recreation and beautification: Creeping red fescue makes excellent lawns, golf greens and turf for ground cover in landscaping. It is particularly important in shaded locations and on sandy soils."

Qsn #	Question	Answer
	St. John, L., D. Tilley, P. Hunt, and S. Wright. 2012. Plant Guide for Red Fescue (<i>Festuca rubra</i>). USDA-Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho	"Red fescue is used as a cover crop in orchards because of its low stature and ability to grow in partially shaded conditions. Recreation and beautification: Red fescue is used as a turf for lawns, athletic fields, golf courses, and playgrounds."

703	Propagules likely to disperse as a produce contaminant	y
	Source(s)	Notes
	Canadian Food Inspection Agency. (2009). Weed Seeds Order Review Proposal For Change. Seed Section, Field Crops Division, Plant Health and Biosecurity Directorate. Ottawa, CA	"Impurities Retrieved from Pedigreed and Common Seed Samples (Domestic)" [Includes Fescue, Creeping Red (<i>Festuca rubra</i>)] ... "Impurities Retrieved from Imported Seed Samples" [Includes <i>Festuca rubra</i>]
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Contaminant, Crop, Herbal, Ornamental, Pasture"
	Conn, J. S. (2012). Pathways of invasive plant spread to Alaska: III. Contaminants in crop and grass seed. <i>Invasive Plant Science and Management</i> , 5(2): 270-281	"Table 2. Occurrence frequency and mean number of seeds (kg-1) of weeds and crop contaminants in grass seed imported to Alaska." [Festuca rubra seeds found in KB, Kentucky bluegrass mix]

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Flyers, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind"
	Valbuena, L., & Trabaud, L. (2001). Contribution of the soil seed bank to post-fire recovery of a heathland. <i>Plant Ecology</i> , 152(2), 175-183	"Table 1. Complete list of species, their biological traits and the number of individual plants appeared in each site." [Festuca rubra - Seed Dissemination Types: V: Anemochory]

705	Propagules water dispersed	y
	Source(s)	Notes
	Wolters, M., Geertsema, J., Chang, E. R., Veeneklaas, R. M., Carey, P. D., & Bakker, J. P. (2004). Astroturf seed traps for studying hydrochory. <i>Functional Ecology</i> , 18(1), 141-147	"Astroturf mats can effectively trap diaspores dispersed by tidal water." ... "Seven species occurred in more than 50% of the plots on the high marsh: <i>Agrostis stolonifera</i> , <i>Plantago maritima</i> , <i>Puccinellia maritima</i> , <i>S. maritima</i> , <i>Festuca rubra</i> , <i>Aster tripolium</i> and <i>Glaux maritima</i> (Table 3)."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Flyers, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind"
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 4 Feb 2019]	"Red fescue tolerates spring flooding and some water logging, and grows well under irrigation."

Qsn #	Question	Answer
706	Propagules bird dispersed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[Birds likely would act as seed predators] "Dispersed by: Humans, Animals, Flyers, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind"

707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	Mouissie, A. M., Lengkeek, W., & Van Diggelen, R. (2005). Estimating adhesive seed-dispersal distances: field experiments and correlated random walks. <i>Functional Ecology</i> , 19(3): 478-486	"After 3 h grazing, five species had attached to the sheep. The Poaceae <i>M. caerulea</i> , <i>A. capillaris</i> and <i>F. rubra</i> had attached in considerable numbers (40–80 seeds per species)."

708	Propagules survive passage through the gut	y
	Source(s)	Notes
	Bakker, J. P., Bravo, L. G., & Mouissie, A. M. (2008). Dispersal by cattle of salt-marsh and dune species into salt-marsh and dune communities. <i>Plant Ecology</i> , 197(1): 43-54	"Appendix 1. Species and seed trait data for seeds found in cattle dung," [Includes <i>Festuca rubra</i>]
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Flyers, Cattle, Donkey, Horse, Livestock, Sheep, Vehicles, Water, Wind"

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	St. John, L., D. Tilley, P. Hunt, and S. Wright. 2012. Plant Guide for Red Fescue (<i>Festuca rubra</i>). USDA-Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho	"There are approximately 614,000 seeds per pound (1,350,000 seeds/kg). Red fescue is usually planted in a mixture and when used as a component of a seed mix, the seeding rate is adjusted to the percent of mix desired." [Natural seed densities unknown]

802	Evidence that a persistent propagule bank is formed (>1 yr)	n
	Source(s)	Notes
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 4 Feb 2019]	"Evidence from European populations indicates that red fescue does not form a persistent buried seedbank [11,65,77,78]."
	St. John, L., D. Tilley, P. Hunt, and S. Wright. 2012. Plant Guide for Red Fescue (<i>Festuca rubra</i>). USDA-Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho	"Red fescue can out-compete some native species on disturbed sites in temperate and arctic plant communities and may colonize disturbed areas naturally by spreading rhizomes. It does not generally develop a persistent seed bank in the soil."

Qsn #	Question	Answer
803	Well controlled by herbicides	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	Unknown, but grass specific herbicides would probably be effective in certain situations

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Walsh, R. A. 1995. <i>Festuca rubra</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/graminoid/fesrub/all.html . [Accessed 4 Feb 2019]	"Red fescue probably sprouts from rhizomes after aerial portions are burned."
	Valbuena, L., & Trabaud, L. (2001). Contribution of the soil seed bank to post-fire recovery of a heathland. <i>Plant Ecology</i> , 152(2), 175-183	"Table 1. Complete list of species, their biological traits and the number of individual plants appeared in each site." [Festuca rubra - Types of regeneration = R: Resprout; S: Seed]

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[Unknown] "Native to Eurasia and North Africa, widely used as a pasture and turf grass; in Hawai'i sparingly naturalized in pastures and shrubland communities, 820-2,140 m, on Maui and Hawai'i."

Summary of Risk Traits:

High Risk / Undesirable Traits

- Broad natural distribution, and elevation range exceeds 1000 m, demonstrating environmental versatility
- Primarily temperate distribution, but reported to occur in regions with subtropical climates
- Naturalized on Maui and Hawaii (Hawaiian Islands), and elsewhere
- A disturbance adapted weed with potential impacts to agriculture, and reported to impact native vegetation in Australia
- Other *Festuca* species are invasive
- Allelopathic
- Some varieties contain endophytes that in high levels may be harmful to livestock
- A severe allergen. Pollen can cause hay fever
- Reported to be both shade tolerant and shade intolerant. Relatively high light levels in Hawaiian ecosystems may not be a limiting factor for establishment of this species
- Tolerates many soil types
- Able to form dense cover that may exclude other vegetation
- Reproduces by seeds and vegetatively by rhizomes
- Naturally hybridizes with other grass species
- Seeds dispersed by machinery, as a contaminant, wind, water, internally and externally by animals, and intentionally by people
- Tolerates and resprouts after fire

Low Risk Traits

- Despite potential weediness, valued as a ground cover and for erosion control
- Unarmed (no spines, thorns, or burrs)
- Palatable to grazing animals
- Reported to be self-incompatible
- Does not form a persistent seed bank