Taxon: Holcus lanatus **Family:** Poaceae

Common Name(s): common velvet grass
fog grass
soft-meadow grass
woolly soft grass
Yorkshire fog

Synonym(s): Holcus argenteus C. Agardh ex Roem.
Notholcus lanatus (L.) Nash ex Hitchc.

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 9 Dec 2015

WRA Score: 20.0 **Designation:** H(Hawai'i) **Rating:** High Risk

Keywords: Temperate Grass, Perennial, Environmental Weed, Dense Cover, Wind-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	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	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	n=0, y = 2*multiplier (see Appendix 2)	y
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		
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	y=1, n=0	y
407	Causes allergies or is otherwise toxic to humans		

Qsn #	Question	Answer Option	Answer
408	Creates a fire hazard in natural ecosystems	y=1, n=0	y
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	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	n
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		
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)	y=1, n=-1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
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	n

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence of domestication

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. 2015. Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. 2015. Personal Communication	NA

201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**Low**
	Source(s)	**Notes**
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"Europe, Eurasia , North Africa, temperate areas."

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	

Qsn #	Question	Answer
203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"In both its native and nonnative ranges, common velvetgrass occupies a wide range of habitats." ... "Climate: A review reports that common velvetgrass tolerates a wide range of moisture conditions within temperate climate regimes. While common velvetgrass grows best in moist areas, it grows well in very wet conditions and tolerates "moderate" periods of drought [134]. The northern limit for common velvetgrass is near the January isotherm of 28.4 °F (-2 C). The 80 °F (26.7 °C) July isotherm approximates common velvetgrass' southern boundary in Europe and the Mediterranean. Beyond this southern boundary, precipitation from May to October is typically less than 5 inches (130 mm) and is likely the reason for common velvetgrass' absence [14]."
	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.	[Elevation range exceeds 2400 m in Hawaiian Islands, demonstrating environmental versatility] "in Hawai'i naturalized in wet, disturbed areas such as pastures, grasslands, mesic shrubland, and along roadsides, 760-3,250 m"

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.	"Native to Europe, now widely naturalized; in Hawai'i naturalized in wet, disturbed areas such as pastures, grasslands, mesic shrubland, and along roadsides, 760-3,250 m, on Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i. First collected on Hawai'i in 1909 (Rock 3437, BISH)."

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"A review reports that it was likely introduced several times to both the east and west coasts of North America as a contaminant or an intentional component of imported forage seed [113,134]. As of 1800, common velvetgrass occurred in many parts of North America [9]. Based on early North American floras, it occurred in Pennsylvania by 1755 and was frequent in 1814 [163]. In New England, common velvetgrass introductions probably occurred in the 17th century [92]. The first known collection of common velvetgrass from London, Ontario, occurred in 1879 [134]. In Hawaii, it was first collected in 1909 [153]."

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 Europe, now widely naturalized; in Hawai'i naturalized in wet, disturbed areas such as pastures, grasslands, mesic shrubland, and along roadsides, 760-3,250 m, on Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i. First collected on Hawai'i in 1909 (Rock 3437, BISH)."

Qsn #	Question	Answer
302	**Garden/amenity/disturbance weed**	
	Source(s)	**Notes**
	Thompson, J.D. & Turkington, R. 1988. The biology of Canadian weeds. 82. Holcus lanatus L. Canadian Journal of Plant Science, 68(1): 131-147	"In the U.K., H. lanatus is considered to be a weed of "turf for sport or in traditional ornamental lawns" (Roberts 1982)."
	WRA Specialist. 2015. Personal Communication	A disturbance-adapted grass with negative impacts to agriculture and the natural environment

303	**Agricultural/forestry/horticultural weed**	**y**
	Source(s)	**Notes**
	Thompson, J.D. & Turkington, R. 1988. The biology of Canadian weeds. 82. Holcus lanatus L. Canadian Journal of Plant Science, 68(1): 131-147	"Holcus lanatus is not a serious agricultural weed in Canada, but it is a problem on roadsides, pastures and lawns in British Columbia and Nova Scotia."
	CABI, 2015. Holcus lanatus. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"It is a widespread weed of herbage seed crops and can reduce seed yield of other species."

Qsn #	Question	Answer
304	**Environmental weed**	**y**
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"It is invasive because it forms dense swards that reduce native species richness and eliminate native grasses and forbs"
	CABI, 2015. Holcus lanatus. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Where introduced, H. lanatus invades disturbed sites more rapidly than native species and will persist as one of the dominant species. It competes aggressively for both water and nutrients and forms dense swards that shade out the seedlings of native plants. Particularly in Hawaii, H. lanatus will rapidly colonise disturbed sites (US Forest Service, 2013). The presence of H. lanatus changes litter composition and alters soil chemistry, modifying the composition and quantity of soil microbes and fungi, altering the nutrient cycling and significantly changing the plant composition of the invaded ecosystem."
	Loope, L.L., Nagata, R.J. & Medeiros, A.C. 1992, Alien plants in Haleakala National Park Pp. 551-576 in Stone et al (eds) Alien plant invasions in native ecosystems of Hawaii. Coop. Nat. Park Resources Studies Unit, University of Hawaii, Honolulu, HI	[Inhibits reproduction of native shrubs] "The subalpine shrubland has been modified by years of impact of goats, cattle, and pigs. The often dense mat of alien grasses such as velvet grass (Holcus lanatus), sweet vernalgrass (Anthoxanthum odoratum), and orchard grass (Dactylis glomerata) inhibits reproduction by seed of native shrubs. Pines, eucalypts, gorse (Ulex europaeus), and blackberry (Rubus argutus) are also potentially serious invaders of this zone." ... "This perennial grass from Europe is abundant in most open shrubland habitats of East Maui at 6,000-9,000 ft (1,830-2,745 m). It is particularly dense in the lower elevation subalpine shrubland of northwestern Haleakala between Hosmer Grove and Park Headquarters. Wherever it grows it displaces seedling establishment by native species, such as the important shrub/tree mamane (Sophora chrysophylla). Velvet grass is also the major alien species invading pig-damaged montane bogs of northeastern Haleakala. Though it is currently a serious threat, control of the widespread velvet grass is impractical."

305	Congeneric weed	y
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	"Holcus mollis L. Poaceae Cultivated, Pasture Refs: 52 1278-N, 1266-A, 1262-E, 1238-W, 1162-N, 1134-Q, 1049-N, 946-W, 945- N, 931-A, 919-N, 889-A, 869-W, 853- W, 819-N, 794-N, 743-E, 534-N, 519-N, 417-A, 407-W, 396-N, 392-W, 360-W, 354-N, 327-E, 322-A, 317-UZ, 287-N, 280-N, 272-W, 253-A, 250-A, 243-A, 218-W, 212-W, 198-N, 176-N, 161-W, 151-E, 121-AZW, 118-A, 101-N, 91-W, 87-W, 85-NZW, 80-E, 70-W, 44-A, 42-N, 30-A, 23-W"

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	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; culms 30-60 cm tall, velvety canes cent. Sheaths 6-12 cm long, striate, velvety canescent; ligule membranous, 1-2 mm long, narrowly lacerate, with short hairs at apex; blades 10,..20 cm long, 4-8 mm wide, velvety canescent, the midrib prominent."

402	Allelopathic	
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 9 Dec 2015]	[Potentially] "Allelopathy: In laboratory tests, common velvetgrass showed possible allelopathic properties. When common velvetgrass and garden sorrel (Rumex acetosa) seedlings were grown in sand that was collected beneath a common velvetgrass monoculture, growth of both species was "markedly depressed" as compared to controls, even when nutrients were added (Al Mashhadani and Grime, personal communication, cited in [158]). Germination and radicle extension were significantly lower for bulbous canarygrass (Phalaris aquatica) and orchardgrass (Dactylis glomerata) seeds kept moist with water containing common velvetgrass leaf extracts than for those kept moist with deionized water (P=0.001) [154]."

403	Parasitic	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; culms 30-60 cm tall, velvety canes cent." [Poaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 9 Dec 2015]	"Palatability/nutritional value: Although consumed by elk and deer, common velvetgrass is not considered very palatable [70]. Common velvetgrass has been described as "without forage value" [85] and "not well liked by stock" [131]. Watt [157] reports that common velvetgrass is considered palatable early in the growing season, but palatability decreases as plants reach the flowering stage."
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Palatable, but not preferred] "pasture grass, poor forage grass, low palatability to stock, velvety leaves generally avoided by stock" ... "cultivated fodder, sometimes grown for hay"

405	Toxic to animals	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Thompson, J.D. & Turkington, R. 1988. The biology of Canadian weeds. 82. Holcus lanatus L. Canadian Journal of Plant Science, 68(1): 131-147	[Potentially Yes] "It is listed as being poisonous to livestock in British Columbia (Taylor and MacBryde 1977) but there is little evidence to support this claim. Holcus lanarus sometimes conlains hydrocyanogenic glucosides (Watt 1978b), although there are no records of this causing livestock poisoning. The cyanogenesis tests performed by Zandee (1983) were all negative for H. lanatus." ... "Holcus lanatus is a common species in many permanent pastures in New Zealand in which outbreaks of 'grass' or 'beef' tetany (hypomagnesaemia), have occurred in grazing cattle, possibly due to the high percentage dry weight of trans-aconitic acid in H. lanatus plants (Molloy and Richards l97l)."

406	Host for recognized pests and pathogens	y
	Source(s)	**Notes**
	Thompson, J.D. & Turkington, R. 1988. The biology of Canadian weeds. 82. Holcus lanatus L. Canadian Journal of Plant Science, 68(1): 131-147	"It is a primary and a secondary host for a range of viruses and other microorganisms (Section l3b)." ... "Lists of the fungi that infect H. lanatus in Britain have been compiled by Moore (1959), Beddows (1961a) and Wilson and Henderson (1966). In New Zealand, H. lanatus was shown by Sinclair (1961) to provide a substrate for Pithomyces chartarum, which can cause facial eczema and liver damage in sheep. It was also recorded as a host for Hyperodes bonariensis, the Argentine stem-weevil (Jacques and Munro 1963)."

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	**Notes**
	Schramm, G., Petersen, A., Bufe, A., Schlaak, M., & Becker, W. M. (1996). Identification and characterization of the major allergens of velvet grass (Holcus lanatus), Hol l 1 and Hol l 5. International Archives of Allergy and Immunology, 110(4): 354-363	[Pollen may be allergenic to susceptible individuals] "Although extract of velvet grass pollen is an important ingredient of commercial allergen extracts for immunotherapy, it is not defined concerning its major allergenic components. We have investigated the extract of velvet grass pollen by Western blotting using the sera of 97 patients and identified two major allergens of 34 and 30 kD. By two-dimensional immunoblotting with monoclonal antibodies and lectins, and by biochemical analysis the 34-kD protein was identified as a group I grass pollen allergen and the 30-kD protein as a group V grass pollen allergen. According to the nomenclature for grass pollen allergens we designated these allergens Hol l1 and Hol l 5, respectively. Fragmentation of the velvet grass pollen extract by CNBr provided the first information on the localization of IgE binding epitopes on these two allergens. With Hol l1 and Hol l 5 we identified two important components of commercial allergen extracts."

408	Creates a fire hazard in natural ecosystems	y
	Source(s)	**Notes**
	CABI, 2015. Holcus lanatus. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Impact outcomes ... Modification of fire regime"

Qsn #	Question	Answer
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 9 Dec 2015]	"While common velvetgrass could potentially increase fine fuel loads in many of its nonnative US habitats, this is described only in Hawaii and California. Establishment of common velvetgrass may reduce the frequency and/or size of gaps in subalpine vegetation and increase fire potential through increased fuel continuity [128]. In coastal grasslands of Sonoma, California, litter accumulations are often greater in common velvetgrass communities than in annual grasslands [13], which may affect fire probability and/or behavior. This topic is also addressed in Litter accumulation. The Fire Regime Table provides fire regime information for many vegetation types and plant communities in which common velvetgrass may occur."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"Shade effects: Increasing shade reduced seedling growth and survival during field studies in western Oregon. In 0%, 33%, 53%, and 78% shade, 5- to 6-week-old common velvetgrass seedlings had dry weights of 9.2 mg, 3.8 mg, 2.5 mg, and 2 mg, respectively. Shading of 33% or greater significantly reduced seedling growth ($P<0.05$) [63,64]." ... "Shade relationships: Although some consider common velvetgrass shade intolerant [83] and studies have shown that shade may decrease seedling growth and plant biomass [52,63], common velvetgrass may occur in heavily shaded woodlands with high tree density [90], especially with soil disturbance."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"It is tolerant of a wide range of soils."
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"Soils: Although common velvetgrass tolerates a wide range of soil conditions [9], it is often described as occurring on moist sites [125,149]. In British Columbia, common velvetgrass is most common on fresh to very moist soils [83]. In California, common velvetgrass is found in all but the desert regions and grows best in moist, rich soils [125]. In the coastal prairies of California, common velvetgrass is rare on hilltop or steep sites that dry out early in the season (Thomsen, personal observation, cited in [140]). In the eastern United States, common velvetgrass often occurs on damp, moist, or poorly drained sites [149]. In controlled studies, as the water table height increased, common velvetgrass growth decreased. However, on sites with elevated water tables, common velvetgrass developed fine roots at the soil surface and adventitious roots at the plant base, suggesting a possible long-term adaptation to a high water table [160]."

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	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; culms 30-60 cm tall, velvety canes cent."

412	Forms dense thickets	y
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"It is invasive because it forms dense swards that reduce native species richness and eliminate native grasses and forbs"
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). Hawaii's terrestrial ecosystems: preservation & management. CPSU, Honolulu, HI	"This perennial bunchgrass invades disturbed sites rapidly. It forms dense stands which shade out seedling establishment, but allelopathic activity is also suspected (Watt 1978)."

501	Aquatic	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.	[Terrestrial grass] "... in wet, disturbed areas such as pastures, grasslands, mesic shrubland, and along roadsides"

502	Grass	y
	Source(s)	**Notes**
	Quattrocchi, U. 2006. CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	Poaceae

503	Nitrogen fixing woody plant	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; culms 30-60 cm tall, velvety canescent." [Poaceae]

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; culms 30-60 cm tall, velvety canescent. Sheaths 6-12 cm long, striate, velvety canescent; ligule membranous, 1-2 mm long, narrowly lacerate, with short hairs at apex; blades 10,..20 cm long, 4-8 mm wide, velvety canescent, the midrib prominent."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	[Widespread. No evidence] "Common velvetgrass is native to Europe, western Asia, northwestern Africa, and the Canary Islands and is very common throughout temperate Europe [14,15]."

602	Produces viable seed	y
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"Common velvetgrass reproduces primarily from seed, but tillering is also common and can be important to clump size increases."
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). Hawaii's terrestrial ecosystems: preservation & management. CPSU, Honolulu, HI	"Seeds are produced abundantly and dispersed by wind."

603	Hybridizes naturally	y
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 9 Dec 2015]	"A review reports that common velvetgrass and creeping velvetgrass (H. mollis) hybridize. Hybrids closely resemble creeping velvetgrass [157]."
	Western Australian Herbarium (1998–2015). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. https://florabase.dpaw.wa.gov.au/. [Accessed 9 Dec 2015]	"Agricultural cultivars and natural hybrids are formed with H. mollis."
	Thompson, J.D. & Turkington, R. 1988. The biology of Canadian weeds. 82. Holcus lanatus L. Canadian Journal of Plant Science, 68(1): 131-147	"Natural hybridization can occur between the diploid H. lanatus and the tetraploid race (2n : 28) H. mollis to produce a triploid F1 hybrid. The hybrids are either morphologically intermediate, or, more commonly, tend to resemble the H. mollis parent (Carroll and Jones 1962). In Canada, there has been only one recorded collection of tetraploid H. mollis and there are no records of hybridization between the species. Details of natural and artificial hybridization outside of Canada are provided by Beddows (l96la;1971), Carroll and Jones (1962) and Zandee and van Scheepen (1981)."

604	Self-compatible or apomictic	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"Pollination and breeding system: A review reports that common velvetgrass flowers are cross pollinated by wind [14]. Experiments have shown that common velvetgrass is "highly self-sterile"
	Beddows, A. R. (1961). Flowering Behaviour, Compatibility and Major Gene Differences in Holcus lanatus L. New Phytologist, 6(3): 312-324	"The self-compatibility of H. lanatus follows much the same pattern as that in other wind-pollinated species (Beddows, 1931, 1961) with the exception that plants of high self-fertility have not been found." ... "It must be concluded that Holcus latiatus is a highly self-sterile species and that the selection pressure against self-fertility must have been strong."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Beddows, A. R. (1961). Flowering Behaviour, Compatibility and Major Gene Differences in Holcus lanatus L. New Phytologist, 6(3): 312-324	"Holcus lanatus is wind-pollinated. Anthesis occurs twice a day if weather conditions are favourable, the first time between 5 and 9 a.m. and the second between noon and 4 p.m. G.M.T. The two fflorets composing the spikelet each produce anthers but the upper may sometimes be hermaphrodite and can then develop a caryopsis."
	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 silvery to purplish, paniculate, contracted, sometimes almost spike-like, 8-15 cm long, occasionally enclosed within the uppermost sheath; spikelets 4-4.5 mm long, short-pedicellate; glumes 4-4.5 mm long, keeled, the keels hirsute, otherwise scabrous, first glume 1- nerved, 0.5-0.7 mm wide from keel to margin, second glume 3-nerved, 1-1.2 mm wide from keel to margin; lemma of perfect floret ca. 2 mm long, rather broad, slightly keeled, the keel hirtellous, lemma of staminate floret 2-2.5 mm long, narrow, acute, indistinctly keeled, the keel minutely hirtellous, apex with a hooked awn ca. 1.5 mm long; palea 1.7-2 mm long, minutely hirtellous at apex."

606	Reproduction by vegetative fragmentation	y
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"Vegetative regeneration: Common velvetgrass clumps expand through tillering or the growth and development of prostrate rosette shoots (Tansley 1949, as cited in [14]). In reviews, vegetative growth of common velvetgrass has been described as producing a "blanket of runners or stolons" on the soil surface [158] and as "aggressive tillering" that allows clumps to "enlarge rapidly" [149]. Claims of rhizome production [40] and sprouting following top-kill [51] were not substantiated by the available literature." ... "While vegetative growth commonly occurs, recruitment of seedlings is typically the primary method of common velvetgrass reproduction."

607	Minimum generative time (years)	2

Qsn #	Question	Answer
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 9 Dec 2015]	"Common velvetgrass is typically a pubescent, tufted, perennial grass." ... "Common velvetgrass seedlings develop rapidly, making them competitive at this early stage. After 20 weeks of growth in a greenhouse, common velvetgrass produced the greatest overall root biomass and root:shoot biomass of 6 coastal prairie species grown from seed collected in Marin County, California. "

701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**y**
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"Human activities: Mowing equipment was likely an important dispersal vector for common velvetgrass in the Netherlands. After mowing in common velvetgrass-dominated grasslands, 86% of seeds removed from equipment were common velvetgrass [132]."
	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.	[Distribution on roadsides suggests inadvertent dispersal through human activity] "in Hawai'i naturalized in wet, disturbed areas such as pastures, grasslands, mesic shrubland, and along roadsides"

702	**Propagules dispersed intentionally by people**	**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.	[Possibly intentionally dispersed in the past. No current evidence of introduction found] "First collected on Hawai'i in 1909 (Rock 3437, BISH)."

703	**Propagules likely to disperse as a produce contaminant**	**y**
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 9 Dec 2015]	"A review reports that it was likely introduced several times to both the east and west coasts of North America as a contaminant or an intentional component of imported forage seed [113,134]."
	Thompson, J.D. & Turkington, R. 1988. The biology of Canadian weeds. 82. Holcus lanatus L. Canadian Journal of Plant Science, 68(1): 131-147	"Holcus lanatus is a common weed of grass seed crops in Britain (Hunt 1966; Harkess and Hope I974; Roberts 1982) and New Zealand (Jacques and Munro 1963) especially with Lolium perenne and Phleum pratense. Wellington (1960) recorded H. lanatus as a contaminant in 26% of Lolium perenne and L. multiflorum seed samples, 18% of Dactylis glomerata samples, and 12% of Festuca pratensis samples."

704	**Propagules adapted to wind dispersal**	**y**
	Source(s)	**Notes**

Qsn #	Question	Answer
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"Seed dispersal: There are many potential common velvetgrass seed dispersal vectors. Seeds are easily shed [14], and a large spikelet surface area encourages wind dispersal [14,134]. In a field study in northern California coastal grasslands, 90% of common velvetgrass seeds dispersed within a 17-foot (5.2 m) radial distance from the parent plant. Half of all seeds fell within a 5.6-foot (1.7 m) distance [110]."
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). Hawaii's terrestrial ecosystems: preservation & management. CPSU, Honolulu, HI	"Seeds are produced abundantly and dispersed by wind."

705	Propagules water dispersed	y
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"Water: Buoyancy of common velvetgrass seed suggests that it may be dispersed by water. In stagnant water, 54% of common velvetgrass seeds remained floating after 25 days and 9% after 90 days. In moving water, 47% remained floating after 25 days and 2% after 90 days. Germination of floating seeds was not tested [150]."

706	Propagules bird dispersed	
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	[Possibly. Unknown in Hawaiian Islands] "Not all birds are likely to disperse common velvetgrass seed. Common velvetgrass seeds that passed through the digestive tract of sparrows were killed, but seeds passing through the digestive tract of rooks had only slightly reduced viability (Krach 1959, as cited in [157])."

707	Propagules dispersed by other animals (externally)	y
	Source(s)	**Notes**
	Istituto di Biologia Agroambientale e Forestale (IBAF). 2015. Holcus lanatus Factsheet. www.ibaf.cnr.it	"The seed is spread in mud on machinery and vehicles, and can adhere to animals and clothing."

Qsn #	Question	Answer
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 9 Dec 2015]	[Primarily wind & secondarily internal dispersal] "Animals: Worms, birds, rabbits, and cattle are possible dispersers of common velvetgrass seed. McRill (1974, as cited in [121]) reported that common velvetgrass seed was a major component of earthworm castings collected from grasslands in North Wales. Worms are likely important in the burial and unearthing of common velvetgrass seed (McRill 1974, as cited in [156]). Not all birds are likely to disperse common velvetgrass seed. Common velvetgrass seeds that passed through the digestive tract of sparrows were killed, but seeds passing through the digestive tract of rooks had only slightly reduced viability (Krach 1959, as cited in [157]). A small number of common velvetgrass seedlings emerged from rabbit pellets collected from an acidic grassland in Norfolk, United Kingdom. Although field and greenhouse studies indicated that the seed bank was most important to the colonization of bare patches, dispersal and establishment from rabbit pellets was possible [103]. For more on this study, see Seed banking. Common velvetgrass also germinated from cattle dung collected from heather (Calluna spp.) moorland in northeastern Scotland [162]."

708	Propagules survive passage through the gut	y
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"A small number of common velvetgrass seedlings emerged from rabbit pellets collected from an acidic grassland in Norfolk, United Kingdom. Although field and greenhouse studies indicated that the seed bank was most important to the colonization of bare patches, dispersal and establishment from rabbit pellets was possible [103]. For more on this study, see Seed banking. Common velvetgrass also germinated from cattle dung collected from heather (Calluna spp.) moorland in northeastern Scotland [162]."

801	Prolific seed production (>1000/m2)	y
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"A review reports that although seed is generally only produced by lower florets, common velvetgrass is "notoriously a prolific seed producer". Studies conducted in native and nonnative habitats indicate that common velvetgrass seed production can vary by vegetation type and sowing date. In Britain, common velvetgrass produced 63 to 611 spikelets/panicle in a greenhouse setting [15]. In a "closed" common velvetgrass-dominated grassland in Bangor, United Kingdom, the average number of common velvetgrass seeds/panicle was 270 but ranged from 100 to 380. Average seed production was 19,000 seeds/m² (Mortimer 1974, as cited in [157]). In coastal prairies of Sonoma County, California, common velvetgrass seed rain was 82,300 seeds/m² in a patch type where 91% of the relative cover was common velvetgrass. Seed rain was less than 6,000 seeds/m² in a patch where the relative cover of common velvetgrass was 4.6% [107]."

Qsn #	Question	Answer
	Thompson, J.D. & Turkington, R. 1988. The biology of Canadian weeds. 82. Holcus lanatus L. Canadian Journal of Plant Science, 68(1): 131-147	"Holcus lanatus is a prolific seed producer. In Britain, Watt (1976) found that spaced plants sown monthly from January to June produced, on average, 177 000 seeds per plant the following summer, with a maximum of 24O 000 from those sown in March."
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). Hawaii's terrestrial ecosystems: preservation & management. CPSU, Honolulu, HI	"Seeds are produced abundantly and dispersed by wind."

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"Seed banking: Studies from native and nonnative ranges indicate that common velvetgrass produces an abundant seed bank that is important to population persistence. A review of studies conducted in northwestern Europe reported that common velvetgrass seed may remain viable in the soil for more than 12 years. In one study, a maximum number of 16,900 common velvetgrass seeds/m² occurred in a sample of the top 2 inches (5 cm) of soil from a natural habitat. Another study reported collecting viable common velvetgrass seeds from a depth of 20 inches (50 cm) [136]. In other reviews, 5% of common velvetgrass seed reportedly germinated after 12 years of storage in a laboratory [14], and at the Welsh Plant Breeding Station, 14% of common velvetgrass seeds germinated after 10 years of burial beneath 5 inches (125 mm) of mineral soil [157]."
	CABI, 2015. Holcus lanatus. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Thompson et al. (1993) reports that based on seed characters, H. lanatus seed is likely to persist for longer than 5 years. H. lanatus seed is persistent in the seedbank (Grime et al., 1988). During field experiments, seeds sown in a 75 mm layer of soil in cylinders, sunk in a UK field and stirred periodically, emerged mainly from April to October (Roberts, 1986). Most seedlings emerged in years 1 and 2 but some emergence of seedlings continued into year 3. Seed buried in mineral soil at 13, 26 or 39 cm depth and left undisturbed retained 17, 19 and 5% viability respectively after 4 years, but none were viable after 20 years (Lewis, 1973). Seeds buried in peat soil at 26 cm for 1, 4 and 20 years retained only 1% viability after a year. Seeds stored under granary conditions exhibited 82% viability after 1 year and 6% viability after 4 years, but were not viable after 20 years. Seed in dry storage had a 5% viability after 12 years (Beddows, 1961)."

803	Well controlled by herbicides	y
	Source(s)	**Notes**
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 9 Dec 2015]	"Chemical: Herbicides potentially useful in common velvetgrass control are discussed in the following reviews: [46,134,161]. McHenry (1985, cited in [113]) suggests herbicide treatments may be most effective in the spring or when the first seed head appears because translocation to the roots is likely at that time."

Qsn #	Question	Answer
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Effective herbicides are atrazine or diuron"
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). Hawaii's terrestrial ecosystems: preservation & management. CPSU, Honolulu, HI	"Holcus has not been evaluated for biological control but potential agents and the effectiveness of some herbicides are noted by Watt (1978)."
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching,L. 2003. Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide. CTAHR, UH Manoa, Honolulu, HI	"Susceptible to foliar application of glyphosate at 1-1.5% product (Hank Oppenheimer, Maui Pine)"

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y**
	Source(s)	**Notes**
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). Hawaii's terrestrial ecosystems: preservation & management. CPSU, Honolulu, HI	"As with most bunchgrasses, this species tolerates fires and regenerates rapidly from basal shoots."
	Gucker, C. L. 2008. Holcus lanatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. [Accessed 8 Dec 2015]	"In frequently mowed habitats, the importance of tillering increases. In the North Wales Treborth Botanic Garden, nearly all species, including common velvetgrass, colonized cleared patches through vegetative growth in frequently mowed grassland (1-2 times/2 weeks)."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	**n**
	Source(s)	**Notes**
	Smith, C.W. 1985. Impact of Alien Plants on Hawaii's Native Biota. Pp. 180-250 in Stone & Scott (eds.). Hawaii's terrestrial ecosystems: preservation & management. CPSU, Honolulu, HI	"Holcus has not been evaluated for biological control but potential agents and the effectiveness of some herbicides are noted by Watt (1978). The sugar industry will probably resist any move to import biocontrol agents."
	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.	[No evidence of natural enemies impacting Holcus distribution] "Native to Europe, now widely naturalized; in Hawai'i naturalized in wet, disturbed areas such as pastures, grasslands, mesic shrubland, and along roadsides, 760-3,250 m, on Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i. First collected on Hawai'i in 1909 (Rock 3437, BISH)"

Summary of Risk Traits:

High Risk / Undesirable Traits
• Broad climate suitability & elevation range exceeds 2000 m, demonstrating environmental versatility
• Naturalized in regions with tropical climates
• Widely naturalized
• Agricultural and environmental weed
• Other Holcus species are invasive
• Alternate host of pests & pathogens
• Pollen may be allergenic
• Increases fuel load in fire prone habitats
• Tolerates shade, but prefers full sun
• Tolerates many soil types
• Forms dense cover
• Reproduces primarily be seeds & secondarily by tillering
• Hybridizes with Holcus mollis
• Seeds dispersed by wind, water, as a crop contaminant, internally & externally by clinging to equipment, clothing, & animals
• Prolific seed production (>1000/m2)
• Forms a persistent seed bank (5-20 years)
• Tolerates mowing & fire

Low Risk Traits
• Unarmed (no spines, thorns or burrs)
• Palatable to browsing & grazing animals (but lower than other grasses)
• Primarily outcrossing (mostly self-incompatible)
• Herbicides provide effective control