Washington Invasive Ranking System

Washington Natural Heritage Program

Holcus lanatus (Common Velvet-grass)

Assessed by
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Ecological Impact Rank: **Moderate** (59)	Confidence: **Moderate** (42)
Management Difficulty Rank: High (75)	Confidence: Moderate (50)
Biological Characteristics of Invasiveness: High (70)	Confidence: High (71)
Concern Related to Distribution and Abundance: High (87)	Confidence: High (100)

Photo Credit: David Giblin 2023, used under Creative Commons license (Burke Herbarium, University of Washington, 2024).

Ranking Notes

None

Legal Listings

Washington State Weed Board: No

Washington Invasive Species Council: No

Section 1: Distribution and Abundance

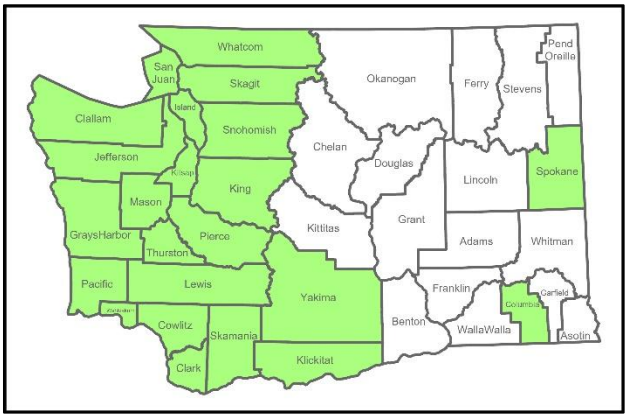

Figure 1. Distribution of counties where *Holcus lanatus* has been documented in Washington State (CPNWH, 2023; EDDMapS, 2023; iNaturalist Contributors, 2023).

Q1: Current Range Size in Washington

Rating: High

Confidence: High

Holcus lanatus is found in 59% counties in Washington State (CPNWH, 2023; EDDMapS, 2023; iNaturalist Contributors, 2023).

Source: Herbarium records and other observations

Q2: Current Trend in Total Range

Rating: Moderate

Confidence: High

Based on herbarium records and iNaturalist observations, *Holcus lanatus* is increasing in abundance and range west of the Cascades, but total range has not expanded east of the Cascades in the last 20 years (CPNWH, 2023; iNaturalist Contributors, 2023). Models predict that suitable habitat for this species is available in all counties in Washington State (EDDMapS, 2023).

Source: Herbarium records and other observations.

Q3: Proportion of Potential Range Currently Unoccupied

Rating: Low

Confidence: High

Models predict that *Holcus lanatus* will expand into all counties in Washington, though it will remain most abundant west of the Cascades (EDDMapS, 2023).

Source: Model predictions.

Q4: Local Range Expansion or Change in Abundance

Rating: High

Confidence: High

Over the last 20 years, *Holcus lanatus* abundance and local range appears to have increased rapidly west of the Cascades, particularly around Puget Sound (CPNWH, 2023; iNaturalist Contributors, 2023).

Source: Professional expertise, Herbarium records and other observations

Q5: Diversity of Ecosystems Invaded

Ecosystem types: Forest & Woodland, Grassland & Shrubland, Marine Coastal Shore, Emergent Open Wetland

Rating: High

Confidence: High

Holcus lanatus is found in pastures, grasslands, wet and mesic meadows, and open forests and woodlands of all successional stages. In Washington, this species is also known from coastal scrub communities. This species is abundant in Willamette Prairie and oak woodland communities. This species is most competitive moist conditions but can grow well in wet conditions and survive moderate drought. In the Pacific Northwest, this species is generally known from areas with cool, wet, and relatively snow-free winters and warm, dry summers. It can be killed by heavy frosts. Throughout its introduced range, *H. lanatus* is frequently found in poor, shallow and/or acidic soils. *Holcus lanatus* commonly occurs with other introduced species such as *Daucus carota*, *Anthoxanthum odoratum*, and *Agrostis gigantea* (Gucker, 2009; Conner et al., 2013).

Source: Informal publication, Professional expertise

Section 2: Biological Characteristics

Q6: Aggressive Mode of Reproduction

Rating: Yes

Confidence: High

Holcus lanatus is a perennial that can live for several decades in moist habitats. It is comparatively short-lived (2–4 years) in dry habitats and can even grow as an annual on the east coast of North America.

Holcus lanatus usually reproduces from seed but can also reproduce vegetatively by tillering or rooting from stem nodes. This species may need to experience cold temperatures to set flowers. Seed production requires cross-pollination. In coastal California, *H. lanatus* was found to produce 6000–19,000 seeds per square meter (depending on the density of the adult population) (Gucker, 2009). Seed

production in *H. lanatus* can be up to four times greater than that of native species in these habitats (Bennett et al., 2011). Seeds have high germination rates (frequently 90% or greater) (Gucker, 2009). *Holcus lanatus* can also produce seeds in its first year (Thomsen & D'Antonio, 2014).

Source: Published research, Informal publication

Q7: Innate Potential for Long-Distance Dispersal

Rating: No

Confidence: Low

Holcus lanatus seeds can be dispersed short distances by wind. A study in California found that most seeds fell within 17 feet of the parent plant. Animals may also disperse seeds, though they do not survive traveling through the digestive tract in all species. Seeds float easily and may be dispersed by water, though it is unknown how floating in water might affect seed viability (Gucker, 2009).

Source: Informal publication

Q8: Potential to be Spread by Human Activities

Rating: Yes

Confidence: High

Holcus lanatus was likely introduced to North America multiple times, both as a crop contaminant and as a forage species. Seeds can be moved by equipment, with mowing equipment particularly noted (Gucker, 2009; Conner et al., 2013).

Source: Informal publication

Q9: Allelopathy

Rating: Yes

Confidence: Moderate

Holcus lanatus is likely mildly allelopathic. Extracts from this species have been shown to reduce growth in both *H. lanatus* seedlings and the seedlings of other species (Gucker, 2009; Bennett et al., 2011).

Source: Published research, Informal publication

Q10: Competitive for Limiting Abiotic Factors

Rating: Yes

Confidence: High

Studies in California and the Pacific Northwest have found *Holcus lanatus* to be highly competitive. This species can crowd out both native and other introduced species where it occurs. Rapid growth of seedlings allows *H. lanatus* to quickly exclude other species when it colonizes new sites. It also creates thick litter which can prevent other species from establishing. This species can grow a higher proportion of roots to above ground biomass than many neighboring grass species, which also increases its competitive ability. In the winter, *H. lanatus* stores nutrients in its thick mat of roots (Gucker, 2009; Bennett et al., 2011; Conner et al., 2013).

Experimental studies in coastal prairies in California found that *H. lanatus* biomass was less affected by competition from neighboring plants. In contrast, other species in the study showed the greatest biomass reduction when planted with *H. lanatus* (Gucker, 2009). In another experimental study in California, direct competitive effects of *H. lanatus* had the greatest impact on co-occurring native forb *Erigeron glaucus* (Bennett et al., 2011).

Source: Published research, Informal publication

Q11: Growth Form

Rating: Yes

Confidence: High

Holcus lanatus is reported to form dense stands that exclude native species from several parts of its invasive range, including Hawaii, coastal California, and Willamette Prairie habitats in the Pacific Northwest (Gucker, 2009; Bennett et al., 2011) In California, concerns about this species center on its ability to form monocultural stands and reduce species diversity where it occurs (Ender et al., 2017). Restoration professionals in the Willamette Valley are also concerned about this species' ability to crowd out desirable species and reduce diversity in Willamette Prairie habitats.

Source: Published research, Informal publication, Professional expertise

Q12: Germination Requirements

Rating: No

Confidence: Moderate

Seeds germinate best in full light on the top of the soil, and a study in coastal prairie in California found much greater germination success for this species in areas without litter. However, the same study also found that *H. lanatus* had higher germination rates than co-occurring native grass species when all were buried under litter. Still, soil disturbance is frequently an important contributing factor in *H. lanatus* invasion, particularly in shaded or forested areas, and this species generally appears to require openings to induce germination (Gucker, 2009; Conner et al., 2013).

Source: Informal publication

Q13: Invasiveness of Other Plants in Genus

Rating: Yes

Confidence: Moderate

Holcus mollis also occurs in the Pacific Northwest and is predicted to expand throughout Washington, but this species is much less abundant at this time than *H. lanatus* (EDDMapS, 2023). The Washington Natural Heritage Program considers both species to be invasive for the purposes of Ecological Integrity Assessments (Rocchio et al., 2024).

Source: Reported observations and model predictions

Q14: Shade Tolerance

Rating: Moderate

Confidence: High

In western Oregon, *Holcus lanatus* is most abundant in open areas. At least one study in Oregon found that *Holcus lanatus* seedlings did not grow as well when shaded (Gucker, 2009). However, this species can still be found in shaded areas and will grow in forests if disturbances occur to promote colonization. For example, this species has been found in *Alnus rubra* stands along the Hoh River in Olympic National Park. In Oregon and Washington, this species can frequently occur with *A. rubra* in areas with a history of disturbance (Gucker, 2009).

One study in California coastal prairie found that shade structures or shading by nearby plants could improve survival of *H. lanatus* seedlings in disturbed areas where it co-occurred with native *Bromus carinatus*. Shade may increase soil moisture available to seedlings in prairies. In contrast, shade reduced survival of *H. lanatus* in disturbed areas where it co-occurred with native *Festuca* or *Calamagrostis* species. Perhaps light is a more important resource in competitive interactions with those species. The study authors suggest that treatments that increase light availability (e.g., mowing, grazing, burning) may increase *H. lanatus* abundance in some circumstances. Propagule pressure may increase the likelihood of this species expanding into shaded areas (Thomsen & D'Antonio, 2014).

Source: Published research, Informal publication, Professional expertise

Q15: Disturbance Tolerance

Rating: Yes

Confidence: High

Holcus lanatus is associated with disturbance throughout its range. Soil disturbance increases germination of this species and disturbance (or previous history of disturbance) may result in invasion by this species even in shaded forest conditions (Thomsen & D'Antonio, 2014). Soil disturbance from logging promotes establishment and/or increased cover of *H. lanatus. Holcus lanatus* was documented colonizing debris flows following the Mount St. Helens eruption (Gucker, 2009). A study in California suggests that large-scale disturbance is more likely to promote this species than small-scale disturbance (Thomsen & D'Antonio, 2014).

Grazing and trampling may reduce abundance of this species, but older plants can develop a tolerance for grazing. This species is likely killed by fire and establishes post-fire from the seed bank. In Washington this species has persisted in areas with

frequent (yearly) fire for over 50 years (Gucker, 2009).

Source: Published research, Informal publication

Q16: Propagule Persistence

Rating: >10 years

Confidence: Moderate

Seed banks may be important for *Holcus lanatus'* ability to colonize disturbed areas. Seeds are not innately dormant, but dormancy can be induced. At least one source reported that many seeds can remain viable in the soil for up to 12 years. Other sources report seed viability of only 1–4 years. *Holcus lanatus* produces abundant seeds, with one study reporting 16,900 seeds per meter square in samples from the top two inches of soil in a natural habitat (Gucker, 2009). Seeds are eaten by vertebrates and earthworms in this species' native range (Gucker, 2009; Conner et al., 2013).

Source: Informal publication

Q17: Palatability

Score: No, plant is palatable

Confidence: Moderate

Some sources regard *Holcus lanatus* as unpalatable or not preferred by grazers, but most literature suggests some degree of palatability. Grazing by both cattle and elk are known to reduce the abundance of this species. *H. lanatus* can provide up to 40% of a Tule elk's diet at Tomales Point, in California (Gucker, 2009). One study found that elk grazing at Tomales Point reduced *H. lanatus* abundance, cover, biomass, and seedling establishment in open grasslands (Ender et al., 2017). This species is also an important food source for elk near Mount St. Helens (Gucker, 2009). In addition, *H. lanatus* is eaten by birds and has become an important food source for California Quail (Gucker, 2009). Plants are at their most nutritious when vegetative (Gucker, 2009).

Source: Published research, Informal publication

Section 3: Ecological Impact

Q18: Impact on Ecosystem Abiotic Processes

Abiotic Processes: Fire, Nutrient dynamics

Rating: Low

Confidence: Low

Increased litter from *Holcus lanatus* could potentially change fuel loads and fire behavior. Litter accumulation also reduces germination of native grasses (Gucker, 2009). This species can also increase nitrogen content in the soil. (Bennett et al., 2011). *Holcus lanatus* changes soil communities, increasing bacteria, decreasing mycorrhizal fungi, and reducing detritivores. These effects on the soil community (particularly reduction of mycorrhizal fungi) continue, and can have larger effects on the plant community, even after removal of *H. lanatus* populations (Bennett et al., 2011).

Source: Published research, Informal publication

Q19: Impact on Ecosystem Structure

Rating: Low

Confidence: Moderate

In a study from Europe, *Holcus lanatus* was able to limit the growth of seedling birch trees, but it is unknown if this species can outcompete tree seedlings in the Pacific Northwest. Production of abundant litter can reduce available habitat for co-occurring species to germinate in (Gucker, 2009).

Source: Informal publication

Q20: Impact on Ecosystem Composition

Rating: High

Confidence: Moderate

When left untreated, *Holcus lanatus* populations can outcompete neighboring vegetation and will significantly reduce community biodiversity (Conner et al., 2013). This species changes soil communities, increasing bacteria, decreasing mycorrhizal fungi, and reducing detritivores. These effects on the soil community (particularly reduction of mycorrhizal fungi) continue, and can have larger effects on the

plant community, even after removal of *H. lanatus* populations. For example, a study in California coastal prairie found *Erigeron glaucas*, a native forb, still experienced lower growth rates in areas where *H. lanatus* had been removed, likely because of the changes to the microbial community (Bennett et al., 2011).

Holcus lanatus is part of a suite of introduced perennial grasses that reduce diversity of native plants in Willamette Prairie communities.

Source: Published research, Informal publication, Professional expertise

Q21: Impact on Particular Native Species

Rating: Low

Confidence: Low

Holcus lanatus is part of a suite of introduced perennial grasses that threaten rare butterflies such as the Taylor's Checkerspot and Mardon Skipper that depend on open prairie-oak grasslands and savannas for habitat. *Holcus lanatus* can crowd out or hide host species important for butterfly larvae (Schultz et al., 2011).

Source: Published research, Professional expertise

Q22: Observed Ability to Invade Undisturbed Ecosystems

Rating: Moderate

Confidence: Moderate

Holcus lanatus can invade at least some grasslands without disturbance to aid establishment (e.g., *Bromus carinatus* dominated areas in California's coastal prairies) (Thomsen & D'Antonio, 2014). Seed banks for this species can be extensive in both disturbed and undisturbed sites throughout its range, and increase in propagule pressure can increase likelihood of establishment in undisturbed areas (Gucker, 2009; Thomsen & D'Antonio, 2014).

Source: Published research, Informal publication

Q23: Observed Ability to Invade Naturally Disturbed Ecosystems

Rating: Yes

Confidence: High

Holcus lanatus establishes in naturally disturbed areas in California's coastal prairies (Thomsen & D'Antonio, 2014) and is a common invader in Garry oak woodlands, Willamette Prairie, and other grasslands in the Pacific Northwest (Gucker, 2009). Grasslands and woodlands in wet climates like western Washington, are maintained by disturbances like fire and grazing.

Source: Published Research, Informal Publication, Professional Expertise

Section 4: Management Difficulty

Q24: General Management Difficulty

Rating: Moderate

Confidence: Moderate

Management suggestions for *Holcus lanatus* focus on removal and monitoring to prevent re-establishment from the seed bank. The large amount of seed produced may make this species difficult to control. Hand-pulling or hoeing plants is highly effective (Conner et al., 2013). Tilling larger populations may have a similar effects, though at least one source recommended turning the soil to a 14 inch depth to prevent recolonization from the seedbank (Gucker, 2009)—such intense soil disturbance is not practical in ecosystems that retain native plants. Removal of above ground biomass through fire, mowing, or grazing can be successful, but must be timed to prevent reproduction. If mechanical treatments like mowing or tilling are used, equipment needs to be cleaned to prevent moving seed. Correctly timed herbicide applications can also be effective, and *H. lanatus* is vulnerable to several herbicides. Some of these herbicides have wide-ranging effects on a broad suite of species, but this species' distinctive appearance may make it relatively easy to target (Gucker, 2009; Conner et al., 2013).

In California, *H. lanatus* is regarded as a severe threat to coastal prairies (Bennett et al., 2011), but generally, this species is a larger problem in western Oregon and

Washington grasslands than it is in California (Conner et al., 2013).

Source: Published research, Informal publication

Q25: Minimum Time Commitment

Rating: High

Confidence: Low

Minimum time commitments for treating *Holcus lanatus* invasions were not reported in available literature, but seed longevity suggests that it could take at least 10 years to exhaust the seed bank. Ongoing monitoring coupled with restoration of native plant communities are needed to prevent recolonization (Gucker, 2009; Conner et al., 2013).

Source: Informal publication, Professional expertise

Q26: Impacts of Management on Native Species

Rating: High

Confidence: High

At least some of effective treatments for *Holcus lanatus* may be highly disruptive to co-occurring native species. For example, deep soil-tilling can result in loss of seed banks and propagules for native species. At least some of the effective herbicides for *Holcus lanatus* also affect a broad range of other plant species (Conner et al., 2013), which can also result in long-term changes to native plant communities.

Source: Informal Publication, Professional Expertise

Q27: Inaccessibility of Invaded Areas

Rating: Low

Confidence: Moderate

Holcus lanatus is likely to be spread to new locations by human activity and most of the records for this species are from populated areas in western Washington, suggesting that most invaded areas are relatively accessible (Gucker, 2009; CPNWH, 2023; iNaturalist Contributors, 2023).

Source: Informal publication, Professional expertise, herbarium records and other observations

Q28: Sociopolitical Implications of Management

Rating: Insignificant

Confidence: Moderate

Public objection to treatment is unlikely, beyond broad concerns about herbicide application.

Source: Professional expertise

Additional Comments

None

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