

# Washington Invasive Ranking System

Washington Natural Heritage Program

## *Cynoglossum officinale* (Houndstongue)

Assessed by

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Ecological Impact Rank: **Moderate** (60)

Confidence: **Moderate** (42)

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Management Difficulty Rank: Moderate (58)

Confidence: Moderate (60)

Biological Characteristics of Invasiveness: High (77)

Confidence: High (79)

Concern Related to Distribution and Abundance: High (78)

Confidence: High (90)

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### Ranking Notes

*Cynoglossum officinale* was assessed by multiple individuals. Range of assessor ratings is provided in parentheses following the final assigned rating.

This plant is considered rare in parts of its native range (Williams & Fishman, 2014). Much of the

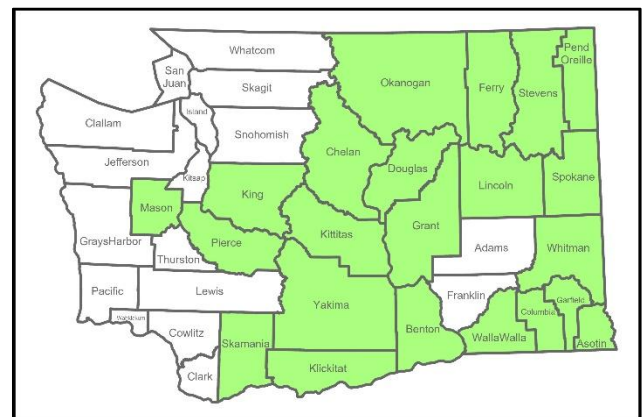
biological and ecological information available for this species is from its native range (Europe and western Asia). Data and observations from native versus introduced ranges are distinguished, where possible.

### Legal Listings

[Washington State Weed Board](#): Class B

[Washington Invasive Species Council](#): No

### Section 1: Distribution and Abundance



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

### **Q1: Current Range Size in Washington**

Rating: High

Confidence: High

*Cynoglossum officinale* is found in 56% 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, *Cynoglossum officinale* is increasing its range in the ecoregions surrounding the Columbia Plateau, particularly in the East Cascades and Blue Mountains. This species' range is also expanding to a lesser extent in the Puget Trough (CPNWH, 2023; iNaturalist Contributors, 2023). Models predict that at least some areas of Washington State do not have suitable habitat for this species (EDDMapS, 2023).

Source: Herbarium records and other observations.

### **Q3: Proportion of Potential Range Currently Unoccupied**

Rating: Low

Confidence: Moderate (range Moderate - High)

Models predict that while available range for *Cynoglossum officinale* will expand to the northwest portion of the state (Snohomish, Skagit and Whatcom Counties), overall *C. officinale* will experience a range contraction in Washington, particularly in the southwest and southeast. Future abundance of *C. officinale* is expected to be concentrated in northeastern Washington (EDDMapS, 2023).

Source: Model predictions.

### **Q4: Local Range Expansion or Change in Abundance**

Rating: Moderate (range High - Moderate)

Confidence: High (range Moderate - High)

Over the last 20 years, *Cynoglossum officinale* abundance and local range appears to have increased east of the Cascades, and increased rapidly in the eastern half of the Columbia Plateau and Okanogan Highlands (CPNWH, 2023; iNaturalist Contributors, 2023).

Source: Professional expertise

### **Q5: Diversity of Ecosystems Invaded**

Ecosystem types: Semi-Desert (includes Shrub-steppe), Forested Wetland, Forest & Woodland, Grassland & Shrubland, Emergent Open Wetland

Rating: High

Confidence: Moderate

Little published information was available on the diversity of ecosystems invaded by *Cynoglossum officinale* in Washington. In its native range (Europe and western Asia), this species is found in open woodlands, meadows, dunes, and in marginal places near agricultural fields and other human disturbances. In North America, *C. officinale* is found in dry rangeland, grasslands, open woodlands and shrublands, and riparian areas, and is most abundant in highly disturbed areas such as clearcuts and grazed areas. This species is frequently associated with disturbed and ruderal habitats throughout its native and introduced ranges. Habitats and range may be limited by summer temperatures rather than winter cold (de Jong et al., 1990; Jacobs & Sing, 2007; Williams & Fishman, 2014; Momayyezi & Upadhyaya, 2017). One of the assessors reports encountering this species in upland shrub-steppe habitats as well as riparian areas.

In its native range, *C. officinale* prefers calcium rich basic soils and is frequently found on limestone and chalk substrates. Acidic soils may limit growth, even where calcium is abundant (de Jong et al., 1990). In its introduced range, this species can be found in rocky, sandy, loamy, or calcareous soils (Jacobs & Sing, 2007). In some areas *C. officinale* can be an indicator of drought or high soil nitrogen, and while this species is known to occur in riparian areas in both its native and introduced ranges, it does not survive in

waterlogged soil (de Jong et al., 1990; Jacobs & Sing, 2007; Williams & Fishman, 2014).

In its native range, *C. officinale* frequently co-occurs with other species that are exotic or invasive in the northwestern U. S., including *Ammophila arenaria*, *Cirsium arvense*, *C. vulgare*, *Jacobaea vulgaris*, *Rumex crispus*, *Solanum dulcamara*, *Arrhenatherum elatius*, *Sonchus arvensis*, *Carduus nutans*, *Myosotis arvensis*, *Geranium molle*, *Mycelis muralis*, *Brachypodium sylvaticum*, and *Verbascum thapsus* (de Jong et al., 1990).

Source: Professional expertise, Herbarium records and species treatment

## Section 2: Biological Characteristics

### Q6: Aggressive Mode of Reproduction

Rating: Yes

Confidence: Low

*Cynoglossum officinale* is a biennial or short-lived perennial. In its native range, this species is usually monocarpic, but up to 20% of plants in its introduced range will flower in multiple years (Williams & Fishman, 2014). This may be due to release from specialist herbivores (Duncan & Williams, 2020). *Cynoglossum officinale* can delay flowering until conditions are favorable for reproduction (de Jong et al., 1990). This effectively creates a “bud bank” that helps plant populations survive years that are poor for seed production or seed germination (de Jong & Klinkhamer, 1988).

In its native range, one study found this species produced between 174–1823 seeds, with an average of 944 seeds per plant. Other studies report 306–1500 seeds per plant (de Jong et al., 1990). Larger plants produce more seeds per flower, and individual plants can produce up to 4000 seeds (Klinkhamer & de Jong, 1987). *Cynoglossum officinale* produced few seeds in pollinator exclusion experiments, and likely requires buzz pollination, suggesting that bumblebees are the most efficient pollinators for this species. Seed production can be limited by both pollinators and resource availability (de Jong et al., 1990). Fresh seeds have an estimated viability of 90%, and

seedlings also have a high rate of establishment, in part because of the maternal provisions provided by large seeds (Jacobs & Sing, 2007).

Iteroparity (reproducing in multiple years) appears more common in Idaho and Montana than in Washington. High winter precipitation can increase flowering and seed set. *Mogulones cruciger*—a weevil approved for use as a biocontrol of *C. officinale* in Canada—reduces flowering and seed set (Duncan & Williams, 2020).

Source: Published research, Informal publication, Professional expertise

### Q7: Innate Potential for Long-Distance Dispersal

Rating: Yes

Confidence: High

*Cynoglossum officinale* seeds are covered in barbs that attach to animals or humans and can be transported for long distances. However, seeds are large and heavy, and are usually found within 2 meters of the parent plant (de Jong et al., 1990).

Source: Published research, Professional expertise

### Q8: Potential to be Spread by Human Activities

Rating: Yes

Confidence: High

*Cynoglossum officinale* was likely transported to North America as a crop contaminant (Jacobs & Sing, 2007). This species also has an attractive flower and could potentially be spread as an ornamental. Seeds are very likely to be spread in clothes and the fur of domestic animals. In British Columbia one study found that 65% of seeds were dispersed by cattle (Jacobs & Sing, 2007). *Cynoglossum officinale* is frequently associated with human disturbances such as logging and heavy grazing (Andreas et al., 2008).

Source: Published research, Informal publication, Professional expertise

### Q9: Allelopathy

Rating: Yes

Confidence: High



One study found that leachate from *Cynoglossum officinale* seeds inhibited root growth in seedlings of other species (native and invasive), but not in *C. officinale*. Heat-killed seeds also exhibited allelopathic effects on neighboring seedlings (Rashid et al., 2005). Leachate from the leaves can also have an allelopathic effect on neighboring plants (Momayyezi & Upadhyaya, 2017).

Source: Published research

#### **Q10: Competitive for Limiting Abiotic Factors**

Rating: Yes (range Yes - No)

Confidence: High (range Low - High)

*Cynoglossum officinale* grows a long, thick taproot and develops mycorrhizal relationships that likely increase its ability to compete with other species for water and nutrients. The taproot also functions as a storage organ for the plant when it dies back to the roots in the winter (de Jong et al., 1990). A study in British Columbia found that *C. officinale* is competitive for water against co-occurring grassland species during drought (Momayyezi & Upadhyaya, 2017). Large seeds provision seedlings so they can establish strong roots after germination (de Jong et al., 1990) providing an edge over co-occurring species, though *C. officinale*'s relatively slow growth may reduce competitive advantages (Jacobs & Sing, 2007).

Genetic studies suggest that *C. officinale* populations in North America come from plants that grew on the edge of agricultural fields in this species' native range. The traits for surviving at the edge of agricultural fields might also make *C. officinale* more competitive in its introduced range (Williams & Fishman, 2014). Comparisons of populations in northwestern North America to native populations also suggest that introduced plants benefit from specialist insect release and less aggressive competition at the seedling stage (Williams et al., 2010; Duncan & Williams, 2020).

Source: Published research, Informal publication, Professional expertise

#### **Q11: Growth Form**

Rating: Yes

Confidence: Moderate

*Cynoglossum officinale* can form monocultural stands that exclude other vegetation (Jacobs & Sing, 2007). Seedlings tend to cluster around their parent plants (de Jong et al., 1990). A study comparing *C. officinale* populations between Montana and Germany found that populations in the introduced range were more dense than populations in the native range (Williams et al., 2010).

Source: Published research, Informal publication, Professional expertise

#### **Q12: Germination Requirements**

Rating: No

Confidence: Moderate

Studies from Dutch sand dunes found that experimental small-scale disturbances resulted in an increase of *Cynoglossum officinale* seedlings the next spring (Klinkhamer & de Jong, 1988). In disturbance experiments done in Montana, seedlings were much less likely to survive in undisturbed plots than disturbed plots (Williams et al., 2010).

Source: Published research

#### **Q13: Invasiveness of Other Plants in Genus**

Rating: Yes

Confidence: High

*Cynoglossum creticum* is on the non-native species Alert List in Australia (Weber & Panetta, 2006). *Cynoglossum lanceolatum* is considered invasive in parts of India (Sheikh & Dixit, 2017).

Source: Published research

#### **Q14: Shade Tolerance**

Rating: Moderate

Confidence: Moderate

*Cynoglossum officinale* can grow in moderate shade, particularly in riparian areas disturbed by cattle. However, it grows best in full sunlight, and prefers



open habitats (de Jong et al., 1990; Jacobs & Sing, 2007).

Source: Published research, Informal publication, Professional expertise

#### **Q15: Disturbance Tolerance**

Rating: Yes

Confidence: High

*Cynoglossum officinale* is frequently associated with disturbed and ruderal areas in both its native and introduced range. Disturbance increases establishment, growth, and recruitment in this species. For example, in its native range, *C. officinale* is known to increase in abundance after sheep grazing. In its introduced range, this species is usually found in clearcuts, pastures, grazed rangelands, and other heavily disturbed sites. (Klinkhamer & de Jong, 1988; Jacobs & Sing, 2007; Andreas et al., 2008; Williams & Fishman, 2014).

*Cynoglossum officinale* has a large taproot that can function as a storage organ. This species also has growing points that are at or just below the soil surface (Jacobs & Sing, 2007), suggesting that established plants may survive low or moderate severity fires. However, severe annual soil disturbance would not benefit this species, since it needs at least two years to reach reproductive age.

Source: Published research, Informal publication, Professional expertise

#### **Q16: Propagule Persistence**

Rating: <5 years

Confidence: High

*Cynoglossum officinale* seeds generally persist only 2-3 years. Seeds are initially dormant, and stratification is required for germination. The presence of soil nitrate improves germination, and seeds are much more likely to germinate below ground than on the surface (de Jong et al., 1990). Seeds can remain attached to the parent plant for a relatively long time, creating a temporary above-ground seed bank (de Jong & Klinkhamer, 1988).

Source: Published research

#### **Q17: Palatability**

Rating: Yes, plant is unpalatable

Confidence: High

*Cynoglossum* has a number of physical and chemical defenses against herbivory. This species accumulates silicon in leaves, roots, and nutlets, which can make it more difficult for herbivores to chew and digest. It also produces alkaloids which can intoxicate or poison horses and cows when consumed, and in general, horses and cows won't eat *C. officinale*. It produces other defensive compounds to prevent herbivory as well. Rabbits also do not eat this species. Sheep will occasionally eat *C. officinale*, but may also be poisoned by it (de Jong et al., 1990; Cortinovic & Caloni, 2015).

*Cynoglossum officinale* may experience less insect herbivory in North America than in its native range (Eigenbrode et al., 2008). Some European butterfly species are able to repurpose *C. officinale*'s defensive chemicals for their own defense (de Jong et al., 1990). In the Pacific Northwest, at least some species of woolly bear caterpillars (Subfamily *Arctiini*) will eat *C. officinale*.

Source: Published research, Professional expertise

### **Section 3: Ecological Impact**

#### **Q18: Impact on Ecosystem Abiotic Processes**

Abiotic Processes: Nutrient dynamics

Rating: Moderate

Confidence: Low

Very little information was found regarding *Cynoglossum officinale*'s effects on abiotic processes. One study that compared populations of *C. officinale* in Montana to populations in similar habitats in Germany found that experimentally disturbed areas in Montana had greater nitrogen content and lower colonization rates from species in the surrounding community than did experimentally disturbed habitats in Germany (Williams et al., 2010). It is

unclear whether *C. officinale* was the cause of these conditions, or merely taking advantage of them.

Source: Published Research

### **Q19: Impact on Ecosystem Structure**

Rating: Low

Confidence: Moderate

*Cynoglossum officinale* is toxic to mammals and can prevent the establishment of desired forage species in its introduced range (Andreas et al., 2008). Disturbed sites with *C. officinale* have slower recruitment of other species (Williams et al., 2010). However, *C. officinale* populations tend not to persist over time. In its native range, this species exhibits metapopulation dynamics (that is, individual populations will go extinct while other habitat patches are recolonized). Combined with ongoing management in its introduced range, individual populations of this species may be unstable and not produce lasting structural impacts (Duncan & Williams, 2020).

Source: Published research

### **Q20: Impact on Ecosystem Composition**

Rating: Moderate

Confidence: Moderate

*Cynoglossum officinale* can outcompete native species and reduces rangeland quality for both livestock and wildlife (Jacobs & Sing, 2007).

Plant species with significant chemical defenses against herbivory, like *C. officinale*, may have associational effects on their neighbors, and can either increase or decrease herbivory pressure on native species.

Source: Informal publication, Professional expertise

### **Q21: Impact on Particular Native Species**

Rating: Unknown

Confidence: Not Rated

No information was found about disproportionate direct effects of *Cynoglossum officinale* on particular native species in Washington. However, biocontrol

agents are not currently approved for use on this species in the U.S. because of concerns about spillover effects on co-occurring native *Boraginaceae* species in the U.S. (Duncan & Williams, 2020). One of the assessors has observed what are likely illegally introduced populations of one of these biocontrol agents (a weevil) growing in abundance near Cle Elum.

Source: Published research, Professional expertise

### **Q22: Observed Ability to Invade Undisturbed Ecosystems**

Rating: Moderate

Confidence: Moderate

*Cynoglossum officinale* establishes in areas that experience localized disturbance, and likely needs bare ground for seeds to germinate on (de Jong et al., 1990). This species is not likely to establish in undisturbed areas, but could take advantage of small-scale disturbances in mid or late successional habitats with appropriate light and moisture conditions.

Source: Published research, Professional expertise

### **Q23: Observed Ability to Invade Naturally Disturbed Ecosystems**

Rating: Yes

Confidence: High

*Cynoglossum officinale* often establishes in small-scale disturbed areas, like the entrances of rabbit warrens, in its native habitat (de Jong et al., 1990). In its introduced range, ground squirrels, gophers, and other burrowers can provide similar natural disturbances. This species also appears to be more responsive to disturbance in its introduced range than its native range (Williams et al., 2010). *C. officinale* is also common on riparian terraces, particularly where occasional flood disturbance is combined with heavy grazing.

Source: Published research, Professional expertise

## Section 4: Management Difficulty

### Q24: General Management Difficulty

Rating: Moderate

Confidence: Moderate (range Moderate - High)

Both manual and chemical management techniques are effective in treating this species, though population mapping and treatment timing are important. Management should target seed production to prevent spread and recruitment. Herbicides, mowing, tilling, and prescribed fire can all be effective at reducing seed set. Herbicide application can make this species more palatable to livestock, increasing risks of poisonings. Manual removal should include removing root crowns to prevent resprouting, and care should be taken to prevent seed fall when pulling senesced plants. Management techniques that result in disturbance, such as burning or tilling, could also provide improved habitat for *C. officinale* colonization (Jacobs & Sing, 2007). Restoration of native vegetation communities (particularly perennial grasses) can prevent this species from colonizing or recolonizing areas.

A root-boring weevil, *Mogulones cruciger*, was approved for release as a biocontrol agent in Canada in 1997 and has significantly reduced *C. officinale* populations in British Columbia. These weevils reduce seed production by depleting stored food and limiting the ability to uptake water and nutrients from the soil (Duncan & Williams, 2020). *Mogulones cruciger* is not approved for release in the U.S. due to potential spillover effects on rare native species in the same family as *C. officinale* (Jacobs & Sing, 2007). However, populations of this weevil have migrated into the U.S., and low population numbers that result from natural migration could potentially select for weevil-resistant *C. officinale*, ultimately reducing the effectiveness of this particular biocontrol in the U.S. (Duncan & Williams, 2020).

This weevil may also have been illegally released in parts of Washington—where it is found, it appears to have reduced the population of *C. officinale*. However, even where this weevil is present and

effective, dormant *C. officinale* seeds may lead to reappearance of the species.

Source: Published research, Informal publication, Professional expertise

### Q25: Minimum Time Commitment

Rating: Moderate

Confidence: Moderate

None of the sources reviewed mentioned a minimum time commitment for treating *Cynoglossum officinale*. However, it seems likely that active treatment efforts need to extend long enough to exhaust the seed bank for this species, a minimum of two to three years (de Jong et al., 1990). Dormant seeds are known to re-establish populations in treated areas in Washington. Given this, ongoing monitoring coupled with restoration of native plant communities that can outcompete this species are likely necessary to prevent recolonization.

Source: Published research, Professional expertise

### Q26: Impacts of Management on Native Species

Rating: Moderate (range Low - Moderate)

Confidence: Moderate (range Low - High)

Ongoing concerns about spillover effects of biocontrols on co-occurring native plants in the *Boraginaceae* family has prevented their approval in the U.S. (Duncan & Williams, 2020).

Several other techniques, particularly soil-tilling and broadcast herbicide spraying, can also have outsized effects on native communities, and soil disturbance without associated restoration may increase *C. officinale* abundance. Spot-spraying and dicot specific herbicides can reduce the impacts of herbicide treatments.

Source: Published research, Professional expertise

### Q27: Inaccessibility of Invaded Areas

Rating: Low

Confidence: Moderate



*Cynoglossum officinale* is most abundant in areas of human disturbance, particularly logging and heavy grazing (Andreas et al., 2008), suggesting populations are frequently in areas that are accessible for treatment.

Source: Published research, Professional expertise

**Q28: Sociopolitical Implications of Management**

Rating: Insignificant

Confidence: High

*Cynoglossum officinale* reduces the value of pasture and rangelands, and is poisonous to livestock, as well as reducing value of agricultural products like wool (Jacobs & Sing, 2007). Sociopolitical implications of management of this species are generally low, beyond general objections to herbicide use.

Source: Informal Publication, Professional Expertise

**Additional Comments**

None

**References**

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