Washington Invasive Ranking System

Washington Natural Heritage Program

Cirsium arvense (Canada Thistle)

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Ecological Impact Rank: **High** (75) Confidence: **Moderate** (58)

Management Difficulty Rank: Moderate (58)	Confidence: High (80)
Biological Characteristics of Invasiveness: High (80)	Confidence: High (83)
Concern Related to Distribution and Abundance: Low (49)	Confidence: High (90)

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Ranking Notes

Cirsium arvense was assessed by multiple individuals. Range of assessor ratings is provided in parentheses following the final assigned rating.

Legal Listings

Washington State Weed Board: Class C

Washington Invasive Species Council: No

Section 1: Distribution and Abundance

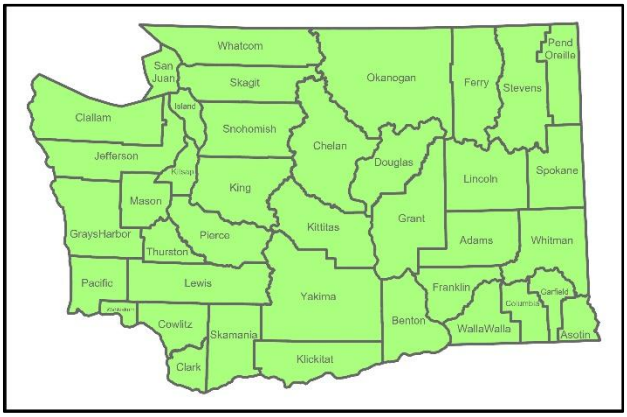

Figure 1. Distribution of counties where *Cirsium arvense* has been documented in Washington State (WSDA, 2018; CPNWH 2023; EDDMapS, 2023; iNaturalist Contributors, 2023).

Q1: Current Range Size in Washington

Rating: High

Confidence: High

WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES

Cirsium arvense has been documented in all 39 counties in Washington State (WSDA, 2018; CPNWH, 2023; EDDMapS, 2023; iNaturalist Contributors, 2023).

Source: Professional expertise, Herbarium records and other observations

Q2: Current Trend in Total Range

Score: Low

Confidence: High

Cirsium arvense is reported from all counties in Washington (CPNWH, 2023; EDDMapS, 2023; iNaturalist Contributors, 2023). This species appears to occur in almost all of the suitable generalized habitat available in Washington (Jarnevich et al., 2023).

Source: Professional expertise, Herbarium records and other observations, U.S.G.S. data set

Q3: Proportion of Potential Range Currently Unoccupied

Rating: Insignificant (range Insignificant - Low)

Confidence: High

Cirsium arvense is reported from all counties in Washington (CPNWH, 2023; EDDMapS, 2023; iNaturalist Contributors, 2023) and it is likely already present in most suitable ecoregions, counties, and watersheds.

Source: Professional expertise, Herbarium records and other observations, Model predictions.

Q4: Local Range Expansion or Change in Abundance

Rating: Insignificant (range Insignificant - Moderate)

Confidence: Moderate (range Low - Moderate)

Areas of disturbance like roadsides, recently logged areas, or construction sites are readily colonized, and once established, populations can grow rapidly if not controlled. As of 2000, *Cirsium arvense* populations were increasing by 10% annually in the northwest (Zouhar, 2001). Based on herbarium records, populations of this species are remaining stable in Washington, and models predicted they will remain stable in the future (CPNWH, 2023; EDDMapS, 2023).

Source: Informal Publication, Professional Expertise, Herbarium records, model predictions

Q5: Diversity of Ecosystems Invaded

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

Rating: High (range Moderate - High)

Confidence: High

Cirsium arvense can be found in almost every upland ecosystem within its range, though it is most likely to be found in prairie or riparian habitats, vernal pools and wet meadows in shrub-steppe systems, or in areas of recent disturbance. In the Pacific Northwest, *C. arvense* is rarely found in undisturbed forests, but readily colonizes forests and woodlands after human or natural disturbances (Zouhar, 2001; CABI, 2024; GISD, 2024; NatureServe, 2024).

Source: Informal publication, Professional expertise, Herbarium records and species treatment.

Section 2: Biological Characteristics

Q6: Aggressive Mode of Reproduction

Rating: Yes

Confidence: High

Cirsium arvense primarily reproduces via vegetative propagation and can rapidly produce dense clonal stands. This species does not produce rhizomes but can produce adventitious root buds at any time of year. Plants can grow from small (6mm long) root fragments (Zouhar, 2001).

Cirsium arvense is the only dioecious species of *Cirsium*. Female plants can produce more than 1000 seeds/plant (Zouhar, 2001). One study in California found 280 (+/- 110) viable *C. arvense* seeds per m^2 in the top 2 cm of soil (Hobbs & Mooney, 1986). However, a study in New Zealand did not find any seedlings over three years of survey efforts, despite viable *C. arvense* seeds being present in the seed bank (Leathwick & Bourdôt, 2012), suggesting that high seed production doesn't necessarily lead to significant population growth in this species.

Cirsium arvense requires 15 hours of daylight to induce flowering, are "imperfectly dioecious" (male plants sometimes produce seeds), and require insect pollination. The major pollinators for this species appear to be honeybees. Extreme heat or cold can inhibit pollination, and seeds are subject to seed predation, which can lead to variable seed set between years (Zouhar, 2001). Since *C. arvense* is an obligate outcrosser, seed production may be more important for maintaining genetic diversity and adaptability in populations than for contributing to population growth or colonization. Even if seed production does not contribute significantly to population growth, *C. arvense* reproduces aggressively via vegetative propagules.

Source: Published research, Informal publications, Professional expertise

Q7: Innate Potential for Long-Distance Dispersal

Rating: Yes

Confidence: High

Cirsium arvense produces lightweight seeds with a feathery pappus for wind dispersal. Evidence from Washington shows *C. arvense* seeds are capable of dispersing more than 1 km. However, the seeds frequently break off from the pappus, so wind may not be the main dispersal mechanism for seeds (Zouhar, 2001). The majority of seeds are deposited near the parent plants (Leathwick & Bourdôt, 2012), suggesting this species may only have moderate ability for natural long-distance dispersal. Seeds are not particularly adapted for attachment to animals, though they may stick to some degree (as can many other types of seeds), facilitating longer distance dispersal. Some publications indicate at least some seeds can survive passing through the digestive tracts of some birds, which can also facilitate long-distance dispersal (DiTomaso et al., 2013; CABI, 2024).

Source: Published research, Informal publication, Professional expertise

Q8: Potential to be Spread by Human Activities

Score: Yes

Confidence: High

Cirsium arvense seeds and plant fragments are very likely to be spread by human activities, particularly by movements of livestock, hay, contaminated crop seeds, soil, and machinery (Zouhar, 2001; CABI, 2024).

Source: Informal publication, Professional expertise

Q9: Allelopathy

Rating: Yes

Confidence: Low

Allelopathy is suspected, but has not been reliably demonstrated in *Cirsium arvense* (Zouhar, 2001). Published research is contradictory, with some studies finding allelopathic effects (Stachon & Zimdahl, 1980). A literature search found a few recent small-scale studies of allelopathy in *C. arvense* since 2001, but data on allelopathy, particularly under natural conditions and outside of agricultural systems, appears to be limited, and one recent study suggested that *C. arvense* might not have allelopathic effects. Researchers have also found that several plant species grown in media inoculated with soil from sites invaded by *C. arvense* showed better growth than when the same species were raised in soil from areas not invaded by *C. arvense* (Verbeek & Kotanen, 2019).

Source: Published research, Informal publication

Q10: Competitive for Limiting Abiotic Factors

Rating: Yes

Confidence: High

Cirsium arvense can reduce crop yields, outcompeting its neighbors for moisture, light, and nutrients (Moore, 1975). This species can metabolize fructans, allowing it to grow at cooler temperatures than other plants (Zouhar, 2001). A common garden experiment done in the Czech Republic comparing the growth and fitness of *C. arvense* from Europe to North American populations found that the populations from North America were more competitive for resources than native populations (Abela-Hofbauerová & Münzbergová, 2011).

However, *C. arvense* establishment can be prevented by seeding aggressive perennial grasses (e.g., introduced species such as crested wheatgrass, orchard grass, or smooth brome) (Zouhar, 2001). This and other reports of *C. arvense* being vulnerable to competition may hinge on the species shade intolerance, particularly as seedlings, though herbivory may also reduce competitive advantages for this species (Leathwick & Bourdôt, 2012).

Cirsium arvense's above-ground mass generally dies off after frost. However, *C. arvense* can use its roots as storage organs, enabling it to better survive disturbances such as fire and mowing, and to survive cold temperatures. These roots are generally short lived (a year or so), and likely influence the abundance and success of the next year's growth (Leathwick & Bourdôt, 2012).

Source: Published research, Informal publication, Professional expertise

Q11: Growth Form

Score: Yes

Confidence: High

Cirsium arvense's vegetative mode of reproduction frequently results in dense clonal stands (Zouhar, 2001). Seedlings may not be competitive for sunlight, however (Leathwick & Bourdôt, 2012), and this species can allow significant sunlight through its canopy.

Source: Published research, Informal publication, Professional expertise

Q12: Germination Requirements

Rating: No

Confidence: Moderate

Cirsium arvense has low-to-moderate ability to propagate in undisturbed systems and does not compete well for light when establishing. Thus, bare ground is relatively important for establishment from seed. This species is occasionally found in undisturbed areas, but this is likely because *C. arvense* is able to take advantage of small disturbance such as rodent burrows or frost heave to establish from seed. Its seeds can germinate under a wide variety of conditions, but seedlings do not survive shading (Moore, 1975; Zouhar, 2001). However, vegetative reproduction is much more important to this species, and seeds probably have limited contribution to the spread of *C. arvense* (Moore, 1975; Zouhar, 2001).

Source: Published research, Informal publication, Professional expertise

Q13: Invasiveness of Other Plants in Genus

Rating: Yes

Confidence: High

Other species in this genus (e.g., *Cirsium vulgare*) are invasive in Washington (NWCB, 2024a). *Cirsium palustre* (marsh thistle) is invasive throughout the Midwest and Canada, including in BC (Gucker, 2009). In addition, other closely related genera in the Cardueae tribe (such as *Onopordum*, *Carduus*, *Centaurea*) contain well-known invasive species.

Source: Informal publications, Professional expertise

Q14: Shade Tolerance

Score: Low/Insignificant

Confidence: High

Cirsium arvense seedlings are poor competitors due to their low shade tolerance; in general, the species is most successful in sunny sites. Once established it can persist for a time under shade and can exist in a partially shaded condition seemingly indefinitely. Plants will grow to an unusual size when shaded and have been observed to grow to over 7 feet tall when shaded by thick snowberry and other shrubs. This species can also be found under closed deciduous canopies (e.g., quaking aspen) which likely receive more sunlight than closed conifer canopies. Post-fire studies have documented reductions in cover of *C. arvense* as tree cover increases (Zouhar, 2001). Mature plants produce fewer flowers in shaded areas (Moore, 1975).

Source: Published research, Informal publication, Professional expertise

Q15: Disturbance Tolerance

Rating: Yes

Confidence: High

Cirsium arvense is an early successional species and appears in communities shortly after disturbances such as logging, fire, volcanic eruptions (e.g., debris deposits and landslides), grazing, and road building. This was one of the first species to recolonize disturbed areas after Mt. St. Helens erupted. This species uses its roots as storage organs, which is a common trait in plant species adapted to above-ground disturbances such as fire, and in fact *C. arvense* roots are known to survive even severe fires. *Cirsium arvense* can also re-establish after discing and herbicide treatment (Zouhar, 2001).

Source: Informal publication, Professional expertise

Q16: Propagule Persistence

Rating: >10 years

Confidence: Moderate

While deeply buried seeds have occasionally been documented to survive longer than 20 years, most studies have found that *C. arvense* seeds do not have a dormancy period. On average, *C. arvense* seeds last for less than 5 years in the seed bank. Most seeds germinate in the first year (Zouhar, 2001; DiTomaso et al., 2013). Storage roots are generally short-lived (a year or so) (Leathwick & Bourdôt, 2012), but it can take 5-10 years of eradication efforts to exhaust vegetative propagules in a treatment area (Zouhar, 2001).

Source: Published research, Informal publication, Professional expertise

Q17: Palatability

Score: Yes, plant is unpalatable

Confidence: High

While some species may eat *Cirsium arvense*, it is generally thought of as a grazing increaser and is not considered palatable to livestock (Zouhar, 2001; DiTomaso et al., 2013; CABI, 2024). This plant requires thick gloves to pull because of its spines, so animals are likely to find less well-defended plants to eat.

Source: Informal publication, Professional expertise

Section 3: Ecological Impact

Q18: Impact on Ecosystem Abiotic Processes

Abiotic Processes: Light availability, Hydrology, Fire, Nutrient dynamics

Rating: Moderate (range Insignificant - Moderate)

Confidence: Moderate

Cirsium arvense's thick root system may stabilize some banks when growing in riparian areas. This plant typically grows in relatively mesic areas. In Canada, *C. arvense* has been shown to increase fire frequency when it occurs in boreal wet meadows (Hogenbirk, 1995 as cited by Zouhar, 2001).

Research also suggests that *C. arvense* can alter soil microbial community composition (Verbeek & Kotanen, 2019), which can alter nutrient cycling.

Source: Informal publication, Professional expertise

Q19: Impact on Ecosystem Structure

Rating: Moderate (range Low - Moderate)

Confidence: Low (range Low - Moderate)

Research of severe soil disturbance in northern Idaho found *Cirsium arvense* was a component in a forb-rich vegetation community that prevented the re-establishment of trees (Green & Jensen, 1991; Jensen, 1991). This species can change vegetation density in grasslands, shrublands, and mixed shrub and forb ecosystems.

Source: Published research, Professional expertise

Q20: Impact on Ecosystem Composition

Rating: High (range Moderate - High)

Confidence: Moderate (range Moderate - High)

Cirsium arvense frequently occurs in monospecific stands and is potentially allelopathic (Stachon & Zimdahl, 1980). Native species diversity and

abundance is frequently reduced in areas where it occurs. Research suggests that *C. arvense* can alter soil microbial community composition. Changes in soil microbial community can benefit some plant species while inhibiting others, contributing to changes in vegetation community composition (Verbeek & Kotanen, 2019). Recent evidence suggests that *C. arvense* competes for pollinators and alters the structure of native plant-pollinator relationships. A study in Appalachian plant communities found pollinator visitation rates were reduced for all neighboring plants, and pollinator visitation for plants with radial symmetry was reduced community-wide in areas invaded by *C. arvense* (Daniels & Arceo-Gómez, 2020).

Source: Published research, Professional expertise

Q21: Impact on Particular Native Species

Rating: Moderate

Confidence: High

Cirsium arvense serves as the host plant for weevil species that will attack native thistles (Louda & O'Brien, 2002) and can potentially hybridize with another native thistle (*C. hookerianum*) (NWCB, 2024b).

Source: Published research, Professional expertise

Q22: Observed Ability to Invade Undisturbed Ecosystems

Rating: Moderate

Confidence: Moderate (range Low - High)

Cirsium arvense rarely spreads into undisturbed forests or mature, intact native ecosystems, and maintaining natural communities is recommended as the best defense against this species. However, in Yellowstone National Park, *C. arvense* was found across all disturbance regimes, though abundance increased as disturbance did. This species can also establish in wet meadows from nearby populations, as well as establishing in disturbed patches within old-growth forests (Zouhar, 2001). In Washington, populations of this species have been observed growing densely amid competitive species such as snowberry under a mature aspen stand and in reed canarygrass fields. This indicates that this species can, at least occasionally, establish in competitive and mature vegetation (or requires only a small natural disturbance to establish).

Source: Informal publication, Professional expertise

Q23: Observed Ability to Invade Naturally Disturbed Ecosystems

Rating: Yes

Confidence: High

Cirsium arvense can take advantage of natural as well as human disturbance, and has been found after fires, landslides, volcanic eruptions (e.g., Mt. St. Helens), grazing, and other disturbance by native animals (e.g., bison, pocket gophers) (Zouhar, 2001). *Cirsium arvense* is also known to invade intact vernal pool ecosystems in Eastern Washington, such as the populations at Marcellus Shrub Steppe Natural Area Preserve. The disturbance caused by frost heaving and the natural recession of water create openings for this species to germinate. It then thrives and severely impacts native species.

Source: Informal publication, Professional expertise

Section 4: Management Difficulty

Q24: General Management Difficulty

Rating: Moderate (range Moderate - High)

Confidence: High (range Moderate - High)

Control of *Cirsium arvense* is not impossible, but it is quite difficult, in part due to its ubiquitous nature. Effective control methods vary by context (e.g., tilling works in agricultural fields, but increases invasion in natural areas). Pulling and mowing are time-consuming but can be effective if efforts are carried out multiple times a year and persist over multiple years. However, mowing can increase *Cirsium arvense* populations instead of decreasing them, particularly in humid areas. Biocontrol is not effective, even within this species' native range. Herbicide effectiveness may also vary by conditions, though herbicides like aminopyralid and clopyralid can be very effective when used for multiple years,

albeit with high off-target damage. The bare ground left behind when controlling this species allows new seedlings to germinate—and the problem can begin again (Zouhar, 2001; DiTomaso et al., 2013).

Source: Informal publication, Professional expertise

Q25: Minimum Time Commitment

Rating: Moderate

Confidence: Moderate

Multiple broadcast treatments with clopyralid or aminopyralid can eliminate occurances of *Cirsium arvense* in 2 to 3 years. There is a 6-month (clopyralid) or one year (aminopyralid) re-seed interval after the last herbicide treatment. By year four, reseeding or replanting forbs into the treated area can begin, with follow-up in year five, with occasional follow-up and spot treatments afterward (Zouhar, 2001; DiTomaso et al., 2013). An isolated patch of *C. arvense* can be controlled in 2-5 years, but the ubiquity of this plant on the landscape makes it more difficult to manage. High rates of reintroduction and the potential for propagules to last 5-10 years suggest that the minimum time commitment for managing an established occurances of this species is also 5-10 years.

Source: Informal publication, Professional expertise

Q26: Impacts of Management on Native Species

Rating: Moderate (range Low - High)

Confidence: High (range Moderate - High)

Depending on the method of control, off-target damage can vary. Spot treatment of patches with aminopyralid or clopyralid restricts damage to a small radius around treated plants. However, broadcast treatments are often deployed to save time. Broadscale herbicide treatments can cause significant and persistent reduction of native species. Mowing and tilling can also cause significant off-target damage (Zouhar, 2001; DiTomaso et al., 2013).

Source: Informal publication, Professional expertise

Q27: Inaccessibility of Invaded Areas

Rating: Low

Confidence: Moderate

Cirsium arvense is mainly spread by human activities and human disturbance. This species usually grows in disturbed, relatively mesic areas that are generally not difficult to access. The main impediment to access is simply the extent of its range.

Source: Professional expertise

Q28: Sociopolitical Implications of Management

Rating: Insignificant (range Insignificant - Moderate/Low)

Confidence: High (range Moderate - High)

Cirsium arvense is one of the most widespread invasive plants in the world. This species is a major crop pest, has little palatability to livestock or wildlife, and is generally considered undesirable in recreational areas. This species also has little documented benefit to native pollinators (Zouhar, 2001; Daniels & Arceo-Gómez, 2020), though apiarists have been known to oppose the control of species like *C. arvense* that are used by honeybees. Public objections to herbicide use may present obstacles to management in some communities, but no more so than for management of any other invasive species.

Source: Professional expertise

Additional Comments

None

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