

Washington Invasive Ranking System

Washington Natural Heritage Program

Ailanthus altissima (Tree-of-Heaven)

Assessed by

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Ecological Impact Rank: **Moderate** (69)

Confidence: **Moderate** (50)

Management Difficulty Rank: Low (46)

Confidence: Moderate (60)

Biological Characteristics of Invasiveness: Moderate (63)

Confidence: High (70)

Concern Related to Distribution and Abundance: High (76)

Confidence: Moderate (50)



Photo Credit: Thomas Belfield 2023 (Burke Herbarium, University of Washington, 2024).

Ranking Notes

Ailanthus altissima 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

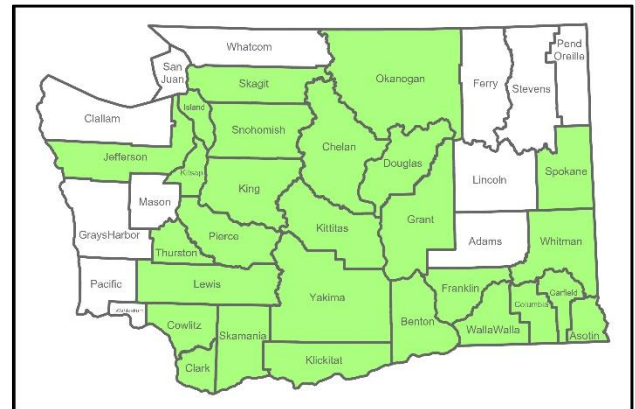


Figure 1. Distribution of counties where *Ailanthus altissima* has been documented in Washington State (CPNWH, 2023; EDDMapS, 2023; iNaturalist Contributors, 2023).

Q1: Current Range Size in Washington

Rating: High

Confidence: High

Ailanthus altissima is found in 27 of 39 counties in Washington. Most populations are found in cities and towns (CPNWH, 2023; EDDMapS, 2023; iNaturalist Contributors, 2023). Escaped populations are frequently associated with the Columbia and Snake Rivers.

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

Q2: Current Trend in Total Range

Rating: Moderate

Confidence: Moderate

Ailanthus altissima is mostly spreading in urban and suburban settings, especially in the greater Seattle area and eastern cities (Yakima, Tri-Cities, Spokane). Some in-filling or spread along the Columbia and Snake Rivers has also been observed. The rate of spread seems low, given potential for fruits to disperse downriver. This species has been in the state for almost 100 years (CPNWH, 2023; EDDMapS, 2023; iNaturalist Contributors, 2023).

Source: Herbarium records and other observations

Q3: Proportion of Potential Range Currently Unoccupied

Rating: Low (range Low - Moderate)

Confidence: Moderate

There is potential for expansion of *Ailanthus altissima* in urban and suburban settings, though largely through assistance by humans (plants escaping from plantings). Some potential for spread also exists on the Columbia and Snake Rivers and major tributaries in eastern Washington. This species is likely able to occur in all counties in the state, at least in riparian systems (CPNWH, 2023).

Source: Professional expertise, Herbarium records

Q4: Local Range Expansion or Change in Abundance

Rating: Moderate (range Low - High)

Confidence: Low (range Low - Moderate)

Recent evidence of expansion comes mostly from iNaturalist records that may be cultivated landscape trees in urban areas. Spread by natural means appears low compared to other introduced riparian trees and shrubs.

This species begins to rapidly infill areas shortly after establishment. Some experts suggest it is likely to increase by greater than 25% in density and range in

many of the areas it occupies and will continue to do so until it dominates all suitable habitat in any invaded area.

Source: Professional expertise, iNaturalist observations

Q5: Diversity of Ecosystems Invaded

Ecosystem types: Forest & Woodland, Forested Wetland, Open Rock

Rating: Moderate

Confidence: Moderate

In Washington this species can be found in riparian systems in shrub-steppe and grassland landscapes. It can also be found in forested areas in Klickitat County (sometimes forming its own closed canopy forests in what was initially oak woodland) as well as numerous environments in western Washington. While this species can be found in dry environments it typically only occurs in low competition areas (such as rocky scree) or in areas with at least seasonal moisture, such as lakeshores, riparian areas, and drainages (CPNWH, 2023).

This species is found throughout the U.S., and the ecosystems in which it occurs are likely underreported. In the eastern and midwestern U.S., *A. altissima* is frequently found in early successional deciduous forests, and in the south it is often found in early successional pine forests and along roadsides and logged areas. In the southwest, this species is invasive in riparian areas. In California it is also found in valley and foothill plant communities in addition to riparian areas. Less information is available regarding where this species is found in the Pacific Northwest (Fryer, 2010).

Source: Informal publication, Professional expertise, Herbarium records.

Section 2: Biological Characteristics

Q6: Aggressive Mode of Reproduction

Rating: Yes

Confidence: High

This species is extremely fecund (producing up to 325,000 seeds per year) and can sprout from even small root fragments (NWCB, 2011; Knüsel, 2019).

Source: Informal publication, Professional expertise, Thesis

Q7: Innate Potential for Long-Distance Dispersal

Rating: Yes

Confidence: Moderate

This species has samaras that are well-adapted to wind-dispersal. Seeds can also be transported by water, as can viable root fragments (NWCB, 2011; Knüsel, 2019).

Source: Informal publication, Professional expertise, Thesis

Q8: Potential to be Spread by Human Activities

Rating: Yes

Confidence: High

This species was introduced to many areas intentionally. It has potential to be used ornamentally, in bioremediation, and for silkworm cultivation, among other uses (NWCB, 2011; Knüsel, 2019).

Source: Informal publication, Professional expertise, Thesis

Q9: Allelopathy

Rating: Yes

Confidence: High

There are many studies demonstrating allelopathy in *Ailanthus altissima* (Heisey, 1990; Lawrence et al., 1991; Gómez-Aparicio & Canham, 2008; NWCB, 2011).

Source: Published research, Informal publication

Q10: Competitive for Limiting Abiotic Factors

Rating: No

Confidence: Moderate

While *Ailanthus altissima* has an extensive root system, is fast growing, and can spread quickly (all traits that can aid it in outcompeting other species), its

phenology and the depth of its root system are not unusual for at least some of the systems it has been observed in. This suggests that *A. altissima* may not be especially competitive for limiting abiotic factors.

Source: Published research, Professional expertise

Q11: Growth Form

Rating: Yes

Confidence: High

Ailanthus altissima suckers and forms dense thickets that crowd out other species and can form a closed canopy (NWCB, 2011).

Source: Informal publication, Professional expertise

Q12: Germination Requirements

Rating: Yes

Confidence: Low

Ailanthus altissima's ability to germinate without disturbance is context dependent. This species has shown the ability to germinate through litter and in relatively undisturbed forests. However, it is also considered a "gap obligate species" that does not do well in areas with a closed canopy and restricted access to light. Studies have also shown that open spaces and rocky areas in a forest can provide suitable habitat for *A. altissima* to germinate. Many areas in Eastern Washington have forests without closed canopies, where light access would not be a limiting factor for this species (e.g. oak woodlands and open ponderosa pine forests). Once this species successfully establishes through generative reproduction it can then begin reproducing vegetatively. These vegetative sprouts have increased resiliency due to provisioning by the mother plant, and thus the impact of germination without disturbance is compounded by the effects of vegetative reproduction after germination and establishment (Knüsel, 2019).

Source: Professional expertise, Thesis

Q13: Invasiveness of Other Plants in Genus

Rating: No

Confidence: Moderate



Ailanthus is a small genus with only 6 members. No evidence was found that any of the other species in the genus are invasive outside of their native range. There are no other species of *Ailanthus* recorded from Washington State (CPNWH, 2023).

Source: Professional expertise, Herbarium records

Q14: Shade Tolerance

Rating: Low/Insignificant

Confidence: High

The research indicates this species is somewhat tolerant of slight shade but does not tolerate the low light levels one would expect in a closed canopy forest (Knüsel, 2019). Assessors have not found *Ailanthus altissima* persisting under a closed canopy except when the canopy is at least partially comprised of adults of this species, which are likely assisting their suckering offspring via the connected root system.

Source: Professional expertise, Thesis

Q15: Disturbance Tolerance

Rating: Yes

Confidence: Moderate

Ailanthus altissima germinates best in areas with high nutrient availability, good access to light, and low litter cover. This is the environment one would expect to see after a fire, and studies have shown this species to increase or establish in post-fire scenarios. *A. altissima* has been observed to reproduce by root suckers following a fire, so not only will it more readily establish following a fire, but its ability to sprout from surviving roots would give it a competitive advantage over some species in Washington State, like Douglas-fir and ponderosa pine, which do not resprout (Knüsel, 2019).

Source: Professional expertise, Thesis

Q16: Propagule Persistence

Rating: >5 years

Confidence: Moderate

While some older sources indicate that persistent seed banks are unlikely (Fryer, 2010; DiTomaso et al., 2013), more recent research indicates that seeds may remain viable for at least six years (Rebbeck & Jolliff, 2018).

Source: Published research, Informal publication, Professional expertise

Q17: Palatability

Rating: Yes, plant is unpalatable

Confidence: Low

While some sources indicate *Ailanthus altissima* can be controlled with grazing, others indicate that it is relatively unpalatable to ungulates. Several studies show that it is browsed less frequently than associated species in natural settings (Fryer, 2010; Knüsel, 2019).

Source: Informal publication, Professional expertise, Thesis

Section 3: Ecological Impact

Q18: Impact on Ecosystem Abiotic Processes

Abiotic Processes: Light availability

Rating: Low

Confidence: Moderate

Ailanthus altissima forms a closed canopy forest when conditions are suitable and it is allowed to spread. Some areas of closed canopy *A. altissima* have sufficient moisture that the native canopy would likely have been significant before its arrival. However, this species frequently increases the amount of shade relative to the semi-open canopies of oak or big-leaf maple woodlands.

Source: Professional expertise

Q19: Impact on Ecosystem Structure

Rating: Moderate

Confidence: Moderate

Ailanthus altissima primarily invades disturbed sites. This species prefers forested sites such as oak

woodlands and riparian areas and will increase canopy density. This reduction in light availability, combined with the allelopathic effects of *A. altissima*, is likely to result in major changes to the understory of invaded areas. Eventually, changes in the overstory may follow.

Ailanthus altissima is the preferred host of the spotted lanternfly (*Lycorma delicatula*), an invasive insect that may also have a major impact on ecosystem structure (Washington Invasive Species Council, 2024).

Source: Informal publication, Professional expertise

Q20: Impact on Ecosystem Composition

Rating: High

Confidence: High

Ailanthus altissima is known to reduce native species abundance and diversity and can increase shade, which may in turn reduce certain diagnostic understory species. In addition, allelopathy may further reduce native species abundance and diversity (Knüsel, 2019; Demeter et al., 2021).

Source: Published research, Professional expertise, Thesis

Q21: Impact on Particular Native Species

Rating: Unknown

Confidence: Not Rated

The allelopathic nature of this species could potentially have outsized effects on particularly sensitive native species (Demeter et al., 2021; Knüsel, 2019).

Source: Published research, Professional expertise, Thesis

Q22: Observed Ability to Invade Undisturbed Ecosystems

Rating: Moderate

Confidence: Moderate

Ailanthus altissima is mostly thought of as a disturbance-dependent species, however, studies have

shown that it can germinate and establish in certain portions of undisturbed (or only mildly disturbed) ecosystems. It can establish in rocky areas (such as talus fields) and once established quickly spread by vegetative reproduction into denser vegetation (Knüsel, 2019).

Source: Professional expertise, Thesis

Q23: Observed Ability to Invade Naturally Disturbed Ecosystems

Rating: Yes

Confidence: Moderate

Ailanthus altissima can establish and increase in abundance following fires, provided appropriate habitat and a nearby seed source. In addition, this species is known to root from branches when soil is moist and is likely to benefit from open soil caused by flooding (Knüsel, 2019).

Source: Professional expertise, Thesis

Section 4: Management Difficulty

Q24: General Management Difficulty

Rating: Moderate

Confidence: Moderate (range Low-High)

Control of *Ailanthus altissima* requires the use of herbicide over several years to kill the existing root system and requires follow-up work for several years to exhaust the existing seedbank.

Source: Professional expertise

Q25: Minimum Time Commitment

Rating: Moderate

Confidence: Moderate

Attempts to control *Ailanthus altissima* are relatively recent in Washington. Initial treatment and subsequent removal of dead trees is relatively expensive and the precise time commitment needed to control seedlings and eradicate the species from a site is not known. It is likely that *A. altissima* requires a moderate amount of time investment over many

years to reduce to acceptable levels. Control requires the use of herbicide over several years to kill the existing root system and requires follow-up work for several years to exhaust the existing seedbank. In some areas, constant reintroduction may be an issue, and vigilant site managers may be needed to keep this species at bay.

Source: Professional expertise

Q26: Impacts of Management on Native Species

Rating: Insignificant (range Insignificant - Low)

Confidence: Moderate (range Moderate - High)

Collateral damage from *Ailanthus altissima* management is minimal and does far less damage to native species than uncontrolled spread. Typically, this species is controlled with herbicide. *Ailanthus altissima* control projects typically use hack and squirt, basal bark, or EZ-Ject lance systems to administer herbicide. These application methods are targeted, though they may result in occasional off-target damage (depending on which herbicides are chosen; herbicide type plays an important role in off-target damage). Managers have been known to use less targeted methods that may result in long term reductions in certain species. However, following best management practices, it is not difficult to limit off-target damage.

Source: Professional expertise

Q27: Inaccessibility of Invaded Areas

Rating: Low

Confidence: Moderate

Ailanthus altissima appears to be mainly urban and along travel corridors. This species was largely introduced by human activity in the past 200 years, and most populations are still near areas frequented by humans. Perhaps 5% of the populations one assessor observed are on rocky slopes or thick riparian vegetation, but with enough effort these are also accessible.

Source: Professional expertise

Q28: Sociopolitical Implications of Management

Rating: Moderate/Low

Confidence: Moderate (range Moderate - High)

Ailanthus altissima is a conspicuous species that requires herbicide to control and typically occurs in areas frequented by humans. While this species frequently functions as a shade tree for landowners, most are happy to get rid of it because of its odor and its production of many seedlings and suckers. Some in the public oppose the removal of any tree on general principle unless the reasons behind removal are made clear. In areas that are highly visible to the public, treatment of *A. altissima* should be paired with concise and clear communication.

Source: Professional expertise

Additional Comments

Ailanthus altissima is the preferred host plant for the spotted lanternfly (*Lycorma delicatula*), which is a serious pest on tree fruit crops in the eastern U.S. (Washington Invasive Species Council, 2024).

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