

Oregon Department of Agriculture
Plant Pest Risk Assessment
Tree of Heaven, *Ailanthus altissima*
2012

Name: Tree of Heaven, Chinese sumac, *Ailanthus altissima* (Mill)
Family: Simaroubaceae

Findings of this Review and Assessment: Tree of heaven, *Ailanthus altissima*, is an escaped exotic Asian species in the US. Tree of heaven was analyzed using the ODA Noxious Weed Qualitative Risk Assessment and ODA Noxious Weed Rating System, receiving scores of **45** and **12.5**, respectively. Under both systems, tree of heaven scored as a “**B**” rated weed. Tree of heaven is found in the north central Columbia Basin and western Oregon, and has been reported in all neighboring states. Tree of heaven is a “**B**” listed weed in Vermont and a prohibited species in Connecticut, Massachusetts, and New Hampshire (USDA Plant Profile).

Introduction:



Stands of tree of heaven by the railroad tracks in Rufus, Oregon, photo by Eric Coombs, ODA

Tree of heaven is an aggressive, highly persistent tree species known to infest both urban and rural areas of the East, Midwest and Western states. Originally planted as an ornamental tree as far back as 1784 it became readily available in nurseries by the 1840's. Tree of heaven is a survivor. It thrives in the toughest of city conditions tolerating dry soils, heavy air pollution, dust, and poor soils. It frequently grows through sidewalks, parking lots and streets, pushing up through pavement making control difficult. Away from cities it is commonly found in fencerows, woodland edges and forest openings. In Oregon it is highly naturalized along the Columbia River from Hood River County to Umatilla County growing in low moisture and high wind conditions.

Growth Habits, Reproduction, and Spread: Tree of heaven can reach a height of 25 to 50 feet, depending on the location and local conditions. The leaves are large, 1-3 feet long, pinnately compound, leaflets 2-7 inches long, lanceolate and smooth edges, which give the tree an appearance similar to a sumac. Stems and branches have prominent scars where leaves have detached. Flowers are small in panicles up to 20 inches long, and are yellowish to reddish in color, with five petals. The tree is dioecious with male and female flowers produced on separate trees. The seeds are produced on the female tree in samaras (much like a maple seed) and are produced in large numbers and dispersed by the wind. The tree has a rank odor, similar to foul smelling peanuts.

Tree of heaven produces an abundance of winged seeds born on dense clusters. Flowering begins in June with seed maturity occurring in September-October. Seeds will remain on the trees throughout the winter and can be dispersed well away from the parent trees by winter storms. On the east coast, seeds establish rapidly forming a deep taproot and in compacted soils they put forth long lateral roots. Root fragments separated from the mother plant send forth shoots forming new trees. Mechanical disturbance can increase tree densities by chopping roots up into many fragments. In California, despite high seed production, very few seedlings are observed. Most reproduction and spread result from lateral root growth sometimes extending 50 feet from the mother plant. This growth produces clonal thickets of up to an acre. Vertical growth is also rapid with emerged shoots often growing a meter per year for several years.

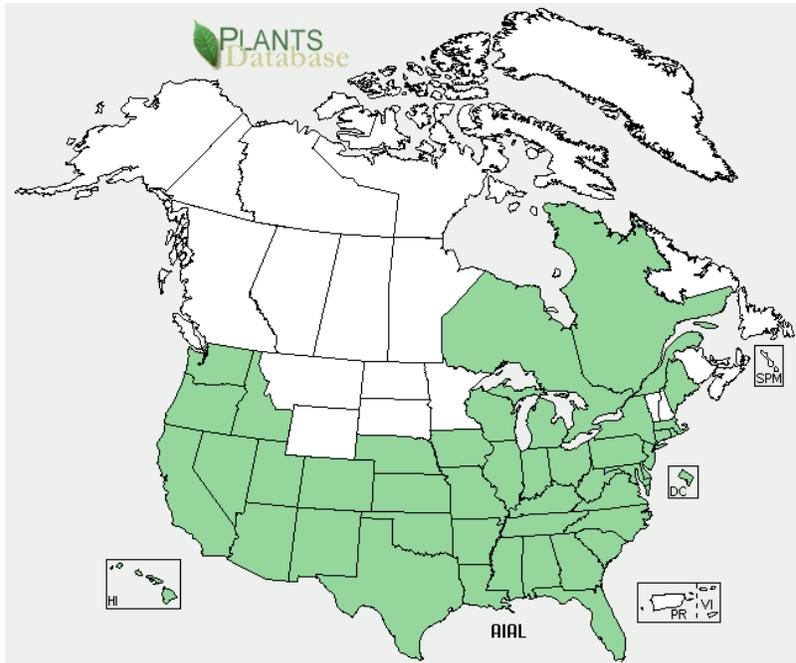


Maturing seed heads, photo by Eric Coombs, ODA

Native Range: *Ailanthus* is native to china. Much of the populations on the west coast were a result of Chinese laborers importing the plant for herbal medicine and for plantings. It is widespread on the east coast because of landscape plantings.

Worldwide Distribution: Literature indicates that it is escaped in Europe primarily the Mediterranean region, eastern Australia (limited) and the Americas. In North America it is common on both coasts with the greatest abundant throughout the eastern states where it was planted widely as an ornamental and in California along the coastal belt and Sierra foothills.

Oregon Distribution: In Oregon, it is scattered throughout western Oregon mostly escaped from urban plantings. It is very abundant along the Columbia River. Populations are also expanding along the pools of the Snake River Dams at Brownlee and Hells Canyon.



Tree of heaven US distribution on Plants Database

Biological factors effecting growth and expansion: Tree of heaven is unaffected by herbivory in Western North America and expresses its full biological potential. Growth after establishment is vigorous in all but the most hostile environments.

Probability of detection: Tree of heaven is showy and easily recognized by professional botanists, avid gardeners and lay people alike.

Dispersal by humans: Humans have been responsible for the majority of long-distance dispersal. Localized dispersal is now predominantly through seed dispersal and root fragments.

Hardiness zones: As indicated by the US Plants Database map, tree of heaven is one of the most adaptable plant species in North America. It thrives in 5+ hardiness zones.

Positive Economic Impact: Tree of heaven has a long history of use as an herbal medicine. Once a very popular urban tree because of its resistance to pollution it is no longer marketed because of its unpleasant fragrance and root suckering problems. The tree has been used to reclaim acid mine spoils tolerating a pH of less than 4.1.

Negative Economic Impacts: Tree of heaven does have some positive uses, a source of silk from the ailanthus silkworm moth, *Samia cynthia*, and as a medicinal plant for various oriental medications. The plant has naturalized in several countries and become invasive, especially in disturbed areas in cities where it acquired a nickname “ghetto palm”. There is a consensus that it has allelopathic ability to prevent the germination and growth of adjacent vegetation. Its growth outpaces many of the native trees in similar habitats, which reduces the biodiversity of important habitats, which has been particularly noted in the Columbia River Gorge. Because of its invasiveness and difficulty to control, some habitat managers have renamed the plant “Tree-of-Hell”.

On the west coast tree of heaven creates problems in natural systems by forming large thickets via root suckering. Riparian areas are especially affected. Western Oregon populations occasionally invade road right-of-ways, parks and private property where they create vegetation management problems for managers. Eastern Oregon populations are expanding but most are not located in areas where they

create economic problems. Lateral rooting can push up pavement and sidewalks and has been noted to ruin septic tank drain fields in its search for moisture.

Control: Tree of heaven produces large numbers of seeds and vigorously resprouts after cutting, making control a difficult process. Most weed control officials agree that once tree of heaven is well established, eradication is highly unlikely. Cuttings may resprout and should be burned. Many of the trees that were cut along the railways in the Columbia Gorge have resprouted and quickly regain their former stature without continual follow-up treatments. Stem injection with herbicides can be effective, but are costly. General herbicide applications while the tree is leafed out have been minimally successful. Biological control is not yet available for tree of heaven, but current research is seeking approval for release of the weevil *Eucryptorhynchus brandti* as a classical biological control agent. The tree will need to be listed as a noxious weed before the State of Oregon can expend resources against it as a biocontrol target.

Noxious Weed Qualitative Risk Assessment

Oregon Department of Agriculture

Common name: Tree of Heaven
Scientific name: *Ailanthus altissima*
Family: Simaroubaceae, Quassia

For use with plant species that occur or may occur in Oregon to determine their potential to become serious noxious weeds. For each of the following categories, select the number that best applies. Numerical values are weighted to increase priority categories over less important ones. Choose the best number that applies, intermediate scores can be used.

Total Score: 45 Risk Category: B

GEOGRAPHICAL INFORMATION

- 1) **4 Invasive in Other Areas**
0 Low- not know to be invasive elsewhere.
2 Known to be invasive in climates dissimilar to Oregon's current climates.
6 Known to be invasive in geographically similar areas.
Comments: Tree of heaven is a listed noxious weed in several other states.
- 2) **5 Habitat Availability:** Are there susceptible habitats for this species and how common or widespread are they in Oregon?
1 *Low* – Habitat is very limited, usually restricted to a small watershed or part of a watershed (e.g., tree fern in southern Curry County).
3 *Medium* – Habitat encompasses 1/4 or less of Oregon (e.g., oak woodlands, coastal dunes, eastern Oregon wetlands, Columbia Gorge).
6 *High* – Habitat covers large regions or multiple counties, or is limited to a few locations of high economic or ecological value (e.g., threatened and endangered species habitat).
Comments: It is scattered throughout western Oregon mostly escaped from urban plantings.
- 3) **0 Proximity to Oregon:** What is the current distribution of the species?

- 0 *Present* – Occurs within Oregon.
- 1 *Distant* – Occurs only in distant US regions or foreign countries.
- 3 *Regional* – Occurs in Western regions of US but not adjacent to Oregon border.
- 6 *Adjacent* – Weedy populations occur adjacent (<50 miles) to Oregon border.

Comments:

4) 5 **Current Distribution:** What is the current distribution of escaped populations in Oregon?

- 0 *Not present* – Not known to occur in Oregon.
- 1 *Widespread* – Throughout much of Oregon (e.g., cheatgrass).
- 5 *Regional* – Abundant (i.e., occurs in eastern, western, central, coastal, areas of Oregon) (e.g., gorse, tansy ragwort).
- 10 *Limited* – Limited to one or a few infestations in state (e.g., kudzu).

Comments: It is very abundant along the Columbia River. Populations are also expanding along the pools of the Snake River Dams at Brownlee and Hells Canyon.

BIOLOGICAL INFORMATION

5) 4 **Environmental Factors:** Do abiotic (non-living) factors in the environment effect establishment and spread of the species? (e.g., precipitation, drought, temperature, nutrient availability, soil type, slope, aspect, soil moisture, standing or moving water).

- 1 *Low* – Severely confined by abiotic factors.
- 2 *Medium* – Moderately confined by environmental factors
- 4 *High* – Highly adapted to a variety of environmental conditions (e.g., tansy ragwort, Scotch broom).

Comments: It thrives in the toughest of conditions tolerating dry soils, heavy air pollution, dust, and poor soils.

6) 5 **Reproductive Traits:** How does this species reproduce? Traits that may allow rapid population increase both on and off site.

- 0 *Negligible* – Not self-fertile, or is dioecious and opposite sex not present.
- 1 *Low* – Reproduction is only by seed, produces few seeds, or seed viability and longevity are low.
- 3 *Medium* – Reproduction is vegetative (e.g., by root fragments, rhizomes, bulbs, stolons).
- 3 *Medium* – Produces many seeds, and/or seeds of short longevity (< 5 years).
- 5 *High* – Produces many seeds and/or seeds of moderate longevity (5-10 years) (e.g., tansy ragwort).
- 6 *Very high* – Has two or more reproductive traits (e.g., seeds are long-lived >10 years and spreads by rhizomes).

Comments: It produces an abundance of winged seeds born on dense clusters. Seed maturity occurring in September-October. Seeds will remain on the trees throughout the winter and can be dispersed well away from the parent trees by winter storms.

7) 4 **Biological Factors:** Do biotic (living) factors restrict or aid establishment and spread of the species? (What is the interaction of plant competition, natural enemies, native herbivores, pollinators, and pathogens with species?)

- 0 ***Negligible* – Host plant not present for parasitic species.**
- 1 *Low* – Biotic factors highly suppress reproduction or heavily damage plant for an extended period (e.g., biocontrol agent on tansy ragwort).

- 2 *Medium* – Biotic factors partially restrict or moderately impact growth and reproduction, impacts sporadic or short-lived.
- 4 *High* – Few biotic interactions restrict growth and reproduction. Species expresses full growth and reproductive potential.

Comments: Biological control is not yet available for Tree-of-Heaven, but current research is seeking approval for release of the weevil *Eucryptorhynchus brandti* as a classical biological control agent.

8) 2 Reproductive Potential and Spread After Establishment - Non-human Factors:

How well can the species spread by natural means?

- 0 *Negligible* – No potential for natural spread in Oregon (e.g., ornamental plants outside of climate zone).
- 1 *Low* – Low potential for local spread within a year, has moderate reproductive potential or some mobility of propagules (e.g., propagules transported locally by animals, water movement in lakes or ponds, not wind blown).
- 3 *Medium* - Moderate potential for natural spread with either high reproductive potential or highly mobile propagules (e.g., propagules spread by moving water, or dispersed over longer distances by animals) (e.g., perennial pepperweed).
- 5 *High* – Potential for rapid natural spread throughout the susceptible range, high reproductive capacity and highly mobile propagules. Seeds are wind dispersed over large areas (e.g., rush skeletonweed).

Comments: Most reproduction and spread result from lateral root growth sometimes extending 50 feet from the mother plant.

9) 3 Potential of Species to be Spread by Humans. What human activities contribute to spread of species? Examples include: interstate or international commerce; contaminated commodities; packing materials or products; vehicles, boats, or equipment movement; logging or farming; road maintenance; intentional introductions of ornamental and horticultural species, or biofuel production.

- 1 *Low* – Potential for introduction or movement minimal (e.g., species not traded or sold, or species not found in agricultural commodities, gravel or other commercial products).
- 3 *Medium* – Potential for introduction or off-site movement moderate (e.g., not widely propagated, not highly popular, with limited market potential; may be a localized contaminant of gravel, landscape products, or other commercial products) (e.g., lesser celandine, Canada thistle).
- 5 *High* – Potential to be introduced or moved within state high (e.g., species widely propagated and sold; propagules common contaminant of agricultural commodities or commercial products; high potential for movement by contaminated vehicles and equipment, or by recreational activities) (e.g., butterfly bush, spotted knapweed, Eurasian watermilfoil).

Comments: Once a very popular urban tree because of its resistance to pollution. It is no longer marketed because of its unpleasant fragrance and root suckering problems.

IMPACT INFORMATION

10) 5 Economic Impact: What impact does/can the species have on Oregon’s agriculture and economy?

- 0 *Negligible* – Causes few, if any, economic impacts.
- 1 *Low* - Potential to, or causes low economic impact to agriculture; may impact urban areas (e.g., puncture vine, pokeweed).

5 **Medium** – Potential to, or causes moderate impacts to urban areas, right-of-way maintenance, property values, recreational activities, reduces rangeland productivity (e.g., English ivy, Himalayan blackberry, cheatgrass).

10 **High** – Potential to, or causes high impacts in agricultural, livestock, fisheries, or timber production by reducing yield, commodity value, or increasing production costs (e.g., gorse, rush skeleton weed, leafy spurge).

Comments: Eastern Oregon populations are expanding but currently are not located in areas where they create economic problems. Lateral rooting can push up pavement and sidewalks and has been noted to ruin septic tank drain fields in its search for moisture.

11) 3 **Environmental Impact:** What risks or harm to the environment does this species pose? Plant may cause negative impacts on ecosystem function, structure, and biodiversity of plant or fish and wildlife habitat; may put desired species at risk.

0 **Negligible** – None of the above impacts probable.

1 **Low** – Can or does cause few or minor environmental impacts, or impacts occur in degraded or highly disturbed habitats.

4 **Medium** – Species can or does cause moderate impacts in less critical habitats (e.g., urban areas, sagebrush/ juniper stands).

6 **High** – Species can or does cause significant impacts in several of the above categories. Plant causes severe impacts to limited or priority habitats (e.g., aquatic, riparian zones, salt marsh; or T&E species sites).

Comments: On the west coast, tree of heaven creates problems in natural systems by forming large thickets via root suckering. Riparian areas are especially affected.

12) 0 **Impact on Health:** What is the impact of this species on human, animal, and livestock health? (e.g., poisonous if ingested, contact dermatitis, acute and chronic toxicity to livestock, toxic sap, injurious spines or prickles, causes allergy symptoms).

0 **Negligible** – Has no impact on human or animal health.

2 **Low** – May cause minor health problems of short duration, minor allergy symptoms (e.g., leafy spurge).

4 **Medium** – May cause severe allergy problems, death or severe health problems through chronic toxicity, spines or toxic sap may cause significant injury. (e.g., giant hogweed, tansy ragwort).

6 **High** – Causes death from ingestion of small amounts, acute toxicity (e.g. poison hemlock).

Comments: No impact on health.

CONTROL INFORMATION

13) 2 **Probability of Detection at Point of Introduction:** How likely is detection of species after introduction and naturalization in Oregon?

1 **Low** – Grows where probability of early detection is high, showy and easily recognized by public; access to habitat not restricted (e.g., giant hogweed).

5 **Medium** – Easily identified by weed professionals, ranchers, botanists; some survey and detection infrastructure in place. General public may not recognize or report species (e.g., leafy spurge).

10 **High** – Probability of initial detection by weed professionals low. Plant shape and form obscure, not showy for much of growing season, introduction probable at remote locations with limited access (e.g., weedy grasses, hawkweeds, skeletonweed).

Comments: The tree has an appearance similar to sumac.

- 14) 3 Control Efficacy:** What level of control of this species can be expected with proper timing, herbicides, equipment, and biological control agents?
- 1 *Negligible* – Easily controlled by common non-chemical control measures (e.g., mowing, tillage, pulling, and cutting; biocontrol is very effective at reducing seed production and plant density) (e.g., tansy ragwort).
 - 2 *Low* – Somewhat difficult to control, generally requires herbicide treatment (e.g., mechanical control measures effective at preventing flowering and but not reducing plant density; herbicide applications provide a high rate of control in a single application; biocontrol provides partial control).
 - 4 *Medium* – Treatment options marginally effective or costly. Tillage and mowing increase plant density (e.g., causes tillering, rapid regrowth, spread from root fragments). Chemical control is marginally effective. Crop damage occurs or significant non-target impacts result from maximum control rates. Biocontrol agents ineffective.
 - 6 *High* – No effective treatments known or control costs very expensive. Species may occur in large water bodies or river systems where containment and complete control are not achievable. Political or legal issues may prevent effective control.

Comments: Difficult to control.

Category Scores:

14 Geographic score (Add scores 1-4)

18 Biological Score (Add lines 5-9)

08 Impact Score (Add lines 10-12)

05 Control Score (Add Lines 13-14)

45 Total Score (Add scores 1-14 and list on front of form)

Risk Category: 55-89+ = **A** 24-54 = **B** < 24 = unlisted.

This Risk Assessment was modified by ODA from the USDA-APHIS Risk Assessment for the introduction of new plant species.

Vers. 3.8 1/15/2013

Oregon Department of Agriculture Noxious Weed Rating System

Common Name: Tree of heaven

Scientific Name: *Alianthus altissima*

Point Total: 12.5

Rating: B

- 1) 2 Detrimental Effects:** Circle all that apply, enter number of circles.
1. *Health:* causes poisoning or injury to humans or animals
 2. *Competition:* strongly competitive with crops, forage, or native flora
 3. *Host:* host of pathogens and/or pests of crops or forage
 4. *Contamination:* causes economic loss as a contaminant in seeds and/or feeds
 5. *Interference:* interferes with recreation, transportation, harvest, land value, or wildlife and livestock movement
- 2) 2 Reproduction & Capacity for Spread:** Circle the number that best describes, enter that number.

1. Few seeds, not wind blown, spreads slowly
2. Many seeds, slow spread
3. Many seeds, spreads quickly by vehicles or animals
4. Windblown seed, or spreading rhizomes, or water borne
5. Many wind-blown seeds, high seed longevity, spreading rhizomes, perennials

3) 3.5 **Difficulty to Control:** Circle the number that best describes, enter that number.

1. Easily controlled with tillage or by competitive plants
2. Requires moderate control, tillage, competition or herbicides
3. Herbicides generally required, or intensive management practices
4. Intensive management generally gives marginal control
5. No management works well, spreading out of control

4) 2 **Distribution:** Circle the number that best describes, enter that number.

1. Widely distributed throughout the state in susceptible habitat
2. Regionally abundant, 5 or more counties, more than 1/2 of a county
3. Abundant throughout 1- 4 counties, or 1/4 of a county, or several watersheds
4. Contained in only 1 watershed, or less than 5 square miles gross infestation
5. Isolated infestation less than 640 acres, more than 10 acres
6. Occurs in less than 10 acres, or not present, but imminent from adjacent state

5) 3 **Ecological Impact:** Circle the number that best describes, enter that number.

1. Occurs in most disturbed habitats with little competition
2. Occurs in disturbed habitats with competition
3. Invades undisturbed habitats and crowds out native species
4. Invades restricted habitats (i.e. riparian) and crowds out native species

12.5 TOTAL POINTS

Note: Noxious weeds are non-native plants with scores of 11 points or higher. Any plants in 4.1, 4.2, and 4.3 should not be classified as "A" rated weeds. *Ratings:* 16 + = A, 15 – 11 = B
ODA Weed Rating System 8/30/2012 V3.2

Risk Assessment produced by Eric Coombs, ODA

References:

- Ailanthus altissima*: Invasive Species. www.invasive.org
The Source for Information and Images of Invasive & Exotic Species
A joint project of The University of Georgia's Bugwood Network, USDA FS and USDA APHIS PPQ.
Bossard C., Randall J, Hoshovsky M. 2000. *Ailanthus altissima*. Invasive Plants of California
Wildlands University of California Press
Hoshovsky M. 1988 The Nature Conservancy, California Regional Office, *Ailanthus altissima*
Element Stewardship Abstract..
USDA, NRCS. 2007. The PLANTS Database (<http://plants.usda.gov>, 11 January 2007). National
Plant Data Center, Baton Rouge, LA 70874-4490 USA.
Arnie Grammon, Baker County Weed Control pers. Commun. 2007
Don Farrar, Gilliam County Weed Control, per. Commun. 2007

Attachment A

