

Oregon Department of Agriculture  
Plant Pest Risk Assessment for  
Purple Starthistle, *Centaurea calcitrapa*  
September 2010

Name: Purple Starthistle *Centaurea calcitrapa* L.; aka. Red starthistle

Family: Asteraceae

**Findings of this review and assessment:** *Centaurea calcitrapa* has been determined to be an “A” listed noxious weed as defined by the Oregon Department of Agriculture (ODA) Noxious Weed Policy and Classification System. This determination is based on two independent risk assessments supported by a literature review. Using a rating system adapted from United States Department of Agriculture, Animal and Plant Health Inspection Services, Plant Protection and Quarantine (USDA-APHIS PPQ) Weed Risk Assessment Guidelines, purple starthistle scored **44** out of a potential score of 48. Using the ODA Noxious Weed Rating system, purple starthistle scored **18**.

**Introduction:** Purple starthistle *Centaurea calcitrapa* is a highly competitive member of the knapweed family. The *Centaurea* genus is made up of thistle like flowering plants, knapweeds and starthistles, native to the Middle Eastern, Mediterranean, and European regions. As a group the knapweeds and starthistles are some of the most invasive introduced plants to the western United States. Purple starthistle is armed with ridged spines. The species name *calcitrapa* comes from caltrop, a spiked weapon from the middle ages that is dropped on the battlefield to injure advancing troops and horses. The species is known globally as an introduced weedy plant and is considered invasive or noxious in North and South America, New Zealand and Australia. First reported in North America from Santa Barbara County in the early 1900’s it has spread aggressively throughout California and to many western states including Washington, Utah, Arizona, and New Mexico. Three Oregon sites have been confirmed, one each in Clackamas, Sherman, and Wheeler Counties. Near eradication, the Clackamas site has been under treatment since 1993. The Sherman County site consisted of a single plant and was eradicated in 1998. The Wheeler County infestation is the newest, detected in 2009, and is spread over five acres. Two historic records of Iberian starthistle, *Centaurea iberica*, a near identical sister species, were collected in Jackson County in 1954 and 1955. There are no records of treatment and repeated investigations have not found plants at the sites.

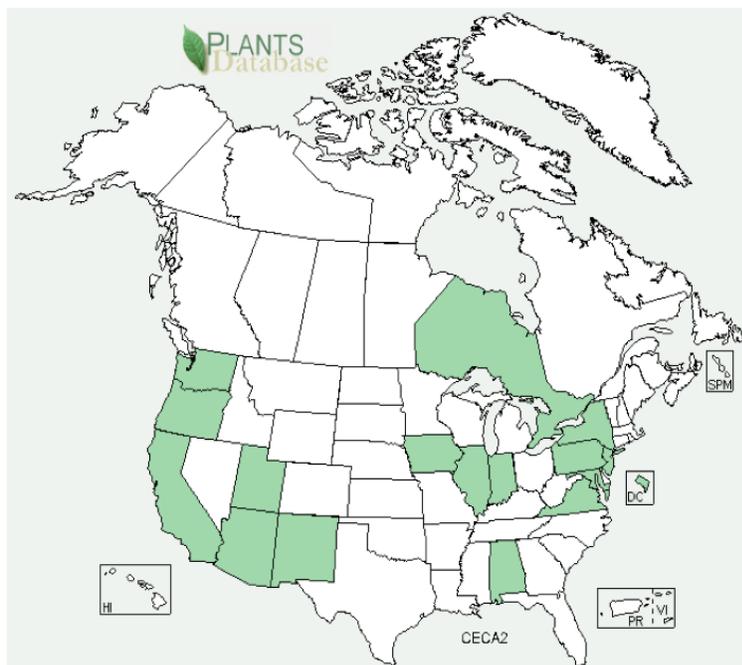


Flower head, photo by Tom Forney, ODA

**Growth Habits, Reproduction, and Spread:** Purple starthistle is a pioneering species that rapidly establishes disturbed sites and open niches. It inhabits fields, roadsides, grasslands, rangelands, waste areas, and open forests. It grows in full sun and does not persist in shade. It prefers fertile alluvial soils of bottomlands.

The life cycle of purple starthistle is variable and it can develop as an annual, biennial, or short-lived perennial depending on the environmental conditions. It grows upright to three feet tall as an erect, branched, shrubby herb. Light dusty green in color, the leaves and stems are covered with fine hairs and resin glands giving the plant a dusty appearance. Leaves are divided into narrow elongated segments. Bracts on the flower heads are tipped with sharp rigid spines over one inch long. Flower color is lavender to deep purple and blooms July through October. Rosettes are crowned with a cluster of stiff straw-colored spines in the center; leaves are deeply lobed with light-colored midribs.

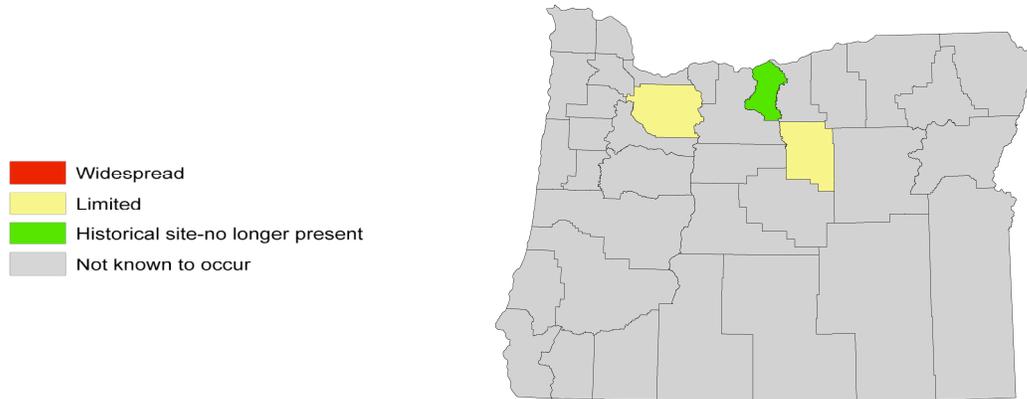
Reproduction is by seed, and the species is highly prolific producing thousands of seeds per plant. Established populations develop persistent seedbanks. Most seeds fall near the parent plant. Seed heads dislodge and act as dispersal units spreading seed late summer into winter. Distant spread is aided by human activities, vehicles, machinery, soil movement, and by livestock and wildlife. Seeds germinate during the summer or fall with adequate rain and moisture. A single plant produces several types of seed dormancy leading to longevity of the seedbank.



**Native Range:** Mediterranean Europe and northern Africa.

**Distribution in North America:** Purple starthistle is prevalent throughout most of California. Populations are documented in the Pacific Northwest (PNW), three recent sites in Oregon and three from Washington. The first PNW site was reported at Ellensburg, Washington in 1929. In 1989, sites were found in Asotin and Island counties in Washington. All of the Oregon and Washington populations have been controlled or are currently being treated for eradication.

*Oregon distribution of purple starthistle on WeedMapper*



**Positive Economic Impact:** There are no positive benefits noted in the literature.

**Negative Economic Impact:** The climatic and environmental conditions are ideal in most regions of the State and the potential for widespread establishment is high. An economic assessment estimates 1.5 million acres are at risk with impacts exceeding \$12 million per year. Widespread establishment would effect livestock production, recreation and be a general nuisance. It is highly competitive and displaces desirable plants and forage over a wide range of conditions. The plant can thrive in arid regions of eastern Oregon as well as in high rainfall areas west of the Cascades. It prefers fertile soils and forms dense stands in pasture, range, open forest, and riparian areas. A long taproot provides a competitive advantage over annual and perennial grasses reducing available forage. The rigid spines make it unpalatable and reduce the quality of infested hay. It restricts access and deters grazing by livestock and wildlife. Infestations can restrict recreational opportunities and degrade the quality of parks and natural areas.

**Ecological Impacts:** Purple starthistle can inhabit a wide range of environmental conditions and replace native species. The variable nature of the plant's life cycle to develop as either an annual or perennial provides a competitive ability to thrive and compete with native species for space, moisture, and resources. It prefers alluvial soils and often infests riparian areas and other highly valued resource areas. The sharp spines deter access by wildlife and cause injuries.

**Control:** Seedbank longevity is the most difficult challenge when treating heavily infested sites. Buried seed can lay dormant for six years or more requiring repeated monitoring and treatment for effective control. Purple starthistle germinates and produces mature plants that seed throughout the growing season adding to the challenge of stopping the contribution to the seedbank. Herbicides are an effective control measure and there are several selective and nonselective chemicals available. Hand pulling and digging of small infestations can be successful. Hand pulling must be repeated several times a year. Mowing is not effective at killing plants but can reduce seed production if timed at full bloom. Regrowth occurs from root crowns when the tops are removed. In California where purple starthistle is a common pasture weed, cultural control measures such as grazing and fertility management are used. There are no biological control agents approved for purple starthistle.

## Assessing Pest Risk

The ODA-USDA modified risk assessment identifies several dominant factors that influence plant establishment, reproduction, dispersal and impacts, and then applies numerical value to these factors. The choices taken by reviewers on each topic can often be very subjective and variable based on the knowledge, observations and experience of the reviewer. Every effort was made by the authors to be inclusive in the descriptions as reasonably possible with the expectation that some weeds will not fit well in every category. It is intended that the risk assessment serve as a logical process for governmental agencies and weed control professionals for listing plant species as noxious weeds and to help prioritize target species for control.

### ODA Modified USDA - Qualitative Risk Assessment

#### Purple starthistle (*Centaurea calcitrapa*) (Intermediate scoring may be used e.g. =4.5)

##### 1. **Habitat Availability:**

Does habitat availability restrict a plant's ability to survive and establish in the analysis area? How much susceptible habitat is available and are their physical or environmental factors that would favor or restrict the ability of the plant to thrive in the available habitats in Oregon? If plant is parasitic, do suitable host plants exist for establishment?

- **High (5) Susceptible habitat is enormous covering large regions or multiple counties in the analysis area *or* limited to a restricted habitat of high economic/ecological value. Plant may demonstrate great adaptability to a variety of environmental conditions.**
- Medium (3) Susceptible habitat encompasses 1/4 or less of the analysis area. Plant only moderately confined by environmental factors such as certain soil types, moisture holding capacity, competing vegetation, and human intervention.
- Low (1) Susceptible habitat is very limited usually restricted to a small watershed or part of a watershed. Plant is severely confined by certain soil types, moisture holding capacity, competing vegetation, human intervention.

##### **SCORE: 5**

Explanation: Growing conditions are ideal in western Oregon and purple starthistle would invade most of the deeper bottomland soils. Much of eastern Oregon would also be at risk with some limitations in the driest desert areas where it may be limited to riparian areas and irrigated pastures.

##### 2. **Spread Potential after Establishment:**

Dispersal potential (speed and distance)

- High (5) Plant has potential for rapid natural spread throughout its susceptible range. Have high reproductive potential and highly mobile propagules. (e.g. Seeds can be wind dispersed over long distance.)
- **Medium (3) Plant has a moderate potential for natural spread with *either* high reproductive potential *or* highly mobile propagules. Propagules spread by moving water or animals.**

- Low (1) Plant has potential for *local* spread within a year. Moderate reproductive potential or some mobility of propagules. Animals may move propagules locally, also wind and wave action in lakes.
- Negligible (0) Plant has no potential for natural spread in the analysis area.

**SCORE: 4**

Explanation: Highly prolific seed production. Seeds are not wind blown and fall near the parent plant. Distant dispersal is by livestock, wildlife and human activities.

**3. Economic Impact:**

Should consider human health and livestock losses in the HIGH section.

- **High (5) Plant has *potential* to cause or *demonstrates* potential to cause *significant* impacts throughout analysis area resulting in reduced crop yield, lowered commodity value, increased cost of production** or a loss of markets due to contamination *or* weed also may cause high (larger) financial impacts to **recreation**, livestock losses, fishing and hunting, and property values. **Control costs to manage infestations would become significant.** Plant directly linked to human health concerns (e.g. poisoning, burns or contribute to increases in vertebrate or invertebrate pests which serve as infectious disease carriers).
- Medium (2) Plant has *potential* to cause or *demonstrates* moderate impacts in few of the above economic categories or moderate to low impacts over a wide range (over 5 types) of economic plants, recreation, products or livestock throughout analysis area.
- Low (1) Plant has potential to cause or demonstrates moderate to low potential impacts throughout analysis area in one or few of the above categories.
- Negligible (0) Plant causes none of the above impacts.

**SCORE: 4**

Explanation: Purple starthistle has the potential to become a widespread weed throughout most of Oregon and impact livestock production, reduce forage yields and hay production, and interfere with recreation. There would be losses of recreational opportunities. Costs would be high due to how widespread it would likely become.

**4. Environmental Impact:**

Descriptions of environmental harm: Causes impacts on ecosystem processes; causes changes in plant community composition; in plant community structure and function; causes indirect impacts that are measured by a reduction in aesthetic value, reduced opportunities for recreation and reductions in other non-monetary values.

- **High (5) Plant has *potential* to cause, or *demonstrates* significant impacts in several of the above categories. Or plant causes impacts in select *priority* habitats such as aquatic, riparian, salt marsh, T&E plant sites and other sites deemed critical.**
- Medium (2) Plant has *potential* to cause, or *demonstrates* moderate impacts throughout analysis area or impacts occur in less critical habitats.
- Low (1) Plant has *potential* to cause, or *demonstrates* few or minor environmental impacts throughout analysis area or impacts occur in degraded or highly disturbed habitats.
- Negligible (0) None of the above impacts probable.

**SCORE: 5**

Explanation: Plant demonstrates the potential to impact a wide range of habitats throughout Oregon.

## 5. Likelihood of Introduction and Spread:

Entry Potential: The likelihood that an exotic plant will be introduced and spread depends on the number of associated factors, some physical, some biological, some social/economic.

For this analysis, consider the following five factors:

### 5a. Weed is a pest in similar climactic zones:

- **5= Plant is known to be a significant pest in similar climactic zones, at place of origin, or demonstrates significant adaptation to multiple climactic zones wherever it is found.**
- 3= Plant demonstrates weedy characteristics in non-place of origin areas only. Plant limited to a few climactic zones.
- 1= Plant is strictly limited to one minor climactic area or zone. Plants exhibit little adaptability to new environments or complete information is lacking on plant distribution in climate zones.

#### SCORE: 5

Explanation: Adapted to multiple climatic zones, is listed a noxious and is considered as a serious pest in California and other western states.

### 5b. Current distribution:

- **6= Plant population limited to 1 or a few infestations in state or not known to occur but with weedy populations *directly* adjacent to Oregon border.**
- 3= Plant regionally established (eastern/western Oregon) with eradication impossible, or weedy populations found in Western US regions but not *directly* adjacent to Oregon border.
- 1= Plant widespread, occurs throughout the state with containment improbable or weedy populations mostly found in more distant US regions or foreign country only.

#### SCORE: 6

Explanation: Two active infestations in Oregon and limited to five net acre.

### 5c. Probability of detection at introduction point:

- 3= Plant populations growing with high probability of no initial detection, plant shape and form obscure/not showy for much of growing season, introduction probable on lands remote or with limited access to weed professionals.
- **2= Plant easy to identify by weed professionals, ranchers, botanists, some survey and detection infrastructure in place.**
- 1= Plants growing where probability of rapid detection high, plants showy, public easily recognizes plant, access not limited.

#### SCORE: 2

Explanation: The large spiny bracts give this plant an ominous look and most weed professional, botanists, and ranchers would recognize this as being unusual.

5d. **Probability of weed import or movement to suitable habitat through human activities:** Does not consider transport by recreation, equipment and vehicles; you may choose to address that here.

- 3= high probability that weed will be introduced or moved within state annually. Plant widely propagated, highly popular and widely sold or traded or plant propagules are a common contaminant of agricultural commodities. Or, high potential exists for movement by contaminated vehicles and equipment or by recreation.
- **2= moderate probability of introduction or off-site movement. Plant not widely propagated, not highly popular with limited market potential or may be a localized contaminant of gravel or landscape products.**
- 1= low probability of introduction or movement. Plant not traded or sold or plant not found in agricultural commodities, gravel or other commercial products.

**SCORE: 2**

Explanation: Purple starthistle is not traded or used as an ornamental or herbal plant. It has been documented as a seed contaminate in California and Washington. Contaminated seed is also thought to be the source of the Oregon Sherman County infestation. Two of the Washington infestations were from contaminated seed.

5e. **Environment and reproductive potential:**

- **5= Environment possesses ideal conditions for growth and reproduction. Plant expresses full growth and reproductive potential in environment. If dioecious then both sexes present and plant is self-fertile.**
- 2= Environmental factors restrict full growth and reproductive potential and plant is poorly or clearly not self-fertile.
- 1= Environmental factors damage plant growth and/or prevent reproduction. Obligate pollinator not present.

**SCORE: 5**

Explanation: Most of Oregon provides ideal good growing conditions and purple starthistle would fully express its growth and reproduction potential.

**SCORE = Subtotal of 5a-e = 20**

**6. Current Distribution in Oregon:**

- 6= Not known to occur, or limited to 1 or a few infestations in the state.
- 3= Regionally abundant (eastern/western Oregon).
- 1= Widespread, occurs throughout the state.

**SCORE: 6**

The total assessment score for *Centaurea calcitrapa* (out of a possible 48) with the modified ODA-USDA Risk Assessment is: **44**

**“A”** 35 - 48 “A” Weed    25 - 34 “B” Weed    Below 24: unlisted

## Oregon Department of Agriculture Noxious Weed Rating System

Purple Starthistle  
Common Name

*Centaurea calcitrapa*  
Scientific Name

### Points Category:

- 1) **3 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 contaminate in seeds and/or feeds**
  5. **Interference: interferes with recreation, transportation, harvest, land value, or wildlife and livestock movement**
- 2) **3 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 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) **6 Distribution:** Circle the number that best describes, enter that number
1. Widely distributed throughout the state in susceptible habitat
  2. Regionally abundant in part of the state, 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**

**TOTAL POINTS: 18**

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**Note: Noxious weeds are those non-native plants with total 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**

## Acknowledgments:

-Author: Thomas Forney, ODA

-Photos by: Thomas Forney, ODA

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