Weed Risk Assessment for

Onopordum illyricum L.

Illyrian thistle

Addendum to a report, Analysis and Assessment of the Invasive risk of *Onopordum illyricum*, submitted by Sarah Reichard and Lizbeth Seebacher, University of Washington, College of Forest Resources, Center for Urban Horticulture.

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Addendum to a report, Analysis and Assessment of the Invasive risk of Onopordum illyricum, submitted by Sarah Reichard and Lizbeth Seebacher, University of Washington, College of Forest Resources, Center for Urban Horticulture.

This addendum provides a risk assessment conforming to the USDA, Animal and Plant Health Inspection Service (APHIS) format for weed risk assessment. The information from the report was adapted to this format and risk ratings were assigned by Polly Lehtonen, USDA, APHIS, Plant Protection and Quarantine, 4700 River Road, Unit 133, Riverdale, MD 20737-1236. The weed risk assessment area is the United States.

Stage 1: Initiating Weed Risk Assessment Process

Step 1. Document the Initiating Event(s) for the weed risk assessment.

This assessment is part of Plant Protection and Quarantine's continuous effort to identify potential Federal noxious weeds. The attached report was the product of a USDA Invasive Species Coordination initiative, a contract with Dr. Sarah Reichard of the University of Washington. The WRA area is the United States.

Step 2. Identify and Cite Previous Weed Risk Assessments.

This is the first USDA weed risk assessment for this species.

Step 3. Establish Identity of Weed.

Scientific Name: Order, Family, Genus, and species:

Asterales, Asteraceae, *Onopordum illyricum* L.

Synonym(s): None.

Common name(s): Illyrian thistle, Illyrian cottonthistle

Description, general morphology:

Illyrian thistle is a tall, erect annual or biennial herb, to 2 meters high, with gray, white or occasionally greenish, tomentose, stems. The peduncle is narrowly winged. The leaves are densely woolly, whitish, oblong-lanceolate and divided into spiny lobes. The flowers are purple, glandular, with a minutely barbed pappus. Flower heads are globular, to 8 cm. in diameter, occurring singly on stem ends. Achenes are 4-5 mm long, minutely pitted, transversely wrinkled, flattened, with pappus bristles cream-colored and 10-12 mm long (Bailey and Bailey,

1976).

Pertinent information regarding life history, including growth, development, means of reproduction and dispersal:

Onopordum illyricum consists of monocarpic plants which reproduce only by seeds (achenes). Each plant forms a rosette in the first year and develops a thick taproot (Pettit et al., 1996) that can reach the depth of a foot (Gammie, 1972) to support the development of a tall, erect flowering stem up to 1 to 2.5 meters high later in the life cycle (Pettit et al., 1996). *O. illyricum* behaves like a biennial or facultative monocarpic perennial both within and outside of its native range (Rees et al., 1999). Groves and Kaye (1989) found that plants can set seed within 12 months but always required a period of winter cold before stem elongation and flowering could occur. If this requirement for vernalisation was not met, the plants did not flower until the spring/summer of the following season, regardless of their size. Rees et al. (1999) found that these thistles flowered at all ages between two and five years and that flowering depended on the growing conditions in a particular year.

Preferred habitat and climatic tolerance:

In Australia, Illyrian thistle prefers rocky hillsides in sub humid temperate regions and occurs on neglected sites and pastures (Parsons and Cuthbertson, 1992). In California, Illyrian thistle is found in natural areas, disturbed sites, roadsides, fields, and especially sites with fertile soils (CAL Flora database, 2001).

Native distribution:

Asia-Temperate: Cyprus; Syria; Turkey
Europe: Albania; Bulgaria; France [including Corsica]; Greece [including Crete]; Italy [including Sardinia, Sicily]; Portugal; Spain [including Baleares]; Yugoslavia

Onopordum illyricum is most widespread throughout the western Mediterranean region (Rees et al., 1999).

Current world distribution beyond native distribution:

Illyrian thistle is naturalized in Australia, occurring throughout temperate areas of southeastern Australia (Auld and Medd, 1992), and in California, at the San Francisco Bay region of Santa Clara County (Cal Flora database, 2001).

Stage 2: Assessing pest risk

Step 4. Regulatory and Geographic Information .

Federal noxious weeds are prohibited entry into the United States.
Onopordum illyricum is recorded in the United States from California only and is classified by the California Department of Food and Agriculture as a Noxious Weed List A: control action is

required by state agencies. This species is not widely distributed in the United States and is subject to control in the area of its current range.

Step 5. Assess Economic and Environmental Importance: Consequences of Introduction.

After each of the four risk elements (A-D) in step 5, discuss the rationale for your rating and the level of certainty.

A. Establishment potential or habitat suitability in the protected area.

Estimate the potential range in the United States, considering suitable climate conditions.

Assign rating as follows:

Rating	Numerical Score	Explanation: A suitable climate and habitats would permit the weed to survive and establish:
High	3	In most or all of the United States (generally, in more than four plant hardiness zones).
Medium 3	2 3	Approximately one third to two thirds of the United States (generally, in three or four plant hardiness zones).
Low	1	Approximately one third or less of the United States (one or two plant hardiness zones).
Negligible	0	No potential to survive and become established in the WRA area.

Rationale for the rating and the level of certainty: Based on the Climate prediction model using known locations within the species distribution, the climatic correlation is very high and medium throughout the southeastern United States, in parts of Texas and in Washington state.

Level of certainty = uncertain. The prediction is based on climate preference and documented distribution in other parts of the world.

B. Spread potential after establishment, Dispersal Potential.

Discuss the biological attributes of the species that allow it to spread and identify dispersal mechanisms. Check each of the following that apply:

- Consistent and prolific seed production 3
- Rapid growth to reproductive maturity
- High germination rate under a wide range of conditions
- Ability to suppress the growth of other plants by releasing a chemical inhibitor
- Ability to persist as dormant long-lived propagules or underground parts, such as rhizomes, tubers, turions or stolons
- Seed dormancy 3

- Stress tolerance, including ability to resist herbicides
- Ability to colonize a wide variety of habitats 3
- Lack of natural control agents
- Well-developed storage tissue (for example, tap root) 3
- Dispersal by wind, water 3, machinery 3, animals 3, and/or humans 3

Assign rating as follows:

Rating	Numerical score	Explanation
High 3	3 3	Weed has potential for rapid natural spread throughout its potential range in the WRA area (*e.g.*, high reproductive potential ***AND*** highly mobile propagules).
Medium	2	Weed has potential for natural spread throughout a physiographic region of the WRA within a year (*e.g.*, it has either high reproductive potential ***OR*** highly mobile propagules).
Low	1	Weed has potential for natural spread locally in the WRA area within a year (some reproductive potential and/or some mobility of propagules).
Negligible	0	Weed has no potential for natural spread in the WRA area.

Rationale for the rating and the level of certainty:

Onopordum illyricum consists of monocarpic plants which reproduce only by seeds (achenes). They form rosettes in their first year and develop a thick tap root (Pettit et al., 1996) that can reach the depth of a foot (Gammie, 1972) to support the development of a tall, erect flowering stem up to 1 to 2.5 meters high later in the life cycle (Pettit et al., 1996).

The Illyrian thistle can produce up to 20,000 seeds per plant (Pettit et al., 1996); potentially up to 40,000 (Michalakis et al., 1993). A proportion of these become incorporated in a long-lived seed bank and may acquire a burial-induced dormancy if the seed becomes incorporated into the soil. These seeds can remain viable for more than 20 years.

Seed production is not directly related to plant density as seedling emergence and growth is strongly affected by rainfall and competition (Pettit et al., 1996). Research by Groves and Kaye (1989) showed a seed viability rate of 94%.

The results from a study on seed population dynamics in New South Wales indicated that seedlings appear in all seasons, usually following rain, although most emerged in late summer or autumn. The seed bank consisted of a large pool of strongly dormant seeds that germinated intermittently and each year new seeds enter the seed bank. Some of these either germinate or die within a few weeks but a small number acquire a secondary dormancy and become part of the dormant seed pool. This persistent seed bank makes any short-term control efforts very difficult (Cavers and Groves, 1993).

The level of outcrossing is probably sufficient to generate new genotypes and allow adaptation to new environmental conditions; both of which help to increase the invasive ability of this species (Michalakis et al., 1993).

Intentional importation by humans is likely, as plants within the genus *Onopordum* have traditionally been used for their antibacterial, hemostatic and hypotensive properties (Brace et al., 1999). *Onopordum* species appear to have been introduced into Australia on many occasions as an ornamental and as an agricultural contaminant. Seeds contaminate wool and other agricultural produce and equipment, and are also spread in water (Parsons and Cuthbertson, 1992). Although Parsons and Cuthbertson report wind dispersal, others report a lack of wind dispersal (O'Hanlon et al., 1999).

Level of certainty = reasonably certain. We have sufficient evidence for a high rating.

C. Economic Impact.

Discuss the potential economic importance of the species in the WRA area. Consider three primary types of damage:

1. Reduced crop yield (*e.g.*, by parasitism, competition, or by harboring other pests). 3
2. Lower commodity value (e.g., by increasing costs of production, lowering market price, or a combination); or if not an agricultural weed, by increasing costs of control. 3
3. Loss of markets (foreign or domestic) due to presence of a new Federal noxious weed.

Assign ratings as follows:

Rating	Numerical score	Explanation
High	3	Weed causes all three of the above impacts, or causes any two impacts over a wide range (over 5 types) of economic plants, plant products, or animals.
Medium 3	2 3	Weed causes any two of the above impacts, or causes any one impact to a wide range (over 5 types) of economic plants, plant products, or animals.
Low	1	Weed causes any one of the above impacts.
Negligible	0	Weed causes none of the above impacts.

Rationale for the rating and the level of certainty: In New South Wales, Illyrian thistle crowds out good pastures and alfalfa crops and reduces the stocking capacity and quality of fodder (Gammie, 1972). It is not grazed by stock, except goats, because of dense spines (Parsons and Cuthbertson, 1992; Torrano et al., 1999). In Australia, Illyrian thistle is particularly common in highly fertile soils associated with pasture improvement and is likely to be troublesome in annual clover pastures. It produces fault in wool (Parsons and Cuthbertson, 1992).

The cost of control in Australia for *Onopordum illyricum* and *O. acaulon* combined was about

15-20 million Australian dollars in 1987 (about 7.6-10.2 million US dollars) (CSIRO, 2001).

Level of certainty = reasonably certain.

D. Environmental Impact

Consider whether or not the weed, if introduced, could:

- Cause impacts on ecosystem processes (alteration of hydrology, sedimentation rates, a fire regime, nutrient regimes, changes in productivity, growth, yield, vigor, etc.).
- Cause impacts on natural community composition (*e.g.*, reduce biodiversity, affect native populations, affect endangered or threatened species, impact keystone species, impact native fauna, pollinators, or microorganisms, etc.).
- Cause impacts on community structure (*e.g.*, change density of a layer, cover the canopy, eliminate or create a layer, impact wildlife habitats, etc.).
- Have impacts on human health such as allergies or changes in air or water quality.
- Have sociological impacts on recreation patterns and aesthetic or property values. 3
- Stimulate control programs including toxic chemical pesticides or introduction of a nonindigenous biological control agent. 3

Assign ratings as follows:

Rating	Numerical Score	Explanation
High	3	Three or more of the above. (Potential to cause major damage to the environment with significant losses to plant ecosystems and subsequent physical environmental degradation.) (Population reduction of endangered or threatened species would elevate that one factor to a high rating.)
Medium3	23	Two of the above. (Potential to cause moderate impact on the environment with obvious change in the ecological balance, affecting several attributes of the ecosystem, as well as moderate recreation or aesthetic impacts.)
Low	1	One of the above, unless the factor is potential to reduce populations of endangered or threatened species, which rates High. (Limited potential impact on environment.)
Negligible	0	None of the above. (No potential to degrade the environment or otherwise affect ecosystems.)

Rationale for the rating and the level of certainty:

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Dense patches may form a physical barrier to humans and domesticated animals (Parsons and Cuthbertson, 1992).

Control activity may be necessary for up to six years before any worthwhile results are evident (Gammie, 1972). Present control techniques as of 1999, herbicides, cultivation, pasture management and recent biological control developments are only about 60% effective in killing the weed (Torrano et al., 1999).

See attached report for specific information on control options.

Level of uncertainty: uncertain. Few environmental impacts are reported in the literature.

ECONOMIC and ENVIRONMENTAL IMPORTANCE SUMMARY: Consequences of Introduction: Cumulative Risk Element Score

Add together the numerical estimates for the four risk elements to produce an overall estimate of the Consequences of Introduction Risk Rating for the weed. The overall risk rating is used to assign a Consequences of Introduction Risk Score as follows:

Risk: Consequences of Introduction (Sum Risk Elements #1-4)
2+3+2+2

Cumulative Risk Element Score	Risk Rating	Risk Score
0 - 2	Negligible	0
3 - 6	Low	1
7 - 10 3	Medium 3	2
11 - 12	High	3

The Consequences of Introduction Risk Rating, an indicator of the potential of the weed to become established and spread, and its potential to cause economic and environmental impacts, is medium for Illyrian thistle.

Step 6. Assess Likelihood of Introduction.

Discuss entry potential and establishment potential. What is the likelihood that the species will enter the United States, survive the shipment and find a suitable habitat for establishment?

Assign ratings as follows:

Rating	Numerical Score	Explanation: Introduction is
High 3	3 3	Very likely or certain
Medium	2	Likely
Low	1	Low, but clearly possible
Negligible	0	Extremely unlikely

Rationale for rating and the level of certainty:

As mentioned under risk element one, dispersal potential, *Onopordum* species have been introduced into Australia on many occasions as ornamentals and as agricultural contaminants. The same pathways provide a high likelihood of further introduction into the United States. With bright purple flowers and silvery stems, the species holds interest for gardeners, and several garden clubs on the Internet advertise seeds. Potential pathways into the United States are ornamental seed shipments, contaminated agricultural seed shipments, and passenger baggage. None of these pathways is subject to treatment prior to or after shipping, and the propagules would be likely to survive and be introduced repeatedly into the environment, either intentionally by gardeners or unintentionally as seed contaminants of agricultural crops. *Onopordum illyricum* has already been introduced into California through an unknown pathway.

Level of certainty = very certain

Step 7. Conclusion: Pest Risk Potential of Weed.

Produce an estimate of the pest risk potential by considering the Consequences of Introduction and the Likelihood of Introduction using the following table as a guide. The pest risk potential will be obtained from the combination of the scores for likelihood of introduction and consequences of introduction, and will be assigned as follows:

Likelihood of Introduction (Rating and Score)	Consequences of Introduction (Rating and Score)	Overall Pest Risk Potential
Negligible (0)	Negligible (0)	Negligible
Negligible (0)	Low (1)	Negligible
Negligible (0)	Medium (2)	Negligible
Negligible (0)	High (3)	Negligible
Low (1)	Negligible (0)	Negligible
Low (1)	Low (1)	Low
Low (1)	Medium (2)	Low
Low (1)	High (3)	Low
Medium (2)	Negligible (0)	Negligible
Medium (2)	Low (1)	Low
Medium (2)	Medium (2)	Medium
Medium (2) 3	High (3) 3	Medium- High 3
High (3)	Negligible (0)	Negligible
High (3)	Low (1)	Low
High (3)	Medium (2)	Medium-High
High (3)	High (3)	High

Summary and Conclusion:

Onopordum illyricum has a medium consequences of introduction rating and a high likelihood of introduction rating, for an overall risk rating of medium-high. This species is of limited distribution in the United States, known to occur in California only, but has potential for introduction in other areas within the United States. Difficult to control, Illyrian thistle has potential to infest pastures, reduce carrying capacity, and create physical barriers to stock and wildlife. Illyrian thistle has potential to cause economic damage through competition, reduction in carrying capacity of pastures, and control costs. It has potential to cause environmental damage by creating a physical barrier to wildlife and stimulating chemical and biological control efforts.

Step 8. References.

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