Pacific Northwest's Least Wanted List:

Invasive Weed Identification and Management

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Weed Terms

Apex (pl. apices)—The tip.

Auricle—A small, ear-shaped lobe or appendage.

Awn—A slender, usually terminal bristle.

Axil—The angle between a leaf and stem.

Bract—A small, leaflike structure below a flower.

Disk flower—A tubular flower.

Glabrous—Smooth; without hairs.

Inflorescence—The flowering part of the plant.

Ligule—A thin, membranous outgrowth or fringe of hairs from the base of a grass blade.

Ocrea—A sheath around the stem above the base of the leaf.

Panicle—A loose, irregularly compound flowering part of a plant with flowers borne on individual stalks.

Petiole—A stem or stalk of a leaf.

Pinnate—Arising from several different positions along the side of an axis.

Raceme—An arrangement of flowers along a stem on individual stalks about equal in length.

Ray flower—Marginal petallike flowers.

Rhizome—An underground stem, usually lateral, sending out shoots above ground and roots below.

Rosette—A compact cluster of leaves arranged in an often basal circle.

Senesced—Dead.

Sepal—The outer, leaflike part of a flower.

Serrate—Saw-tooth with forward-pointing teeth.

Silique—An elongated capsule with two separate valves.

Spikelet—A flower cluster in grasses consisting of usually two basal bracts and one or more florets.

Stipule—One of a pair of appendages at the junction of a leaf petiole and a stem.

Stolon—A horizontal stem that roots at the nodes.

Surfactant—A product commonly added to herbicides to improve the wetting, emulsifying, spreading, or dispersing properties.

Trifoliolate—With three leaflets.

Umbel—A flat or rounded flower cluster with all stalks radiating from a common center.

Use Herbicides Safely!

- Wear protective clothing and safety devices as recommended on the label. Bathe or shower after each use.
- Read the herbicide label—even if you've used the herbicide before. Follow closely the instructions on the label (and any other directions you have).
- Be cautious when you apply herbicides. Know your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from herbicide use.

By Jed Colquhoun, Extension weed specialist, Oregon State University.

Cover photo: Three invasive species that dominate the landscape—scotch broom (with yellow flowers), Himalayan blackberry (background), and slender false-brome (foreground, bottom left corner).

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Introduction

What is an invasive weed?

Invasive weeds are plants that have been introduced into an environment outside of their native range. In their new environment, they have few or no natural enemies to limit their reproduction and spread (Anonymous 2002). Invasive weeds affect us all—farmers, homeowners, taxpayers, consumers, and tourists.

Several invasive weeds also are considered noxious weeds. Noxious weeds are nonnative plants that have been legally designated as serious pests because they cause economic loss or harm the environment. Oregon, Washington, and Idaho each has a state-designated noxious weed list that changes over time as weed invasions occur. Some, but not all, of the currently designated noxious weeds are included in this publication.

Why should we care about invasive weeds?

Invasive weeds reduce crop yield and quality.

Five hundred introduced plant species have become invasive weed pests in agriculture. About 73 percent of agricultural weeds are nonnatives. Crop losses due to nonnative weeds are estimated at $24 billion per year. Additionally, $3 billion worth of herbicides are applied each year to manage invasive weeds.

Ranchers alone spend about $5 billion per year on weed control, but invasive weeds continue to spread rampantly in range and pasture land (Pimentel 2000). Invasive weeds have spread over 17 million acres of public rangeland in the western United States at a rate of 4,600 acres per day. The culprits, including leafy spurge, yellow starthistle, and medusahead, are unpalatable or even toxic to livestock (Westbrook 1998).

Invasive weeds reduce not only crop yield, but also crop quality. In Oregon, cleaning of seed crops contaminated by invasive weed seeds represents a major cost of production.

All of these impacts are eventually passed on to consumers as higher product costs.

Invasive weeds reduce biodiversity and displace native plant and wildlife species.

Invasive weeds are considered to be the second most important threat to biodiversity, after habitat destruction (Westbrook 1998). Two-thirds of all endangered plant and animal species are threatened by nonnative competitors. In many areas of the Pacific Northwest, invasive weeds such as yellow starthistle and cheatgrass now grow in monoculture (solid stands) on ground that was previously diverse and productive in plant species and wildlife.

Invasive weeds reduce land values.

The value of cropland often is reduced by invasive species such as leafy spurge and Himalayan blackberry. In Klamath County, Oregon, for example, leafy spurge is so prolific in some areas that cropland has been abandoned.

Invasive weeds inhibit recreational activities and tourism.

Much of the land used for recreational and tourist activities is publicly owned. Thus, the cost of invasive weed management often is passed on to taxpayers. Invasive weeds such as gorse and Himalayan blackberry act as physical barriers that prevent the use of land for recreational activities.

Weed management in the turf industry is very costly. It has been estimated that $500 million per year is spent on invasive weed control in residential turf and $1 billion per year in the golf course industry (Pimentel 2000). Common dandelion, for example, was introduced to North America as a salad green in the 1600s, but is now ubiquitous in American lawns.

Invasive weeds impede water flow, reduce water availability, and increase soil erosion.

Invasive weeds such as purple loosestrife can impede water flow in irrigation canals and streams, thus reducing the amount of water available for irrigation and increasing the risk of flooding. Other weeds deplete water resources used by native plants and wildlife. Saltcedar (tamarisk), for example, can use up to 200 gallons of water per day.

Invasion by weeds that have shallow root systems increases soil erosion on slopes and stream banks. English ivy has a very shallow root system and does not protect erodible soils.

Invasive weeds cause fire hazards.

Dormant or senesced invasive weeds provide fuel for wildfires. Cheatgrass, or downy brome, increases fire frequency from once every 60 years to once every 3 to 5 years. Restoration and fire management in cheatgrass-dominated lands cost taxpayers millions of dollars per year. In 1936, gorse provided the primary fuel source for a fire that burned the town of Bandon, Oregon. Gorse is highly flammable and grows in densely populated coastal areas where property values are high.

Some invasive weeds are toxic to animals and humans.

Several invasive weeds are not only unpalatable to livestock, but also can be toxic. The milky sap of leafy spurge, which dominates a large portion of pasture and rangeland in the western U.S., irritates cattle's eyes, mouth, and digestive tract.

Invasive weeds that are poisonous to humans are not uncommon. Giant hogweed, a weed found in residential areas, ironically was introduced as an ornamental. Unfortunately, the sap is an irritant that, when combined with exposure to sunlight, causes severe skin blistering.

Why are some nonnative plants invasive, while others are not?

The most successful invasive weeds share several biological characteristics:

- Specialized adaptations for spreading long distances by seed
- Seed dormancy that ensures germination and growth in environmental conditions that favor survival and reproduction
- Prolific reproductive capabilities—both as seed and as vegetative tissue (roots, rhizomes, etc.)
- Long seed life in soil or water
- Rapid early growth and expansion of a root system
- Rapid and early maturation
- Tolerance of low resource levels (e.g., nutrients and water)
- Absorption of excessive levels of nutrients and water that otherwise would be used by neighboring plants
- Genetic and environmental adaptability that ensures survival in a variety of climate, soil, and environmental conditions
- Ability to adapt to management strategies (e.g., to develop resistance to herbicides)

General weed management techniques

Cutting/mowing

Cutting or mowing plants effectively controls some weeds, while stimulating regrowth and branching of other species. In general, control often is greatest when weeds are young and with species that branch above the point of cutting or mowing. Low-branching species often grow multiple shoots from a single cut branch, thus increasing the reproductive potential and competitiveness with desirable species. It often is important to remove plant material from the site after plants are cut or mowed to prevent resprouting or weed seed production.

Manual removal

Manual removal of annual weeds, particularly when they are seedlings, can effectively limit their establishment when they are confined to small areas. This management technique is limited by the size of the infested area relative to what can be practically removed by hand. Some invasive weed species, such as giant hogweed, are toxic to humans, so manual removal can be dangerous. As with cutting or mowing, manually pulled weeds often need to be removed from the site to prevent seed production and resprouting.

Biological control

Biological control of invasive weeds can include feeding by insects or animals or control with a plant pathogen. Biological controls available for release must pass stringent standards to ensure that they are specific to the invasive weed and will not harm desirable or native species. Introduced biological control agents also must be able to survive in their new habitat. While these requirements often limit the ability to successfully implement biological control, there are several success stories of invasive weeds being kept in check by introduced agents. Consult your state Department of Agriculture for a list of acceptable control agents and sources of their availability.

Burning

Where allowed and feasible, burning can effectively and economically control several invasive weed species that have spread over large areas. However, several weed species (such as gorse) are extremely flammable and thus pose a fire hazard. Others are very tolerant of fire and opportunistically take advantage after a fire of resources previously occupied by fire-intolerant plant species.

Herbicides

Invasive weeds often are managed with herbicides. The practical use of herbicides for invasive weed management is limited by cost or lack of selectivity. (Desirable species are injured by the herbicide.) Herbicide application timing is critical to successful weed control. Perennial weeds often are controlled best when herbicides are applied from the time the plant is in the bud stage until the first hard frost. At this stage, perennial weeds are moving resources from the aboveground portion of the plants to the roots, and translocated herbicides (herbicides, such as glyphosate, that move in the plant's piping system) will accompany these resources into the root system. For more information on herbicides, consult *How Herbicides Work* (Oregon State University Extension Service publication EM 8785). ***The herbicides listed in this guide are based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.***

References

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CONTENTS

This publication describes the identifying characteristics, origin, habitat and ecology, and management strategies for selected invasive weeds in the Pacific Northwest. The list is not inclusive of all invasive weeds, but focuses on the most dominant or potentially invasive species that plague our land.

Blessed milkthistle (*Silybum marianum*)

Life cycle

Winter annual or biennial

Identification

Blessed milkthistle often is referred to as a thistle, but is a member of the sunflower family. Large (up to 1 foot long) leaves with spiny margins and distinctive white marbling along veins. Multiple ridged stems up to 6 feet tall end in a thistlelike red to purple flower head. Flower head has bracts with long, spiny tips.

Origin

Blessed milkthistle is a native of Europe, the Mediterranean, and North Africa, but is now distributed worldwide. It is thought to have been introduced to the western U.S. in cattle feed and spread quickly in the 1940s.

Blessed milkthistle seedling (top) and mature plant (bottom).

Impact

Blessed milkthistle contains high nitrate levels, which can cause health problems in livestock. It is commonly found in pastures, where it reduces forage yield and marketability. Blessed milkthistle forms dense stands that outcompete native and desirable species.

Habitat and ecology

Blessed milkthistle reproduces by seed but not vegetatively. Seed production is up to 5,000 seeds per plant. Seeds remain viable for about a decade. Germination occurs soon after fall moisture. Plants remain in the rosette stage during winter months, then bolt and flower in early summer. Common in disturbed soils with high fertility and minimal soil litter or plant residue. Poor competitor in established plant communities, but will take advantage of areas of weak vegetation in noncropland areas and pastures.

Management

Cutting/mowing: Cutting or mowing can be effective, particularly when repeated.

Manual removal: Pulling plants is effective in small populations and during the seedling stage. Areas opened by plant removal should be seeded immediately with desirable species to suppress future blessed milkthistle seedlings.

Biological control: The thistle head weevil (*Rhinocyllus conicus*) in the larval stage will attack the seed head and reduce blessed milkthistle seed production. Some strains attack native thistles, so use caution when deciding whether insect release is appropriate.

Burning: Burning effectively limits seed production, but may stimulate germination of seeds already in the soil.

Herbicides: Effective herbicides include:

Herbicide	Comments
2,4-D (several trade names)	Apply to seedlings in the rosette stage for maximum control.
dicamba (Banvel, Clarity, etc.)	Apply to seedlings in the rosette stage for maximum control.
picloram (Tordon)	Apply to seedlings in the rosette stage for maximum control.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Scotch broom (*Cytisus scoparius*), French broom (*Cytisus monspessulanus*), and Spanish broom (*Spartium junceum*)

Life cycle

Perennial

Identification

Scotch broom: Evergreen shrub. Branched stems with few or no leaves reach up to 10 feet in height. Upper leaves simple, lower leaves are trifoliolate. Bright yellow flowers resemble those of pea.

French broom: Plants not as erect as Scotch broom with leaves retained entire year. Many more leaves than Scotch broom, and all are trifoliolate on entire plant. Yellow flowers smaller than those of Scotch broom.

Spanish broom: Stems thicker and rougher than those of Scotch broom with very few leaves. Flowers are similar to those of Scotch broom, but fewer in number.

Origin

Scotch broom is a native of the United Kingdom and southern Europe, while French broom and Spanish broom are natives of the Mediterranean region. Scotch broom was introduced on the east coast of the United States. All three brooms were sold as ornamentals in California in the mid-1800s. Scotch broom was planted along new highways as an erosion control strategy for many years.

Impact

The brooms displace native plant species and prevent reforestation. Dry summer plants create a severe fire hazard. Costs for maintenance of roadways and irrigation canals reach millions of dollars per year because of the brooms. The brooms are also unpalatable to livestock, and anecdotal evidence indicates that they may be slightly toxic.

Habitat and ecology

The brooms proliferate in moderate climates in sandy soils with a pH range of 4.5 to 7.5 and full sunlight. South and east of the Cascades, their spread is limited by low precipitation. They are adaptable to many sites, including pastures, cultivated fields, roadsides, waterways, and recently logged lands. Plants reproduce both vegetatively and by seed. Seeds are dispersed by wind and an explosive opening of pods,

Top: French broom (left) and Scotch broom (right). Bottom: Mixed Scotch and French broom infestation near Eugene, Oregon.

as well as in irrigation water. Seeds can remain viable in soil for more than 80 years. Brooms tolerate low temperatures well and are capable of fixing nitrogen throughout the year.

Management

Cutting/mowing: Cut plants will regrow.

Manual removal: Manual removal is difficult and often ineffective because of the extensive root system.

Biological control: The twig-mining moth, *Leucoptera spartifoliella*, was introduced in the 1970s for broom control, but the insect becomes heavily parasitized and rendered ineffective. The seed weevil, *Apion fuscirostre*, was introduced in 1964 in California and will slow the spread of new plants, but will not reduce existing stands.

Burning: Burning often presents a hazard because of proximity to roads and residences.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Repeated applications necessary. Most effective when applied from flowering through the first hard frost.
picloram (Tordon)	Apply to young plants during active spring growth. Moderately effective.
2,4-D (several trade names)	Apply to young plants during active spring growth. Moderately effective.
dicamba (Banvel, Clarity, etc.)	Apply to young plants during active spring growth. Moderately effective.
triclopyr (several trade names)	Apply to young plants during active spring growth.
triclopyr + 2,4-D (Crossbow)	Apply to young plants during active spring growth.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Butterfly bush (*Buddleja davidii*)

Life cycle

Perennial

Identification

Stems up to 6 feet tall with opposite leaves and long inflorescences of many colors, including white, pink, violet, and blue. Flowers are similar to those of lilac and have a sweet fragrance.

Origin

Butterfly bush is a native of China, where it is common along roadsides. Introduced to the United States as an ornamental and now widely distributed. Butterfly bush is also considered invasive in Great Britain and New Zealand.

Butterfly bush infestation along the McKenzie River in Oregon (Photo courtesy of Brad Withrow-Robinson).

Impact

Butterfly bush rapidly displaces natives and can prevent water movement and drainage in streams and irrigation canals.

Habitat and ecology

Seed is produced prolifically and spread by wind. Butterfly bush rapidly develops an extensive root system that increases water efficiency in drought conditions.

Management

Butterfly bush escapes are a very recent occurrence in the Pacific Northwest. Therefore, minimal information is available for management strategies. In home landscapes, the most important strategy is to contain butterfly bush plantings and prevent escape into habitats that would support its invasive spread as a weed. Consider removing flowers prior to seed production and dispersal.

Downy brome, cheatgrass (*Bromus tectorum*)

Life cycle

Annual

Identification

Stems range from 6 to 30 inches in height with leaf sheaths and blades covered with soft hair. Short ligule. Inflorescence drooping and one sided. Awns are light purplish and long.

Origin

Downy brome is a native of eastern Europe and the Mediterranean region. It is thought to have been introduced in seed in the Columbia Basin in the late 1800s and is now distributed globally.

Impact

Downy brome is the dominant plant species in Pacific Northwest rangeland. While it can be a good early-season forage for sheep, by late spring plants have sharp, pointed awns that can puncture the mouth and throat of livestock. It also competes with and reduces wheat yield by up to 90 percent.

Downy brome plant (top) and landscape dominated by downy brome invasion near Pendleton, Oregon (bottom).

Habitat and ecology

Downy brome is common in rangeland, winter crops, and noncropland, particularly after land is burned. Downy brome germinates in fall and expands its roots during winter. In the spring, it rapidly exploits water and nutrients that otherwise would be used by later germinating native plant species. It is adaptable to many environments and is most prolific in areas with annual precipitation ranging from 6 to 22 inches. Downy brome reproduces by seed and is self-pollinating.

Management

Cutting/mowing: Cut plants will regenerate new stems and produce viable seed.

Manual removal: Manual removal is impractical in large areas.

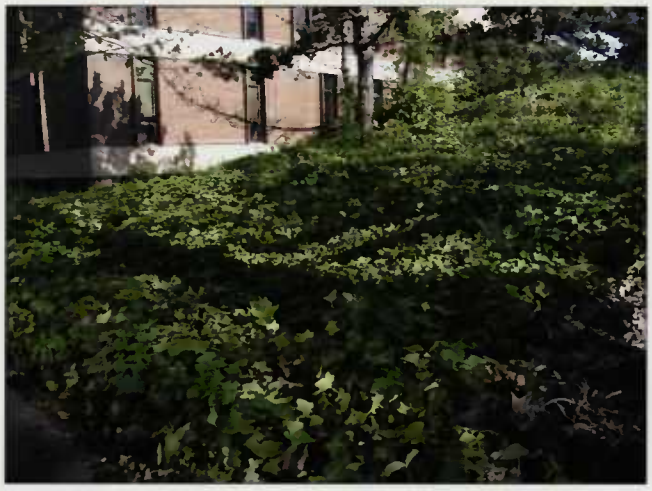
Biological control: Not available.

Burning: Burning in May can be effective if followed by reseeding in the fall. CAUTION: Burning downy brome involves a large amount of fuel and produces a hot fire.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Effective but will damage or kill native plants in a broadcast application.
imazapic (Plateau)	Effectively controls downy brome while leaving warm-season desirable grasses.
sulfometuron (Oust)	Effective but can cause nontarget crop and plant damage.
paraquat (Gramoxone)	Apply soon after the majority of plants have germinated.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.



English ivy infestation.

English ivy (*Hedera helix*)

Life cycle

Perennial

Identification

Woody, evergreen vine. Long, trailing stems with alternate waxy leaves. Leaves are diamond shaped. Green or white flowers produce black berries.

Origin

English ivy is a native of Europe. It was brought to North America in colonial times as an ornamental and is now widely distributed and sold to gardeners worldwide.

Impact

Rapid and massive vegetative growth tops trees, other ornamentals, and displaces native vegetation. English

ivy becomes intertwined with other species and therefore is difficult to manage mechanically or with herbicides. The shallow root system leaves soil prone to erosion after other species are displaced.

Habitat and ecology

English ivy is adaptable to many soil and light conditions. Established plants have an extensive but shallow root system that relies on shallow soil moisture. English ivy does not flower until the plant is mature, which can take up to 40 years. Flowers produce berries that are toxic to animals. Plants also reproduce vegetatively.

Management

Cutting/mowing: Cutting and mowing are ineffective because of the extensive root system and potential for regrowth.

Manual removal: Manual removal is effective in small areas when repeated often. Vines climbing tree trunks are difficult to manage. Cut vines a few feet above the base of the tree to deplete resource translocation from the roots to vegetation in the upper portions of the tree.

Biological control: Not available.

Burning: Burning often is impractical because English ivy cohabitates with native and desirable species that would be injured.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Effective but will damage or kill native plants in a broadcast application. Repeat as necessary.
2,4-D (several trade names)	Effective but will damage or kill broadleaf native plants. Repeat as necessary.
triclopyr (several trade names)	Apply in late summer through fall to leaves or regrowth after cutting. Basal bark applications absorbed by stem bark for effective control.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

False brome (slender false brome) (*Brachypodium sylvaticum*)

Life cycle

Perennial

Identification

Tufted perennial grass forms large bunches. Stems are hollow with broad, flat leaves and an open leaf sheath. Membranous ligules. Few pale green spikelets per plant.

False brome plant (top) and dominated landscape (bottom, photo courtesy of The Nature Conservancy).

Origin

Native to north Africa, the Mediterranean region, and Asia. In North America, false brome was first documented near Eugene, Oregon, but the weed is spreading through the Pacific Northwest.

Impact

False brome can quickly become the dominant plant species in forest understories, resulting in monocultures. The weed inhibits reforestation efforts.

Habitat and ecology

False brome is spreading in low-elevation forests (below 4,000 feet). It reproduces by seed that is relatively short lived in the soil.

Management

Cutting/mowing: Moderately effective when repeated often.

Manual removal: Manual removal is effective if repeated often prior to establishment in localized infestations.

Biological control: Not available.

Burning: Burning is ineffective and may even stimulate germination.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Effective but will damage or kill native plants in a broadcast application. Repeat as necessary.
hexazinone (Velpar)	Moderately effective control.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Garlic mustard (*Alliara petiolata*)

Life cycle

Biennial

Identification

Plants form basal rosette of kidney-shaped leaves in the first year, with a flower stalk elongated in the second year. Upper leaves are alternate on stem and triangular in shape. Leaves produce a distinct garlic odor when crushed. Single flower stem with white flowers produced in second year.

Garlic mustard plants (photo courtesy of John M. Randall, The Nature Conservancy).

Origin

Native to Europe but now found extensively in North America. First recorded in 1868 in Long Island, NY. Most frequent in New England and midwestern United States, but increasing in population in the Pacific Northwest.

Impact

Competitive with native desirable species in deciduous forests, possibly through allelopathy (natural, plant-produced chemicals that negatively affect nearby plants). Native species that are critical to wildlife are displaced.

Habitat and ecology

Commonly found in deciduous forests and shaded roadsides in soils with abundant nitrogen and occasional disturbance. Garlic mustard germinates from seed in spring, develops a rosette in the first year, and produces a seed stalk and seeds in the second year. This species has a low tolerance for drought in the first summer or for acidic soils. Populations are even-aged: a site will contain only rosettes in the first year and none in the second year when the entire population is flowering. Seed is dispersed primarily by humans and animals, and not to any great extent by wind or water. In Europe, populations are kept in check by natural insect and fungal enemies.

Management

Cutting/mowing: Cutting can be very effective during flowering but prior to seed production. When seed is filled, remove seed stalks from site and burn. Prior to seed filling, cut stalks can reflower.

Manual removal: Effective with small, localized populations.

Biological control: Potential biological controls are under investigation.

Burning: Control with burning is variable and can stimulate germination of seeds in the soil.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Most effective when applied in early fall of rosette year.
triclopyr (several trade names)	Apply when actively growing.
bentazon (Basagran)	Apply when actively growing.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Giant hogweed infestation (photo courtesy of Elizabeth Colquhoun).

Giant hogweed (*Heracleum mantegazzianum*)

Life cycle

Perennial

Identification

Grows 15 to 20 feet tall. Often confused with cow parsnip, but with dark purple spots on stem and leaf stalks. Stems 2 to 4 inches in diameter with stiff hairs. Compound leaves up to 5 feet in width, more deeply incised than cow parsnip. Flat-topped umbel up to 2.5 feet in diameter with white flowers.

Origin

Giant hogweed is a native of southwestern Asia, but was introduced as an ornamental in the United Kingdom, Canada, and New York, and has since spread to several states.

Impact

Giant hogweed exudes a watery sap that sensitizes skin to ultraviolet radiation, resulting in severe blistering and painful dermatitis. It also forms a dense canopy that displaces natives and increases the risk of soil erosion along ditchbanks because of its shallow root system.

Habitat and ecology

Giant hogweed is adaptable to many habitats, but is most common along roadsides, vacant lots, and streambanks. Plants often do not flower until several years after germination. Reproduces by seed and vegetatively. Plants die after first flowering and seed set. Seed remains viable for about 7 years.

Management

Cutting/mowing: Cutting giant hogweed stimulates resprouting and branching.

Manual removal: Manual removal is dangerous to human health because of the toxic sap.

Biological control: Not available.

Burning: Burning is not practical because of the human health hazards.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Repeated applications necessary. Most effective when applied during the bud stage of growth.
dicamba (Banvel, Clarity, etc.)	Apply to young plants during active growth.
2,4-D (several trade names)	Apply to young plants during active growth.
MCPA (several trade names)	Apply to young plants during active growth.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Gorse (*Ulex europaeus*)

Life cycle

Perennial

Identification

Multiple branches with leaves modified into thorns produce massive colonies of impenetrable vegetation. Colonies reach 6 to 10 feet tall. Bright yellow, pealike flowers produce pods with one to four seeds.

Spiny gorse stem and modified leaves (top) and infestation near Bandon, Oregon (bottom).

Origin

Native to western Europe, where gorse is planted for hedgerows. Brought to North America as an ornamental in the late 1800s and now found on both the east and west coasts of the United States.

Impact

Gorse produces an oil that fuels fire, thus presenting an extreme fire hazard. In 1936, more than 30,000 acres and many buildings were burned in Bandon, Oregon by a fire that was fueled primarily by gorse. The weed also reduces land value and is impenetrable to livestock and humans.

Habitat and ecology

Gorse is prolific in moderate climates with moderate to high moisture. It is found in logged areas, sand dunes, roadsides, and pastures. As a nitrogen-fixing legume, it can survive in otherwise infertile soils. Reproduction is both vegetative and by seed. Cut plants will resprout and may involve rhizomatous buds. Reproduction by seed is most common. Seeds are ejected from pods and dispersed long distances by humans, animals, and water. Seeds can remain dormant in soil for more than 70 years. Young plants grow very quickly and can accumulate more than 3 tons of biomass per acre in the first year of growth.

Management

Cutting/mowing: Cutting and mowing are ineffective because of the extensive root system, potential for regrowth, and difficulty in accessing spiny stems.

Manual removal: Manual removal is difficult because of the spiny stems and impenetrable plant canopies.

Biological control: The gorse weevil (*Apion ulicis*) was introduced in 1953 but has had minimal success because of the extensive plant reserves available for regrowth.

Burning: Burning is often impractical because of the dangerous fuel level available in gorse.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Effective but will damage or kill native plants in a broadcast application. Repeat as necessary.
picloram (Tordon)	Spring and summer treatments effective. Repeat as necessary.
triclopyr (several trade names)	Moderately effective control.
hexazinone (Velpar)	Moderately effective control.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Hoary cress (*Cardaria draba*) and hairy whitetop (*Cardaria pubescens*)

Life cycle

Perennial

Identification

Hoary cress: Perennial up to 2 feet tall with upper leaves with two lobes clasping the stem. Many white flowers with four petals in clusters. Heart-shaped seed capsules contain two seeds each.

Hairy whitetop: Similar to hoary cress. Fruit provides distinguishing characteristics: while hoary cress produces heart-shaped fruit, that of hairy whitetop is round. Fruit and sepals of hairy whitetop are covered with hair.

Origin

Native to southwest Asia. Hoary cress was most likely introduced in ship's ballast or alfalfa seed in the 1870s. Whitetop was introduced in alfalfa seed from Turkestan in the early 1900s. Both species are now distributed throughout the Pacific Northwest.

Hoary cress plant.

Impact

Hoary cress and hairy whitetop displace native rangeland forage species. The weeds are toxic to livestock and reduce alfalfa and grain crop yield.

Habitat and ecology

Hoary cress and hairy whitetop are adaptable to many habitats and soil types. They are common in cropland, roadside and irrigation ditches, and noncropland. While plants can regenerate from root tissue, plant dispersal to new areas is primarily facilitated by movement of self-pollinated seed in water, crop seed, and attached to machinery.

Management

Cutting/mowing: Cutting and mowing are moderately effective when repeated or when regrowth is treated with herbicides.

Manual removal: Pulling plants is effective with seedlings, but not with established plants.

Biological control: Not available.

Burning: Burning is not very effective because of the extensive root system and potential to regenerate plants from root tissue.

Herbicides: Effective herbicides include:

Herbicide	Comments
MCPA (several trade names)	Effective when seedling plants are treated during active growth.
2,4-D (several trade names)	Effective when seedling plants are treated during active growth.
metsulfuron (Ally, Escort)	Effective when plants are small.
sulfometuron (Oust)	Effective when plants are small.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Himalayan blackberry (*Rubus discolor*)

Life cycle

Perennial

Identification

Root buds produce upright trailing stems with alternate compound leaves with serrate margins. Reddish stems with sharp spines. White flowers result in black aggregate berry fruit.

Origin

Himalayan blackberry is a native of western Europe. It is thought to have been introduced in the United States as a cultivated crop in about 1885 and had spread from coast to coast by 1945.

Impact

Himalayan blackberry displaces native plant species, prevents water flow in streams and irrigation ditches, and inhibits recreational activities.

Habitat and ecology

Himalayan blackberry is most prolific in areas with more than 30 inches annual precipitation and is adaptable to a wide range of soil types and pH. It forms impenetrable thickets in noncropland, pastures, tree plantations, and roadsides. Reproduction is both by seed and vegetatively. Seven thousand to 13,000 seeds are produced in a square meter of growth. Roots reproduce vegetatively at cane apices. Canes can grow more than 20 feet per season with rootstocks more than 30 feet long. Long distance dispersal occurs when seeds are carried by birds and animals.

Management

Cutting/mowing: Effective when regrowth is treated with herbicides.

Manual removal: Manual removal is difficult and often ineffective.

Biological control: Not available.

Burning: Burning after cutting vegetative growth can be effective when regrowth is treated with herbicides.

Himalayan blackberry fruit (top), plants (middle), and landscape view of extensive invasion near Corvallis, Oregon (bottom).

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Repeated applications necessary. Most effective when applied from flowering through the first hard frost.
picloram (Tordon)	Apply to young plants during active spring growth.
2,4-D (several trade names)	Apply to young plants during active spring growth.
triclopyr (several trade names)	Apply to young plants during active spring growth.
triclopyr + 2,4-D (Crossbow)	Apply to young plants during active spring growth.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Japanese knotweed (*Polygonum cuspidatum*)

Life cycle

Perennial

Identification

Rhizomatous perennial that forms dense colonies up to 6 feet in height. Colonies supported by hollow, jointed stems that resemble bamboo. Leaf base sheathed with an ocrea. Leaves are alternate, wide, and up to 10 inches in length. Small, white flowers produced in elongated panicles.

Origin

Native to eastern Asia. Introduced from Japan as an ornamental by way of the United Kingdom in the 1820s. Japanese knotweed is common in the eastern United States.

Impact

Japanese knotweed displaces native plant species with rapid early-season growth and competition for water and nutrients with its extensive rhizomatous root system.

Habitat and ecology

Japanese knotweed is adaptable to many soil types and growing conditions, but is most prolific in high precipitation regions. It grows rapidly in full sunlight and is not adapted to shade conditions. Japanese knotweed reproduces primarily by rhizome fragments, but can hybridize with related *Polygonum* species and produce viable seed. Rhizomes can be up to 60 feet in length and emerge from soil depths up to 3 feet. Rhizomes have been observed to penetrate asphalt. Japanese knotweed is spread long distances through rhizome transport in fill dirt or in streams. Plant growth is rapid in spring and summer, with flowering in August and September.

Management

Cutting/mowing: Repeated cutting can be effective when combined with herbicide treatment of regrowth.

Manual removal: Stimulates growth of new plants by spreading rhizome pieces.

Biological control: None known.

Burning: Often impractical due to plant location.

Japanese knotweed seedling.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Fall application most effective.
picloram (Tordon)	Long-term control but difficult to reestablish desirable vegetation.
dicamba (Banvel, Clarity, etc.)	Apply at seedling stage of growth.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Jointed goatgrass (*Aegilops cylindrica*)

Life cycle

Annual

Identification

Jointed goatgrass and wheat look similar in vegetative growth stages. The most effective way to identify jointed goatgrass in the seedling stage is to dig up young plants and look for a spikelet. Jointed goatgrass seedling leaves are narrower than wheat leaves and darker green, with evenly spaced hairs at 90-degree angles to the leaf margins. Spikes are slender and cylindrical, with 5 to 10 spikelets or joints tipped with long awns.

Origin

Jointed goatgrass is a native of southern Europe and was introduced in the United States in the late 1800s. It is now common in most winter wheat growing areas in the Great Plains and Pacific Northwest.

Impact

Jointed goatgrass causes severe yield and crop quality losses in winter wheat. Five jointed goatgrass plants per square foot reduce wheat yield by about 25 percent in Oregon studies. Jointed goatgrass will hybridize with wheat. Hybrid seed is difficult to clean from wheat seed and can result in significant crop dockage.

Mature jointed goatgrass plant.

Habitat and ecology

Jointed goatgrass is most common in winter wheat production, but roadsides, ditches, waterways, and noncropped areas also can serve as refuges for future infestations in nearby crop production. The life cycle is similar to wheat, but with earlier tillering in the fall and better drought tolerance in the summer. Jointed goatgrass typically emerges in early fall, tillers extensively until late spring, and reproduces in summer when wheat is also in the reproductive stage. In dry years, jointed goatgrass will also emerge in late spring if moisture is available and produce seed in early summer. One jointed goatgrass plant can produce up to 4,000 seeds.

Management

Cutting/mowing: Prior to jointed goatgrass tillering, mowing or cutting is effective. After tillering has begun, cutting will stimulate further tillering.

Manual removal: Hand-pulling sparse infestations is effective. Remove pulled plants from the field if pollination has begun.

Biological control: Not available.

Burning: Burning has killed more than 90 percent of jointed goatgrass seed lying on the soil surface.

Other cultural practices: Prevent jointed goatgrass from spreading to new fields by cleaning equipment and planting certified seed. Crop rotation allows opportunities to use tillage and grass-selective herbicides for jointed goatgrass control. In wheat production, maximize the competitiveness of the crop by selecting taller varieties and planting in narrower row spacings.

Herbicides: Effective herbicides include:

Herbicide	Comments
imazamox (Beyond)	Effectively controls jointed goatgrass, but can be used in wheat only with imazamox-tolerant (Clearfield) wheat varieties.
glyphosate (several trade names)	Spot-spraying sparse infestations in noncropland will prevent seed production if applications are made when jointed goatgrass is vegetative. Applications after pollination will not prevent seed production.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Diffuse knapweed (*Centaurea diffusa*)

Life cycle

Annual or short-lived perennial

Identification

Rough stems up to 2 feet tall with widely dispersed branches. Leaves are pinnately divided. Numerous white or pink flowers with bracts tipped with a fine spine.

Origin

Native to Asia and eastern Europe. First found in the United States in Washington in 1907 in an alfalfa field, probably introduced in the alfalfa seed. Diffuse knapweed is now widely distributed in the western United States.

Impact

Diffuse knapweed displaces natives through early invasion and the suppression of nearby species with the release of an allelopathic chemical from the roots. It is unpalatable to livestock, and plant spines may damage the mouths and digestive tracts of livestock. Diffuse knapweed considerably reduces hay quality.

Diffuse knapweed rosette (top) and mature flowering plant (bottom).

Habitat and ecology

Diffuse knapweed is invasive in rangeland, noncropland, and nonirrigated pastures. It is most prolific in dry soils and arid environments. Seed germinates in fall or early spring depending on moisture availability. Plants remain in the rosette stage for as long as several years, then are triggered by low temperatures and chemical changes to bolt and produce seeds. Plants flower in July and August and can produce up to 18,000 seeds per plant. Seeds display polymorphic germination behavior in which germination is spread over time. Seeds spread primarily by wind. Allelopathic chemicals exuded by diffuse knapweed limit renovation with other species and may persist in soil for years.

Management

Cutting/mowing: Cut plants will regrow and often produce seed. Mowing can increase branching and reduce growth of nearby desirable species.

Manual removal: Pulling plants can be effective in reducing plant densities, particularly when repeated. Flowering plants should be removed from the field and burned.

Biological control: Nine biological agents are established in the United States. Seed production and root and shoot growth are inhibited, but diffuse knapweed densities have not decreased because seed production is so prolific.

Burning: Burning is effective when followed by reseeding of desirable species.

Herbicides: Effective herbicides include:

Herbicide	Comments
dicamba (Banvel, Clarity, etc.)	Effective when seedling plants are treated during active growth. Most effective when tank-mixed with picloram or 2,4-D.
2,4-D (several trade names)	Effective when seedling plants are treated during active growth. Often tank-mixed with dicamba for increased control.
picloram (Tordon)	Very effective control. Reseeding with grasses is difficult given the long-term residual control of picloram.
glyphosate (several trade names)	Effective and often used as a spot treatment (applied with a wick wiper above the canopy of desirable species).

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Russian knapweed (*Centaurea repens*)

Life cycle

Perennial

Identification

Extensive root system supports stems up to 3 feet tall. Lower leaves lobed, upper leaves entire or nearly entire. Multiple branches tipped with pink to light purple flowers with many light-colored bracts.

Origin

Native to eastern Europe, Mediterranean areas, and Asia. First found in North America in Canada in the early 1900s in alfalfa and sugarbeet seed. Russian knapweed is now common in the western United States and Canada.

Impact

Russian knapweed displaces natives through rapid and early growth and through the production of allelopathic compounds that suppress competing plants. It reduces forage and hay quality. It is poisonous to horses and the cause of the neurological disorder called "chewing disease."

Habitat and ecology

Russian knapweed is common in pastures, noncropland, streamside and irrigation ditches, and rangeland. It is a persistent perennial that can survive for many years. Shoots arise from root stems. Plants form rosettes in early spring and flower in the summer. Reproduction is primarily vegetative, but individual plants also can produce up to 1,200 seeds. Seed is dispersed in contaminated hay and by wind. The extensive root system can support up to 300 shoots per square meter. This competition, combined with

the inhibitory effects of the allelopathic compounds, reduces competition from nearby species.

Management

Cutting/mowing: Mowing or cutting plants often will deplete reserves, but is ineffective in dense, well-established populations.

Manual removal: Pulling plants is ineffective because of the extensive root system.

Russian knapweed seedling (top) and mature plant (bottom).

Biological control: Two agents can be moderately effective when combined: *Subanguina picridis*, a gall-forming nematode, and *Aceria acroptiloni*, a seed gall mite.

Burning: Burning is ineffective because of the extensive root system, but can deplete underground reserves if repeated often.

Herbicides: Effective herbicides include:

Herbicide	Comments
picloram (Tordon)	Effective when applied in the fall. Long-term soil residual effect inhibits renovation with grasses.
clopyralid (Stinger, etc.)	Effective when applied in the bud stage of growth. Repeat applications necessary.
glyphosate (several trade names)	Effective when applications are repeated in spring and fall. Spring applications control only top growth.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Spotted knapweed (*Centaurea maculosa*)

Life cycle

Biennial or short-lived perennial

Identification

Basal rosette in first year with deeply lobed leaves. Erect, wiry stems elongate in second year. Grayish alternate leaves decrease in size toward flower. Solitary disk-type flower heads, purple or pink, terminate branches.

Origin

Native to Europe, most likely introduced in alfalfa seed from Asia to North America. Thought to be introduced to Pacific Northwest in ship's ballast.

Impact

The low palatability of spotted knapweed results in overgrazing of natives and soil erosion. Spotted

knapweed displaces native plants and contaminates hay and crop seed production.

Habitat and ecology

Common in well-drained, light-textured soils that receive summer rainfall, and in foothill prairie habitats. Original infestations occur in disturbed sites. Reproduces by seed with fall to early spring germination. Spotted knapweed forms a rosette in first year, followed by production of up to seven flowering stems. When acting as a perennial, plants remain in rosette until environmental conditions favor high seed production. Seeds are typically dispersed short distances. Long-distance seed dispersal is by livestock, vehicles, or contaminated hay or crop seed.

Management

Cutting/mowing: Spotted knapweed will resprout, flower, and produce seed after mowing. Mowing is not practical in rocky, steep terrains. Mowing at flowering but before seeds are filled is moderately effective.

Spotted knapweed rosette (top) and flowers (bottom).

Manual removal: Ineffective or impractical with large populations.

Biological control: Several insect agents have been released for spotted knapweed control with moderate success: the sulphur knapweed moth (*Agapeta zoegana*), the broad-nosed seed weevil (*Bangasternus fausti*), knapweed peacock fly (*Chaetorellia acrolophi*), knapweed root weevil (*Cyphocleonus achates*), spotted knapweed seed head moth (*Metzneria paucipunctella*), bronze knapweed root-borer (*Sphenoptera jugoslavica*), green clearwing fly (*Terellia virens*), banded gall fly (*Urophora affinis*), and the UV knapweed seadhead fly (*Urophora quadrifasciata*).

Burning: Results have been variable: populations have been reduced 5 to 90 percent. Burn should be intense because at low temperatures burning will not prevent, and can even stimulate, seed germination.

Herbicides: Effective herbicides include:

Herbicide	Comments
clopyralid (Stinger, etc.)	Apply at bolting or bud stage of growth.
clopyralid + 2,4-D (Curtail)	Apply at bolting or bud stage of growth.
dicamba (Banvel, Clarity, etc.)	Apply at seedling stage of growth.
2,4-D (several trade names)	Apply at seedling stage of growth.
picloram (Tordon)	Long-term control but difficult to reestablish desirable vegetation.
triclopyr (several trade names)	Apply prior to bud stage of growth.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Kudzu (*Pueraria lobata*)

Life cycle

Perennial

Identification

Alternate compound leaves 6 to 8 inches long with three hairy leaflets oval in shape. Extensive climbing

vine can reach over 100 feet in length. Purple or red flowers resemble those of cultivated peas, but with a grape smell. Stem is covered with brown, smooth bark.

Kudzu infestations dominate a forest (photo courtesy of John M. Randall, The Nature Conservancy).

Origin

Kudzu is a native of southeastern Asia. It was introduced in the southeastern United States in 1876 as an ornamental, and was later promoted as a forage crop and to reduce soil erosion in agricultural areas, often referred to as the "miracle vine." Kudzu is now found in many areas of the United States.

Impact

Known as the "vine that ate the South," kudzu now covers 7 million acres. Kudzu's rapid and extensive growth will smother all vegetation, including forests. It dominates the landscape and can topple trees and telephone poles through the sheer weight of the extensive vines.

Habitat and ecology

Kudzu is common in many habitats and adaptable to a wide range of environmental conditions. It is most prolific in areas with mild winters and greater than 40 inches of precipitation. Vines can grow over 60 feet per season, or 1 foot per day. Reproduction is primarily vegetative. Individual tap roots can be over 6 feet in length and weigh over 400 pounds.

Management

Cutting/mowing: Effective when regrowth is treated with herbicides, but often impractical due to the extensive growth.

Manual removal: Manual removal is not effective or practical considering the extent of the underground root system. Tillage is also ineffective because it spreads rhizomes that form new plants.

Biological control: Not available.

Burning: Burning in spring in forested areas prior to herbicide treatment can be an important tactic in an integrated management program.

Herbicides: Herbicide application often needs to be repeated for several years. Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Repeated applications necessary.
dicamba (Banvel, Clarity, etc.)	Apply to young plants during active growth.
clopyralid (Stinger, etc.)	Apply to young plants or after cutting during active growth.
picloram (Tordon)	Apply to young plants during active growth or to regrowth after cutting. Can be very effective in a long-term program.
metsulfuron (Ally, Escort)	Effective in forested areas.
sulfometuron (Oust)	Effective in forested areas.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Leafy spurge (*Euphorbia esula*)

Life cycle

Perennial

Identification

Multiple stems up to 3 feet tall with alternate narrow leaves. Flowers are yellow-green with distinctive heart-shaped bracts. Roots with many branches and pink buds that produce stems. Seeds consist of a three-celled capsule, each containing one seed.

Origin

Native to central and eastern Europe. Most likely introduced in North America in the 1820s by way of Minnesota in a shipment of oats. Common in Pacific Northwest and upper Midwest United States.

Mature leafy spurge plant.

Impact

Very competitive in pastures and rangeland because of an extensive root system and high water use. Allelopathic towards native species. Reduces value of grazing land and hay as legumes and grasses are displaced. Causes irritation in mouth and intestines of cattle.

Habitat and ecology

Leafy spurge is common in uncultivated sites including roadsides, prairies and rangeland, and pastures. It occupies a wide range of habitats with varying annual precipitation, but is most common in semiarid rangelands with coarse-textured soils. Plants emerge in early spring and flower from May to July. Reproduces both by seed and vegetatively. Seed is dispersed short distances by explosive propulsion of the seed capsule from the plant. Seeds float readily and can travel long distances in irrigation canals, ditchbanks, and streambanks before being deposited. Leafy spurge reproduces vegetatively from crown and root buds. Vegetative tissue is capable of reproduction 7 to 10 days after seedling emergence.

Management

Cutting/mowing: Ineffective, as perennial plant tissue will resprout, often resulting in additional seedheads.

Manual removal: Ineffective because vegetative tissue left below ground is capable of regrowing.

Biological control: Several flea beetles (*Apthona* spp.) will reduce leafy spurge top growth, but have minimal effect on an established root system. Persistent feeding over long periods of time will eliminate plants.

Burning: Impractical in most situations.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate	Most effective when applied in spring to prevent flowering and repeated in early fall.
dicamba (Banvel, Clarity, etc.)	Apply at seedling stage of growth and/or during seed development.
2,4-D (several trade names)	Apply at seedling stage of growth and/or during seed development.
Picloram (Tordon)	Long-term control but difficult to reestablish desirable vegetation.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Mediterranean sage (*Salvia aethiopis*)

Life cycle

Biennial or short-lived perennial

Identification

Densely wooly plant with white hairs. Stems square and up to 3 feet tall, supported by a large taproot. Opposite, wavy leaves primarily at the base of the plant in a rosette. Upper leaves are small and pointed, somewhat purplish with a sagelike odor when crushed. White flowers resemble those of mint.

Origin

Mediterranean sage is a native of southern and southeastern Europe. It was introduced in the United States in alfalfa seed and first collected as an herbarium specimen in California in 1882.

Impact

Common contaminant in alfalfa hay and wheat production. Reduces crop quality and yield. Displaces native species in rangeland.

Habitat and ecology

Mediterranean sage is found in rangeland, alfalfa, and wheat, particularly on dry, south-facing slopes. Reproduces primarily by seed that is produced from May to August. Individual plants produce up to 100,000 seeds. Seeds are dispersed as plants tumble across the ground, and in hay or on farm equipment.

Seedling (top) and mature (bottom) Mediterranean sage plant.

Management

Cutting/mowing: Cutting Mediterranean sage stimulates resprouting and branching.

Manual removal: Small infestations can be removed by digging out the taproot 2 or 3 inches below the plant crown when plants are starting to bolt.

Biological control: The Mediterranean sage weevil (*Phrydiuchus tau*) has been established in the Pacific Northwest for more than 20 years but has not prevented the weed from spreading in most areas.

Burning: Burning is not practical or effective in cropping systems.

Herbicides: Mediterranean sage control with herbicides can be difficult because of the thick, wooly hairs and lack of herbicide uptake.

Medusahead (also known as medusahead rye) (*Taeniatherum caput-medusae*)

Life cycle

Annual

Identification

Stems 6 to 24 inches in length support rolled, narrow leaf blades. Inflorescence long with very long awns that are twisted and barbed.

Origin

Native to Mediterranean region of Eurasia and introduced to United States in the 1880s. First herbarium specimen collected near Roseburg, Oregon in 1887.

Impact

The low palatability of medusahead results in overgrazing of natives and soil erosion. Medusahead rapidly develops an extensive root system that results in excessive moisture use. Dead aboveground plant matter forms dense litter groundcover that prevents emergence of desirable plant species. Medusahead is so competitive that it often displaces other weedy species such as downy brome.

Mature medusahead plant.

Habitat and ecology

Prolific in temperate regions with high-clay-content soils capable of holding water late in the growing season. Often competes for habitat with downy brome, but medusahead germinates earlier in the fall than downy brome and develops an extensive root system that depletes moisture near the soil surface. Reproduces by seed, which is dispersed by wind, water, and livestock.

Management

Cutting/mowing: Effective when repeated and combined with herbicide treatment.

Manual removal: Can be effective with small populations.

Biological control: Not available.

Burning: Controlled burn in June can be effective.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Effective control when repeated applications are followed by seeding of a competitive desirable species.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Perennial pepperweed (*Lepidium latifolium*)

Life cycle

Perennial

Identification

One to 3 feet tall. Lower leaves form a dense clump, while upper leaves are smaller and grayish. White flowers form a dense raceme at terminal of branches.

Origin

Native to Europe, Asia, and Africa, but now widely distributed in the United States. Introduction in the United States is thought to be in sugar beet seed in the 1930s.

Impact

Displaces native vegetation and reduces crop yield, particularly in sugar beet and alfalfa. Perennial pepperweed has a low protein content and

Perennial pepperweed infestation (photo courtesy of Michael Carpinelli).

digestibility and is toxic to livestock. Infestations can be so detrimental that they significantly affect crop land values.

Habitat and ecology

Perennial pepperweed is common in disturbed areas or bare soil, such as agricultural land, rangeland, graded roadside ditches, and irrigation ditches. It germinates in late winter and early spring, with flowering and seed production by early summer. Perennial pepperweed is spread by seed and rhizomatous tissue. Rhizome pieces as small as 0.1 inch can grow into new plants. Rhizomes often travel in weedy hay, and seeds are spread in irrigation water. The weed survives in a wide range of environmental habitats and soil types.

Management

Cutting/mowing: Mowing at the flower bud growth stage can be very effective when integrated with herbicide applications.

Manual removal: Manual removal is not effective or practical considering the extent of the underground root system. Tillage is ineffective because it spreads rhizomes that form new plants.

Biological control: Several *Lepidium* species are endangered; therefore a lack of selectivity between weedy and desirable species limits the application of biological controls.

Burning: Burning is ineffective because perennial pepperweed plants recover faster than native or desirable plant species, thus increasing plant competition.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Most effective when applied to budding plants in the fall but before the first hard frost. In severe infestations, fall and spring applications can be more effective than fall applications alone.
metsulfuron (Ally, Escort)	Effective when applied from flower bud to early flowering.
chlorsulfuron (Glean)	Effective when applied from flower bud to early flowering.
triclopyr (several trade names)	Controls seedling plants prior to establishment, but will not control established plants.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Poison hemlock (*Conium maculatum*)

Life cycle

Biennial or perennial

Identification

Erect stems up to 10 feet tall with purple spots. Multiple branches with shiny leaves finely divided with segmented leaflets. Foliage with musty odor. White flowers in clusters.

Origin

Native of Europe, western Asia, and north Africa. Poison hemlock was brought to the United States from Europe as an ornamental in the early 1800s and is now spread worldwide.

Impact

Poison hemlock is very poisonous to humans and livestock. While all plant parts are toxic, the seeds are particularly potent. Poison hemlock displaces native vegetation, particularly as an early colonizer in disturbed ground.

Habitat and ecology

Poison hemlock is common along roadsides, noncropland, irrigation ditches, and streambanks. Reproduction is by seed. Seed germinates in fall, and plants may flower and produce seed in the first summer. Seed is spread by humans and animals, machinery, and water.

Management

Cutting/mowing: Repeated mowing can be effective and is most effective when regrowth is treated with herbicides.

Manual removal: Pulling plants is dangerous due to toxicity to humans. Pulled plants will not survive, but will remain toxic for years.

Biological control: The hemlock moth (*Agonopterix alstroemeriana*) in the larval stage severely defoliates poison hemlock.

Burning: Burning is not effective or practical given the areas that poison hemlock inhabits.

Poison hemlock seedling (top) and mature plants (bottom).

Posion hemlock stem with distinctive red to purple spotting.

Herbicides: Effective herbicides include:

Herbicide	Comments
dicamba (Banvel, Clarity, etc.)	Effective when seedling plants are treated during active growth. Not as effective as 2,4-D.
2,4-D (several trade names)	Effective when seedling plants are treated during active growth. Activity is enhanced with addition of surfactant.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Puncturevine seedling (top), mature plant (middle), and spiny seed capsule (bottom).

Puncturevine (*Tribulus terrestris*)

Life cycle

Annual

Identification

Prostrate plant that forms a mat with stems up to 4 feet in length. Opposite, hairy leaves divided into four to eight oval leaflets. Yellow flowers borne in leaf axils. Fruits break into sections that are very sharp and spiny.

Origin

Puncturevine is a native of the Mediterranean region. It was first documented in the Pacific Northwest in 1924 and is suspected to have been introduced as seed in wool from Europe.

Impact

Puncturevine produces spiny seeds that often puncture bike and vehicle tires. Livestock can be injured when the spiny seeds become embedded in feet, mouths, eyes, and digestive tracts. Nitrate levels in puncturevine can be toxic to livestock.

Habitat and ecology

Puncturevine is common along roadsides. Seeds germinate from spring through summer from shallow soil depths. Plants can flower as early as 3 weeks after germination, with seeds produced 1 to 2 weeks later. Individual plants produce over 1 million spiny seeds that penetrate tires and skin and are spread long distances. Puncturevine is tolerant of drought conditions and survives well in sandy or gravelly soils.

Management

Cutting/mowing: Effective prior to seed production.

Manual removal: Effective prior to seed production. Burn removed plants if they are past the flowering growth stage to prevent seed maturation.

Biological control: Two species of weevils are available: one that feeds on seeds (puncturevine seed weevil, *Microlarinus lareynii*), and one that feeds on stems (puncturevine stem weevil, *Microlarinus lypriformis*). Both species are moderately effective at best because of a lack of cold hardiness.

Burning: Burning can be effective in preventing seed production.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Apply prior to flowering.
dicamba (Banvel, Clarity, etc.)	Apply to young plants during active growth.
2,4-D (several trade names)	Apply to young plants during active growth.
MCPA (several trade names)	Apply to young plants during active growth.
bromoxynil (Buctril)	Apply to young plants during active growth. Most effective when applied in warm weather.
paraquat (Gramoxone)	Apply to young plants during active growth.
oxyfluorfen (Goal)	Apply to young plants during active growth.
trifluralin (Treflan)	Apply prior to emergence and incorporate with tillage or irrigation.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Purple loosestrife (*Lythrum salicaria*)

Life cycle

Perennial

Identification

Square-sided stem supports leaves that are opposite or in whorls of three. Leaves are lanceolate. Established plants supported by a large root crown. Flowers are deep purple and in terminal spikes up 18 inches in length.

Origin

Native to Eurasia. Became established in the northeastern United States in the 1800s and spread westward through wetlands until distributed throughout North America. Means of introduction is not known but theorized to be an intentional introduction as an ornamental or in wool, hay, or ship's ballast.

Impact

Purple loosestrife often dominates wetlands and impedes water flow in irrigation ditches and streams. Prolific seed production and seedling survival displace native vegetation and food sources for wildlife, such as cattails.

Habitat and ecology

Purple loosestrife is an emergent (partially submerged) aquatic plant found in ditches, streambanks, ponds, and marshes. Prolific in slow-moving streams with fully sunlit streambanks and high organic

Purple loosestrife seedling (top) and flowering plants (bottom).

matter soil, similar to the habitat occupied by cattails, sedges, and reed canarygrass. Spread primarily by seed, which can float in streams or be transported by birds, humans, and other animals.

Management

Cutting/mowing: Impractical in semiaquatic streambanks.

Manual removal: Difficult and often ineffective.

Biological control: Four insect species have been introduced for control of purple loosestrife in the Pacific Northwest: two foliar-feeding beetles (black margined loosestrife beetle, *Galerucella calmariensis*, and golden loosestrife beetle, *Galerucella pusilla*), a flower bud weevil (loosestrife seed weevil, *Nanophyes marmoratus*), and a root weevil (loosestrife root weevil, *Hylobius transversovittatus*). The two foliar-feeding beetles have been the most effective of the biological agents.

Burning: Impractical in aquatic habitats.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Check regulations for labeled aquatic uses, formulations, and permitting procedures. Glyphosate is a nonselective herbicide that will control most desirable species, thus promoting habitat occupation by young purple loosestrife plants. Most effective when stems are cut and glyphosate in a 1 to 2 percent solution is painted on cut surface. Retreatment necessary.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Rush skeletonweed (*Chondrilla juncea*)

Life cycle

Perennial

Identification

As the name suggests, skeletonweed seems to be all stems and no leaves. Stems are erect, grooved, and branched many times. Lower leaves are small and narrow, upper leaves are awnlike. Stem and leaves exude milky latex when broken. Cream to light purple flowers with toothed tips.

Origin

Native to Asia and the Mediterranean region. First reported in North America near Spokane, Washington, in 1938, and quickly spread throughout the Northwest.

Impact

Rush skeletonweed now infests more than 6 million acres of rangeland in the Pacific Northwest. In wheat production, rush skeletonweed can reduce yield by up to 80 percent. Dense infestations displace native forage species that are important to the livestock industry.

Habitat and ecology

Rush skeletonweed reproduces by seed and vegetatively. The majority of seeds germinate 1 or 2 years after they are produced and require several weeks of continuous moisture for establishment. Roots can reach depths up to 8 feet with minimal lateral rooting. Small severed root pieces can form new shoots from soil depths of up to 4 feet. Rush skeletonweed is common in moderate precipitation zones that do not experience severe drought periods. It is common in rangeland, pasture, and wheat production, as well as in noncropland and roadways. Several biotypes are found in the Pacific Northwest. Dense infestations are common in areas void of native vegetation, such as overgrazed rangeland. Rush skeletonweed is palatable to sheep and can be an important nutrient source in poor-quality pastures and rangeland.

Management

Cutting/mowing: Cutting or mowing are ineffective.

Rush skeletonweed seedling (top), rosette (middle), and flower (bottom).

Manual removal: Pulling plants is effective in small populations and during seedling stages. Areas opened by plant removal should be immediately seeded with desirable species to suppress future rush skeletonweed seedlings. Pulled established plants should be burned to prevent regrowth from root pieces.

Biological control: Three biocontrol agents have been used in the Pacific Northwest. The skeletonweed gall mite (*Eriophyes chondrillae*), introduced in the late 1970s, hinders plant growth significantly and reduces seed production. Rush skeletonweed rust (*Puccinia chondrillina*) was the first exotic plant pathogen successfully used for weed control in North America. It was introduced in the late 1970s and is most successful in controlling young plants. The skeletonweed gall midge (*Cystiphora schmidti*) in the larval stage attacks stems and leaves. Unfortunately, native parasitoids have begun to infest this insect agent.

Burning: Burning effectively limits seed production, but will not control deeply rooted plant material that is capable of resprouting.

Herbicides: Effective herbicides include:

Herbicide	Comments
2,4-D (several trade names)	Moderate control with reapplication often necessary. Results can be improved by tank-mixing with dicamba or picloram.
dicamba (Banvel, Clarity, etc.)	Moderate control with reapplication often necessary. Results can be improved by tank-mixing with 2,4-D or picloram.
picloram (Tordon)	Control is often more consistent than that achieved using 2,4-D or dicamba.
clopyralid (Stinger, etc.)	Moderate control improved with repeated applications.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Small broomrape (*Orobanche minor*)

Life cycle

Annual

Identification

Parasitic weed that attaches to the roots of host plants. Orange or brown "spiders" form belowground. Emerged flower stalks resemble purple asparagus and reach 5 to 15 inches in height. Many purple florets per stalk.

Origin

Small broomrape is a native of Europe, the Mediterranean, and North Africa. In North America, it was first documented in California in 1838. Small broomrape introduction routes are largely unknown, but likely involve contaminated crop seed and equipment.

Emerged small broomrape flower stalks in a red clover field in the Willamette Valley, Oregon.

Impact

Small broomrape causes severe crop destruction and yield loss. Crop quality is compromised by contamination with millions of dustlike small broomrape seeds. Small broomrape is a major pest in legume production, and can attach to weedy species, such as spotted catsear (*Hypochaeris radicata*), that are common in turf and landscape management.

Habitat and ecology

Small broomrape (Orobanchaceae family) is an annual. Flowers are self-pollinating in a terminal cluster. Flowering period is short, starting 1 week after emergence, with seed release beginning 1 month after emergence. Small broomrape is an obligate parasite, lacking chlorophyll, and obtaining all nutrients at the expense of the host. Nutrients are removed from the host to the small broomrape plant through a penetrating organ called a haustorium. An individual small broomrape plant produces over 1 million seeds that are 0.3 by 0.2 mm. *Orobanche* spp. parasitize plants from the Asteraceae, Fabaceae, and Solanaceae plant families. Major economic damage from small broomrape is restricted to the Fabaceae family, especially clover.

Management

Cutting/mowing: Cutting or mowing emerged small broomrape plants, accompanied by removal from the site, effectively limits seed production but is too late in the parasite life cycle to mitigate loss of resources from the host plant.

Manual removal: Pulling plants is effective when flower stalks are then removed from the site.

Biological control: Not available.

Burning: Burning effectively limits seed production, but will not prevent below-ground parasite growth or damage to the host plant.

Herbicides: Effective herbicides include:

Herbicide	Comments
imazamox (Raptor)	Most effective when applied after parasitic attachment to the host, but well prior to flower stalk emergence.
glyphosate (several trade names)	Effective in low doses when applied prior to flower stalk emergence. Spot applications

(2.5 percent glyphosate solution) immediately after flower stalk emergence will prevent small broomrape seed production.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Tamarisk, saltcedar (*Tamarix ramosissima* or *T. parviflora* or *T. chinensis*)

Life cycle

Perennial

Identification

Shrub or small tree up to 20 feet tall. Reddish bark. Small, scaly leaves. Pink or white flowers in branched clusters.

Tamarisk flowers (top, photo courtesy of Barry Rice, The Nature Conservancy) and infestation (bottom, photo courtesy of John M. Randall, The Nature Conservancy).

Origin

Native of Europe, Asia, and Africa. Introduced in early 1800s from Asia as an ornamental or to stabilize streambanks and provide a windbreak.

Impact

Tamarisk displaces native woody species and supported wildlife, increases soil salinity, and disrupts water drainage and movement. Individual plants can use hundreds of gallons of water each day.

Habitat and ecology

Invasive in riparian areas, wetlands, and floodplains. Once established, tamarisk can survive without access to groundwater. It is prevalent in high-salt habitats and can accumulate salts in leaves. Soil salinity increases as leaves are dropped, thus increasing soil salinity to such an extent that other species will not survive. Tamarisk reproduces primarily by seed, but also by root fragments or underwater stems. Tamarisk is susceptible to shading, which allows for revegetation as a management strategy.

Management

Cutting/mowing: Cutting plants can be effective, particularly when regrowth is cut repeatedly or treated with herbicides.

Manual removal: Manual removal can be effective with seedling plants.

Biological control: Not available because of closely related ornamentals.

Burning: Burning can be effective when regrowth is cut or treated with herbicides.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Effective but will damage or kill native plants in a broadcast application.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Tansy ragwort (*Senecio jacobaea*)

Life cycle

Biennial or short-lived perennial

Identification

Stems up to 6 feet tall supported by a large taproot. Alternate leaves are lobed and covered with cobweblike hairs when young. Numerous flower heads consisting of both disk and ray flowers.

Origin

Native to Europe and western Asia, but now distributed worldwide. Tansy ragwort arrived in seaports in the Pacific Northwest in the early 1900s.

Impact

Tansy ragwort is toxic to horses and cattle and will cause severe liver damage.

Habitat and ecology

Prolific in pastures, clearcuts, and disturbed roadside areas. Tansy ragwort produces a rosette in the first year.

Management

Cutting/mowing: Mowing can be moderately effective but may need to be repeated as flower stalks resprout.

Tansy ragwort seedling (top) and mature plant (bottom).

Manual removal: Moderately effective with low populations.

Biological control: The foliar-feeding cinnabar moth (*Tyria jacobaeae*) was introduced in Oregon in 1960 for control of tansy ragwort and can reduce plant populations by 50 to 75 percent. The tansy ragwort flea beetle (*Longitarsus jacobaeae*) was introduced in 1971 and feeds on root crowns in the winter. Control with the flea beetle is over 90 percent in some areas. The tansy ragwort seed fly (*Pegohylemyia seneciella*) feeds on seed in the summer, particularly east of the Cascade Range. The most effective biological control has been observed when all three insects are used in combination.

Burning: Ineffective.

Herbicides: Effective herbicides include:

Herbicide	Comments
dicamba (Banvel, Clarity, etc.)	Apply at seedling stage of growth, in combination with 2,4-D.
2,4-D (several trade names)	Apply at seedling stage of growth.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Bull thistle (*Cirsium vulgare*), musk thistle (*Carduus nutans*), and Scotch thistle (*Onopordum acanthium*)

Life cycle

Biennial

Identification

Bull thistle: In the first year, bull thistle forms a rosette of leaves, with bolting and flowering in the second year. Upper sides of leaves are prickly and hairy, undersides of leaves cottony. Stem reaches 2 to 5 feet tall when bolting. Multiple dark purple flowers with spine-tipped bracts.

Musk thistle: Dark green leaves with light green midrib and wavy and spiny lobed margins. Leaves appear

Bull thistle seedling (top) and mature plant (bottom).

winged at attachment to stem. Multiple stems reach up to 6 feet tall, terminated with a single rose to purple flower.

Scotch thistle: Broad stems with spiny wings reach up to 12 feet tall. Leaves with fine, grayish hair and spiny. Lower leaves are large (2 feet long by 1 foot wide) and arranged in a rosette in the first year, upper leaves alternate and irregularly lobed. Flower heads

Musk thistle seedling (top) and mature plant (bottom).

with spine-tipped bracts and violet or violet-red flowers. Many flowers per plant.

Origin

Bull thistle: Bull thistle is native to Eurasia and arrived in Portland, Oregon in the late 1800s, possibly as a crop seed contaminant.

Musk thistle: Musk thistle is native to southern Europe and western Asia. Introduced in ship's ballast in the eastern United States in the mid 1800s. First recorded in North America in Pennsylvania in 1852.

Scotch thistle: Scotch thistle is a native of Asia and Europe but is now found throughout North America. Scotch thistle became the national emblem of Scotland after saving the Scots and Malcolm I from invading Norsemen. The guards of Staines Castle were alerted to an impending attack by cries of pain from invaders attempting to cross a dried moat infested with Scotch thistle. It was introduced to the eastern United States in the late 1800s.

Scotch thistle seedling (top) and mature plants (bottom).

Impact

Bull, musk, and Scotch thistle displace more palatable native plants in pasture and rangeland. Heavy infestations form thickets that are impenetrable to livestock or humans.

Habitat and ecology

Bull thistle: Common along roadsides and in cultivated fields and pastures. Prolific in grazed pastures. Efficient uptake of nitrogen fertilizer, often at the cost of desirable pasture species. Adaptable to many environmental conditions, but not considered as problematic as musk or Scotch thistle.

Musk thistle: Prolific under a wide range of soil pH and moisture conditions. Commonly infests ditchbanks and roadsides, cereal fields, pastures, forests, and rangelands. High moisture and sunlight favor establishment.

Scotch thistle: While typically biennial, Scotch thistle can grow as an annual or short-lived perennial as environmental conditions dictate. Prefers high-moisture swales, gullies, and waterways. Reproduces by seed, with density-independent seed production of up to 40,000 seeds per plant. Seed germination influenced by light quality (germination is greatest in low light quality, suggesting that seed burial is important) and a water-soluble germination inhibitor. The germination inhibitor is diluted in high moisture, thus ensuring that plant growth is initiated in adequate soil moisture. Seed is dispersed by wildlife and livestock, humans, water, and wind.

Management

Cutting/mowing: Effective when combined with revegetation of native species. Repeated mowing, in combination with other management methods, often is necessary for long-term control.

Manual removal: Effective when entire aboveground plant growth is removed.

Biological control: The bull thistle gall fly (*Urophora stylata*) attacks developing seed heads and reduces

seed production, but populations are difficult to maintain given the transient nature of bull thistle. The thistle head weevil (*Rhinocyllus conicus*) in the larval stage will attack the seed head and reduce seed production of several thistle species. Some strains attack native thistles, so use caution when deciding whether to release insects.

Burning: Not practical in most pasture sites.

Herbicides: Effective herbicides include:

Herbicide	Comments
2,4-D (several trade names)	Apply to rosettes in spring.
dicamba (several trade names)	Apply to rosettes in spring, or seedlings and rosettes in fall.
clopyralid (Stinger, etc.)	Apply to rosettes in spring or fall.
picloram (Tordon)	Apply to rosettes in spring or fall.
chlorsulfuron (Glean, etc.)	Apply from bolting to budding in spring. Add a nonionic surfactant.
metsulfuron (Ally, Escort, etc.)	Apply from bolting to budding in spring. Add a nonionic surfactant.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Canada thistle (*Cirsium arvense*)

Life cycle

Perennial

Identification

Rhizomatous perennial up to 5 feet in height with grooved stems. Leaves are alternate, lobed with spiny margins, with the base of each leaf surrounding the stem. Pink or purple flowers with spineless bracts.

Origin

Native to southeast Europe. Introduced to North America in the early 1600s and now distributed worldwide.

Canada thistle seedling (top) and mature plant (bottom).

Impact

Displaces native vegetation and reduces crop yield. Canada thistle can be a host for agricultural pests such as insects and diseases.

Habitat and ecology

Canada thistle is invasive in agricultural lands, grasslands and prairie, and noncropland. It is adaptable to and survives in a wide range of habitats and environmental conditions. It spreads primarily by vegetative means, but is also a prolific seed producer. Individual plants can produce 5,000 seeds, which can remain viable after 20 years of dormancy. Vegetative reproduction is possible with as little as a 0.25-inch section of root. The root system can grow up to 20 feet per season and extend to soil depths up to 30 feet for water and nutrient acquisition, accounting for over 10 miles of total roots in a well-established Canada thistle colony.

Management

Cutting/mowing: Mowing is ineffective because of the potential for vegetative reproduction and resprouting.

Manual removal: Manual removal is not effective or practical considering the spiny nature of the plants and the extent of the underground root system.

Biological control: Several insect agents have been researched and released with poor results because the insect life cycles have not matched well with that of Canada thistle.

Burning: Results have been mixed when Canada thistle is burned.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Most effective when applied to budding plants in the fall but before the first hard frost. In severe infestations, fall and spring applications can be more effective than fall applications alone.
clopyralid (Stinger, etc.)	Most effective when applied to actively growing plants in May or June. Fall applications can reduce spring regrowth.
clopyralid + 2,4-D (Curtail)	Most effective when applied to actively growing plants in May or June. Fall applications can reduce spring regrowth.
bentazon (Basagran)	Most effective when applied in late May or June and then repeated at 14-day intervals.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Italian thistle (*Carduus pycnocephalus*)

Life cycle

Winter annual, occasionally biennial

Identification

Leaves deeply cut into pairs of two to five lobes, with marginal spines. The terminal spine of each leaf is the longest, and undersides of leaves are finely woolly. Stems are woolly with spiny wings and grow as tall as 4 feet. Purple or pink flowers solitary or in clusters of up to five flowers on ends of branches. Hairy bracts.

Origin

Italian thistle is a native of southern Europe and the Mediterranean region. Now widespread, particularly in North America and Australia, New Zealand, and South Africa. Introduced in the western United States in the 1930s.

Impact

Italian thistle outcompetes desirable forage species in pasture and hay production. Sharp spines make it unpalatable to livestock. Italian thistle also dominates grasslands, roadways, firebreaks, and rights-of-way, where annual weed control often is uneconomical.

Habitat and ecology

Italian thistle reproduces by seed but not vegetatively. Seeds germinate in fall when moisture is available. Seedlings overwinter as rosettes with broad, competitive leaves, and plants branch and flower in the spring and early summer. Individual plants can produce up to 20,000 seeds, which are dispersed long distances by wind. Two types of seed are set in each flower head: brown seed and gray seed. Brown seeds remain intact in the flower head until the end of the season, gray seeds are dropped early in the

reproductive cycle. Gray seeds are dispersed longer distances by wind than brown seeds and remain dormant in the soil for longer time periods (up to 10 years). Seeds are covered with sticky mucilage that aids in long-distance dispersal piggybacked on animals or humans. Italian thistle is drought-hardy and prefers high-pH soils (> 6.5).

Italian thistle seedling (top) and mature plant (bottom).

Management

Cutting/mowing: Cutting or mowing often is ineffective because Italian thistle will regrow from a deep taproot.

Manual removal: Manual removal can be effective when the taproot is also excavated to at least 4 inches below the soil surface.

Biological control: Three insect species (*Pyslloidas chalcomera*, *Rhinocyllus conicus*, and *Ceutorhynchus trimaculatus*) will prey on Italian thistle, but also can attack native or endangered thistles. Several naturally occurring rust species are found on Italian thistle, but they do not decrease seed production. Goats will graze young Italian thistle plants.

Burning: Burning often is impractical in pasture and hay production, and Italian thistle can be a formidable fuel source in spreading wildfires.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Effective prior to flowering. Can be applied with a rope-wick for selective control in pastures.
2,4-D (several trade names)	Apply to seedlings before they are 10 inches tall. Generally less effective than the other herbicide options.
clopyralid (Stinger, etc.)	Effective at all stages of growth. Applications to early-flowering plants will cause seed to abort or be sterile.
picloram (Tordon)	Apply in early spring, prior to extensive branching.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Russian thistle (also known as tumbleweed) (*Salsola iberica*)

Life cycle

Annual

Identification

Stems are green with red stripes, and multiple branches create a densely bushy plant. Alternate leaves. Young leaves are very narrow and threadlike; older leaves are short and end in a sharp spine. Small, green flowers borne in axils of older leaves.

Origin

Native of Russia and Siberia. Brought to the United States in 1873 in contaminated flax seed.

Russian thistle seedling (top) and mature plant (bottom).

Impact

Russian thistle obstructs stream channels, road ditches, and recreational areas. Dry plant material in summer months provides fuel for wildfires. Russian thistle can act as a host for insect vectors, such as leafhoppers, that carry crop viruses.

Habitat and ecology

Russian thistle often is found in abandoned or fallowed fields, roadsides, and overgrazed rangeland and pasture. Reproduces by seed. Individual plants produce up to 200,000 seeds. Russian thistle can germinate in a wide range of temperatures and soil conditions, but generally emerges in March and April.

Management

Cutting/mowing: Mowing often results in branching and increased seed production on multiple branches.

Manual removal: Manual removal is effective in light infestations.

Biological control: Not available.

Burning: Often ineffective and dangerous in areas with large amounts of fuel and dry conditions.

Herbicides: Russian thistle can be resistant to several of the sulfonylurea herbicides, including chlorsulfuron (Glean), chlorsulfuron + metsulfuron (Finesse), metsulfuron (Ally, Escort), triasulfuron (Amber), tribenuron (Express), and thifensulfuron (Harmony).

Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Most effective when applied prior to seed set. Control can be poor when glyphosate is applied to drought-stressed plants.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Dalmation toadflax (*Linaria genistifolia*) and yellow toadflax (*Linaria vulgaris*)

Life cycle

Perennial

Identification

Dalmation toadflax: Stem with few branches up to 3 feet tall, with alternate, entire, rounded leaves. Yellow, two-lipped flowers borne in axils of upper leaves.

Yellow toadflax: Extensive root system supports a colony of shoots up to 3 feet tall with few branches. Leaves longer and much narrower than those of dalmation toadflax. Yellow flowers are clustered at end of stems.

Origin

Dalmation toadflax: Native of the Mediterranean region. First reported in North America in 1894 in Massachusetts, where it was grown as an ornamental, but now very common in the western United States.

Yellow toadflax: Native of southeastern Europe and Asia. Introduced to the United States in Delaware in colonial times as a garden ornamental. Common in New England and in the western United States.

Impact

Displaces native vegetation and reduces crop yield. The toadflaxes are not palatable to livestock but are common in grazed pastures, rangeland, and hay.

Habitat and ecology

Dalmation and yellow toadflaxes are common in sandy or gravelly soils and in a wide range of habitats, including roadside ditches, cultivated fields, pasture, rangeland, and reforested areas. Plants emerge in the spring and produce low-growing stems in the first year, followed by flowering and seed production the following summer. Both species reproduce by seed and vegetatively. Seed production requires cross-pollination by insects. Individual plants produce up to 500,000 seeds. The toadflaxes have a deep and extensive root system that is efficient in water uptake in drought conditions.

Dalmation toadflax seedling (top) and mature plant (bottom).

Management

Cutting/mowing: Mowing can be effective in preventing seed production but will not provide long-term control.

Manual removal: Manual removal is not effective or practical considering the extent of the underground root system. Tillage is ineffective because it spreads rhizomes that form new plants.

Biological control: Five insect species are approved for release in control of the toadflaxes, but they have not been highly effective. The seed weevil *Gymnaetron antirrhini* was accidentally introduced from Europe and can control seed production in yellow toadflax by 85 to 90 percent.

Burning: Burning is ineffective because of the extensive root system and potential for regrowth.

Yellow toadflax seedling (top) and mature plant (bottom).

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Most effective when applied to budding plants in the fall but before the first hard frost. In severe infestations, fall and spring applications can be more effective than fall applications alone.
dicamba (Banvel, Clarity, etc.)	Apply to seedlings during active growth.
picloram (Tordon)	Apply to seedlings during active growth.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Velvetleaf (*Abutilon theophrasti*)

Life cycle

Annual

Identification

Stems up to 5 feet tall support very large, rounded, soft leaves that often are the size of a dinner plate. Stems and leaves covered with soft hairs. Yellow flowers produce a disk of sectioned fruit.

Origin

Velvetleaf is a native of Asia. In China, velvetleaf is used as a fiber crop for production of rope and paper. Velvetleaf was introduced to North America as a potential fiber crop in the mid-1700s and now is common in many cropping systems in the United States.

Impact

Reduces crop yield and quality.

Habitat and ecology

Plants emerge in early spring and rapidly overgrow crop canopies. Velvetleaf is self-pollinated and produces up to 17,000 seeds per plant. Seeds remain dormant and viable in soil until environmental conditions favor reproduction, often more than 50 years.

Management

Cutting/mowing: Mowing can be effective in preventing seed production.

Manual removal: Effective prior to seed production.

Biological control: Not available

Mature velvetleaf plant with disk-shaped seed capsules (top), flowering plant (middle), and seedling (bottom).

Burning: Burning is ineffective because of the timing of weed growth relative to active crop growth.

Herbicides: Several herbicides are available that control velvetleaf, but each is appropriate only for specific cropping systems. Please consult the PNW Weed Management Handbook for specific cropping references. Effective herbicides include: 2,4-D (several trade names), atrazine (several trade names), imazethapyr (Pursuit), 2,4-DB (several trade names), glyphosate (several trade names), oxyfluorfen (Goal), terbacil (Sinbar), linuron (Lorox), alachlor (Lasso), metribuzin (Sencor, Lexone), bromoxynil (Buctril), bentazon (Basagran), and norflurazon (Solicam).

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Yellow starthistle (*Centaurea solstitialis*)

Life cycle

Annual, occasional biennial

Identification

Winged stems with multiple branches are covered with cobweblike hairs. Lower leaves are deeply lobed, while upper leaves are entire and narrowly pointed. Branches terminate with single yellow flower heads protected by long, sharp, tan thorns.

Origin

Native to Eurasia. Introduced to North America in 1850s as a seed contaminant in Chilean-grown alfalfa seed.

Impact

Displaces native vegetation. Livestock will not graze mature yellow starthistle because of its spines. When ingested by horses, yellow starthistle causes a neurological disease called chewing disease.

Habitat and ecology

Yellow starthistle is common in grasslands with well-drained soils and an annual precipitation ranging from 10 to 60 inches. Yellow starthistle germinates rapidly and establishes an extensive root system that results in excessive water consumption compared to

nearby native plant species. Reproduction is by seed. Plants are pollinated by bees. One plant can produce more than 10,000 seeds. Seeds are spread by vehicles, animals (including humans), and long distances in hay and uncertified crop seed or by birds.

Management

Cutting/mowing: Mowing is effective on plants with a high branching pattern. Grazing with goats after stems bolt but before seed production can be effective because goats will eat the spiny plants.

Manual removal: Hand pulling prior to seed production is effective for small populations.

Biological control: Six control agents have been introduced in the western United States. The hairy weevil (*Eustenopus villosus*) and the false peacock fly (*Chaetorellia succinea*) have been most successful in California and can reduce seed production by up to 75 percent by attacking flowers and seedheads.

Burning: Burning is effective when yellow starthistle flower heads are dried.

Herbicides: Effective herbicides include:

Herbicide	Comments
glyphosate (several trade names)	Most effective when applied to bolting plants.
clopyralid (Stinger, etc.)	Most effective when applied to seedlings from January to May.
clopyralid + 2,4-D (Curtail)	Most effective when applied to seedlings from January to May.
picloram (Tordon)	Most effective when applied to seedlings from January to May.

The above herbicides are listed based on their ability to control invasive weeds, not on crop or desirable vegetation tolerance. Always check the herbicide label for current rates and labeled uses.

Yellow starthistle seedling (top) and mature plant (bottom).

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