McDonald-Dunn Forest Plan
Invasive Plant Species Management Plan

Background

There are over 100 non-native plant species currently on the McDonald-Dunn Forest. This management plan summarizes the condition and trends of the species that appear to cause the greatest economic or ecological impact to the forest and suggests both priorities and methods for their management. Unique among these species is false-brome (*Brachypodium sylvaticum*), an exceptionally invasive perennial grass; McDonald Forest was one of the first introduction sites for false-brome in Oregon and it serves as a large source population for its spread.

Assessment

A list of non-native plants was compiled from the most recent flora for the McDonald-Dunn Forest (Camacho and Otting, 1997). A subset of "priority" species was then selected based on 1) their classification by the Oregon Department of Agriculture (ODA), 2) whether they are known to currently disrupt ecosystems or 3) whether they have the potential to disrupt ecosystems and/or cause economic losses (Table 1).

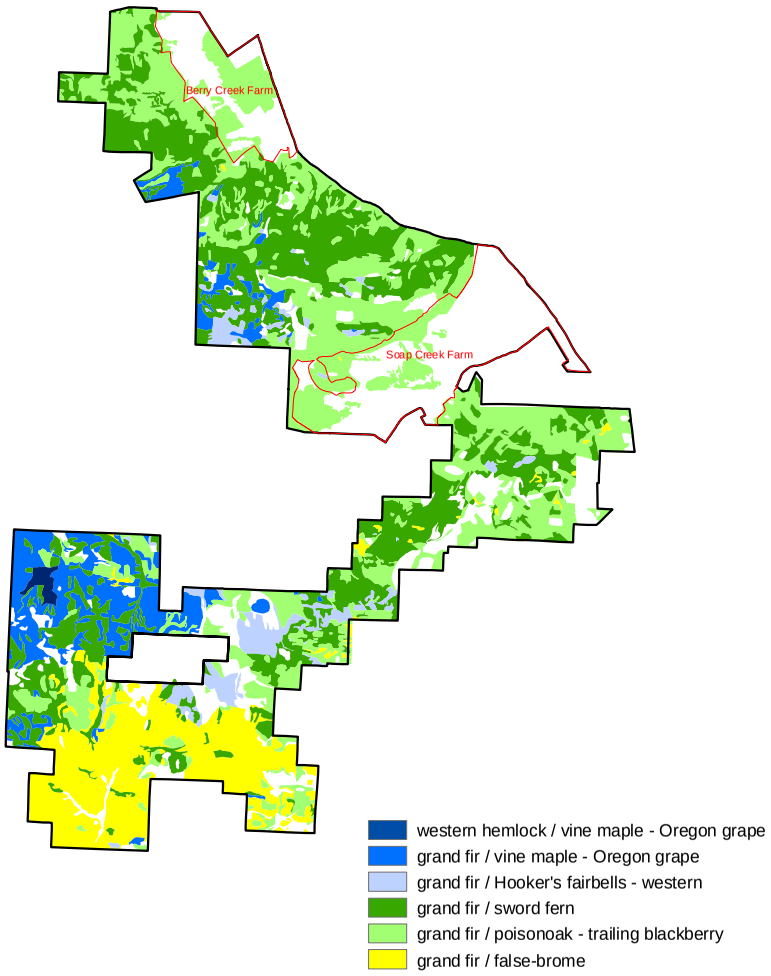
Table 1. Priority invasive plant species found on McDonald-Dunn Forest.

Family	Genus	Species	Common Name	State List[1]	Ecosystem Disrupter	Biocontrol Agents
Poaceae	Brachypodium	sylvaticum	false-brome	B	Y	
Asteraceae	Centaurea	diffusa	diffuse knapweed	B		Y
Asteraceae	Centaurea	pratensis	meadow knapweed	B		Y
Fabaceae	Cytisus	scoparius	Scot's broom	B		Y
Geraniaceae	Geranium	robertianum	Robert's geranium		Y	
Apiaceae	Hedera	helix	English ivy	B		
Aquifoliaceae	Ilex	aquifolium	English holly			
Poaceae	Phalaris	arundinacea	reed canary grass		Y	
Fabaceae	Robinia	pseudoacacia	black locust			
Rosaceae	Rubus	armeniacus	Himalaya blackberry	B	Y	
Asteracae	Silybum	marianum	blessed milk thistle	B		

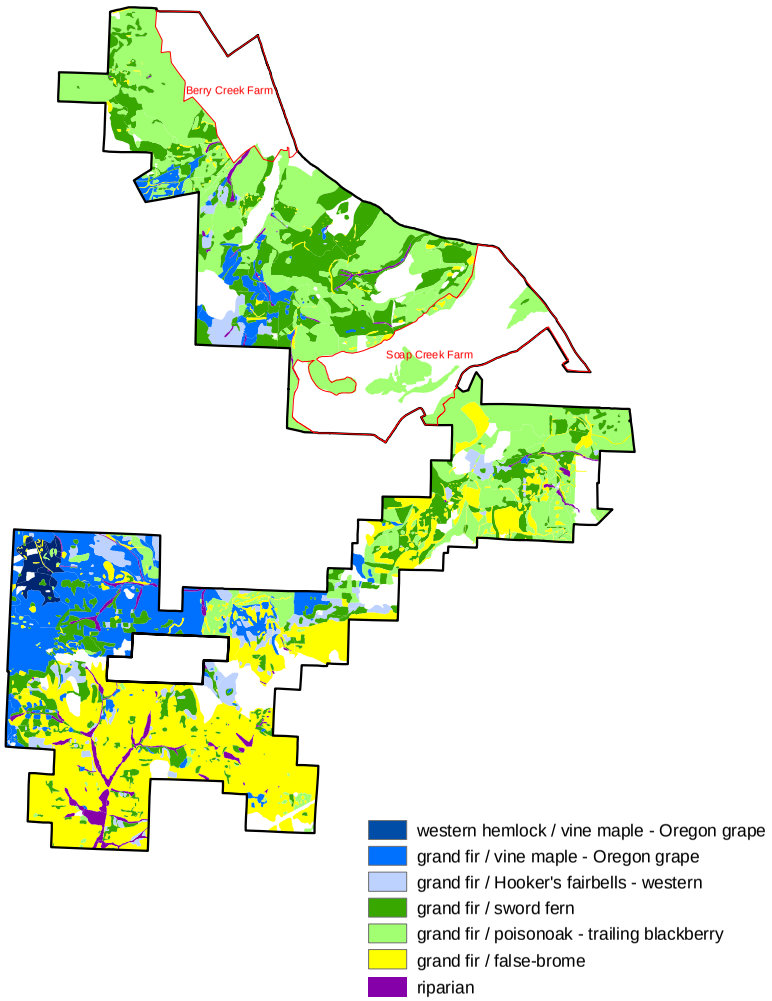
[1]Plants that cause economic impacts to the state are classified by the Oregon Department of Agriculture (ODA) as "A" weeds if they occur in small enough infestations to make containment or eradication possible, "B" weeds if they are abundant in the region but limited in some counties or "T" weeds if they are a particularly high priority in the state.

A1993 plant community mapping project documented the distribution at that time of false-brome based on a forest-wide survey along permanent transect lines using the plant community key found in Hubbard (1991) (Figure 1). In order to understand the current distribution of false-brome as well as the distribution of other priority weeds, plant communities were mapped in 2006 using the same methods and transects as the 1993 survey. In addition to mapping the distribution of false-brome (Figure 2), infestations of weeds on the priority list were mapped

1993 Plant Associations



2006 Plant Associations



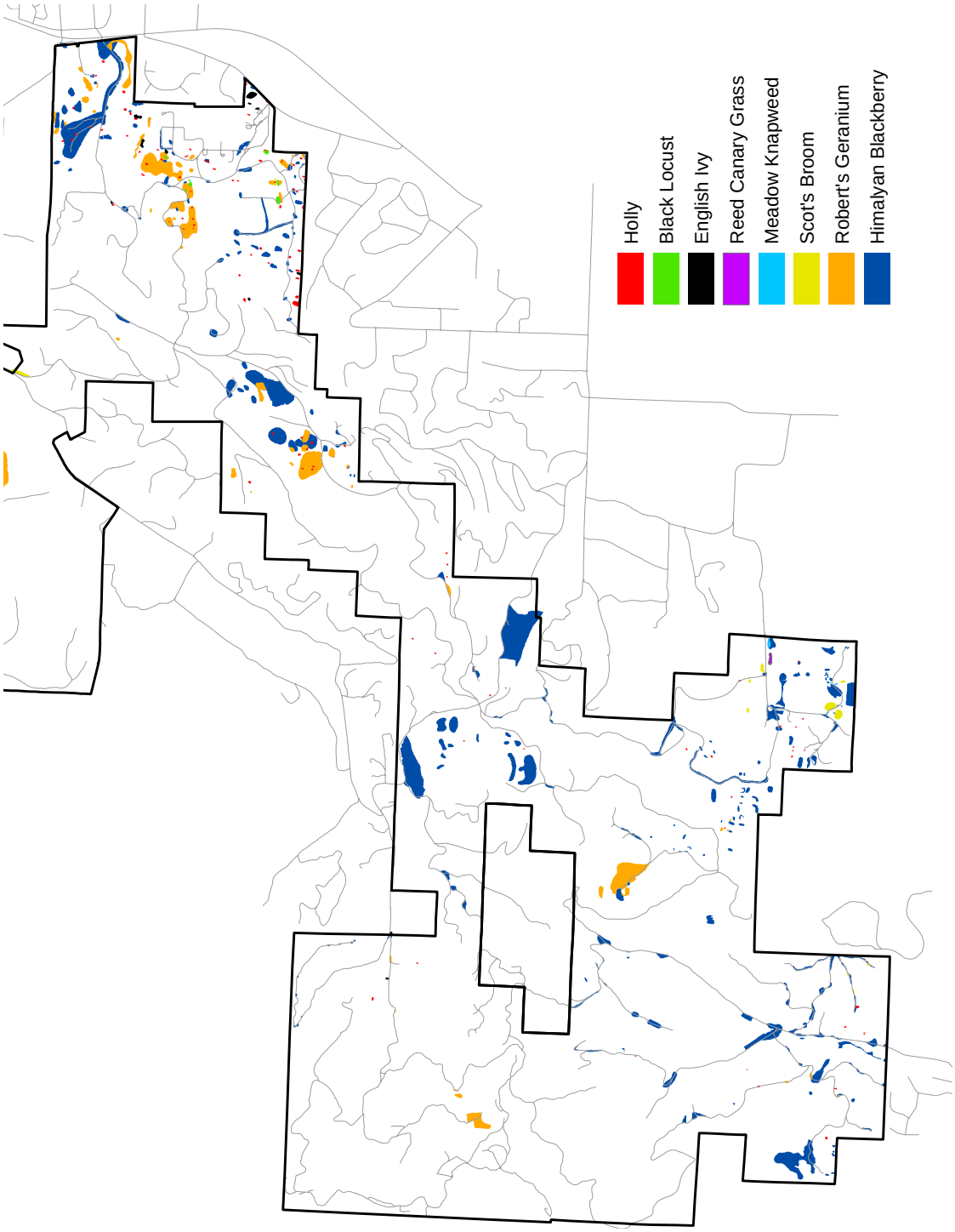


Figure 3a. McDonald Forest priority species

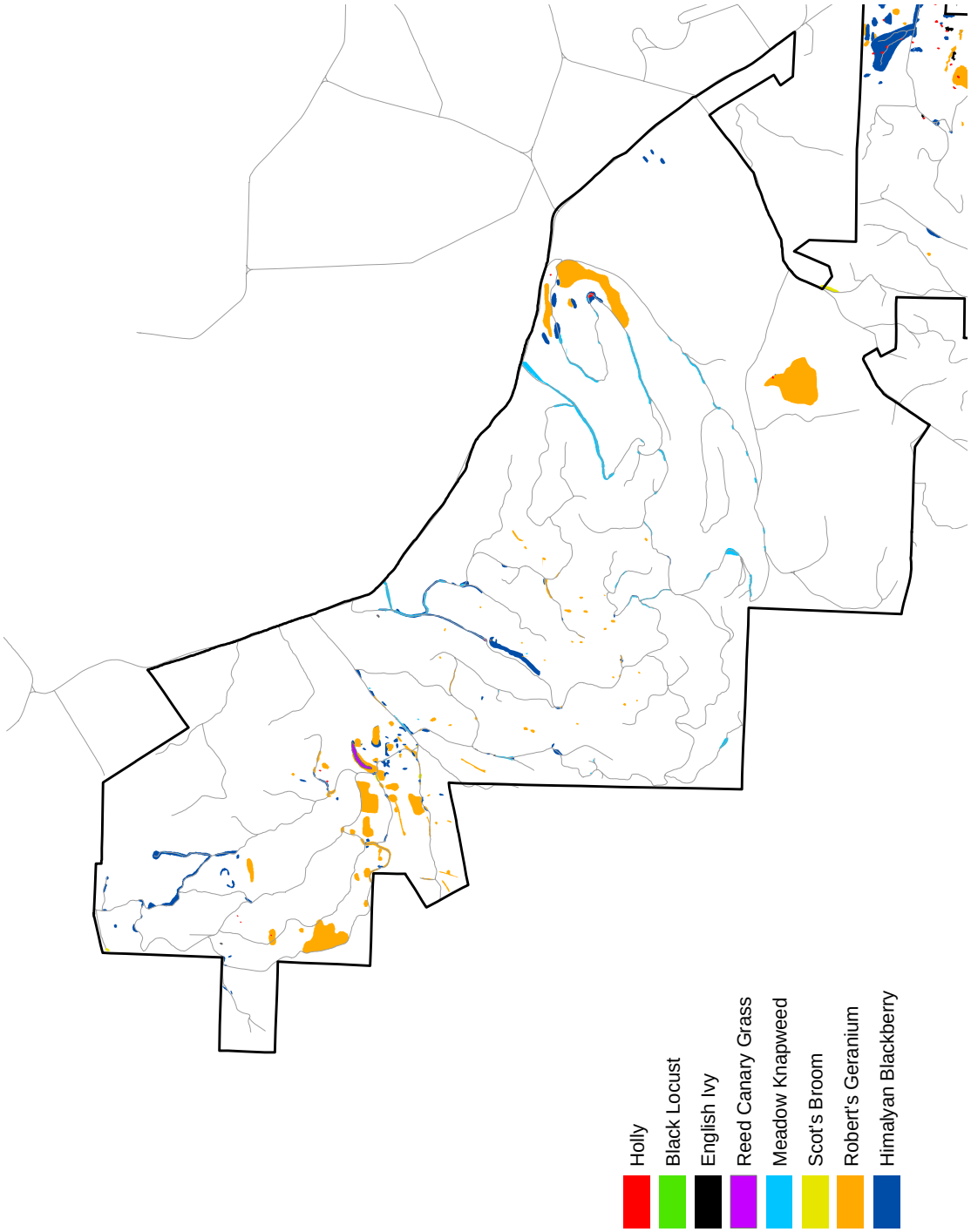


Figure 3b. Dunn Forest priority species

Table 2. Extent and distribution of priority species

Species	Acres	Distribution
False-brome	2591	Well distributed in open/closed, disturbed/undisturbed forest, along roads, riparian areas, meadows, and savannas
Himalaya blackberry	293	Well distributed but limited to roadsides, openings and forested areas with low canopy cover
Robert's geranium	205	Well distributed in disturbed and undisturbed forest, roadsides, and riparian areas
Meadow knapweed	32	Roadsides; moving into meadows
English holly	9	Scattered throughout forest; heavier near Peavy Arboretum
Scot's broom	6	Jackson Place meadows, roadsides in several areas
English ivy	4	Several localized areas in forest
Reed canary grass	4	Lower Oak Creek
Black locust	2	Peavy tract near old forest plantings
Diffuse knapweed	<1	Two roadside areas
Blessed milk thistle	<1	One roadside area

Survey Results

1. False-brome continues to expand across the forest. The number of acres infested with false-brome has increased from approximately 1,649 in 1993 to 2,591 in 2006. Although increases have been seen in all upland and riparian forest types, the Oak Creek, Jackson Place and Vineyard Mountain areas have experienced the largest increases. New populations have been detected in the Soap Creek area of McDonald Forest and the Dunn Forest.

2. Robert's geranium appears to be increasing rapidly in disturbed and undisturbed forest. The extent of Robert's geranium has never been mapped before, but this species was described as an "occasional" plant along roadsides and in other disturbed areas in 1982 by Hall and Alaback. 1n 1989 there was no record of this species on the 115 1/20 ha plant classification plots, but when 105 of these plots were remeasured 12 years later, 14 of them had varying amounts of Robert's geranium (Alley and McCain 2002).

3. Several weeds that can devastate the forest and remnant prairie are still localized enough that they can be greatly reduced and perhaps eliminated from the forest.These include diffuse knapweed, meadow knapweed, Scot's broom, English ivy, reed canary grass, black locust, and blessed milkthistle.

4. English holly appears to be concentrated near ornamental plantings in and around the Peavy Arboretum area.

5. Himalayan blackberry is usually associated with roads, small patch cuts and larger clearcuts, but it also thrives in undisturbed meadows, certain riparian areas and disturbed forest with low canopy cover.

Recommendations

Control Priorities

1. Eliminate the small populations of high risk species using the most effective control technique(s) known for each species (diffuse knapweed, meadow knapweed, Scot's broom, English ivy, reed canary grass, black locust, and blessed milkthistle). Don't wait.

2. Eliminate the arboretum source populations for English holly and black locust.

3. Control false-brome according to the priorities described in this species' management strategy (page 6). Focus control on protection of special ecological areas and satellite populations initially rather than the advancing front of the source population.

4. Do a better job controlling Himalyan blackberry within harvest areas and along roadsides. Use a combination of control techniques on existing infestations to demonstrate their costs and effectiveness.

5. The most important control technique is prevention. Educate staff, students and recreationists about watch-list species so that new introductions are noticed and eliminated as quickly as possible.

Containment Priorities

1. False-brome. Genetics studies suggest that satellite populations in western Oregon north of Eugene may have originated from the McDonald-Dunn Forest (unpublished data, Rosenthal). Private landowners and public land management agencies are now battling these populations. Implement the containment strategies on page 5-6 to reduce the amount of seed leaving the forest.

2. Meadow knapweed, diffuse knapweed. The knapweeds are very invasive species expanding their range in western Oregon. They should be controlled to prevent spread on the forest as well as further expansion via forest users and wildlife outside of the forest.

Research and Teaching Priorities

1. Robert's geranium. Solicit research and classroom projects to begin working on the basic biology of this species so that approaches for eradication, containment or restoration can be developed. These projects include 1) age structure 2) life history, demography, and population dynamics 3) relative growth rate and competitive ability 4) seed dispersal 5) dispersal and herbivory 6) pollination and 7) interference/competition (Radosevich, 2005).

2. False-brome. Solicit research and classroom projects to work on priorities outlined by the False-brome Working Group (http://www.appliedeco.org/FBWG.htm).

Management Strategy for Priority Species

Methods of Control

Manual/Mechanical: This includes techniques such as mowing, pulling, cutting, or damaging the plants in another way. This method is usually most effective in areas where the infestation is small, or in combination with one or more other methods. These methods can be labor and time-intensive, so may not be the best strategy for large areas or where there is difficult terrain.

Mulching:

Grazing: Grazing is typically used in combination with other methods of weed control, because it will rarely completely eradicate a weed population independently. Animals can damage the system if allowed to overgraze, so the use of livestock requires a plan tailored to each individual site.

Prescribed fire: Burning an affected area can be an effective method of weed control. The best times to burn for invasive control are at the seedling stage, or just before flower or seed set. Some invasives are promoted by fire, for example if their seeds are adapted to fire or they are able to resprout vigorously. Application of an herbicide can be used to control the seedlings that sprout after a burn. Spot burning can be used on individual plants, or small groups of plants. In extensively disturbed areas, fire can actually reduce the populations of native plants, and may or may not reduce weedy species.

Biocontrol: Biological control is the introduction of insects or pathogens which are highly selective on a particular weed species. Typically a biocontrol agent is introduced from the pest's homeland, but native pests can also be controlled using non-native biocontrol agents. Biocontrol agents stress the plant by destroying plant tissues and in some cases help to reduce viable seed production, which makes them less competitive against native plants. Because they do not kill the plants, it may take 10-20 years for a biocontrol project to successfully control a weed at the regional scale. Plants stressed by a biocontrol agent will be more susceptible to the other methods listed here. Tables 1 and 2 list the species on the forest that have biocontrol agents. The management approach for these species should focus on maintaining or increasing the abundance of these agents.

Herbicide: Herbicides can be used in a broadcast application, or applied selectively using backpack tanks or spray bottles, or by wiping on using a sponge or wick on a handle. Cutting the bark away before applying herbicide allows contact directly with the cambium. For species like European holly and black locust that resprout after having their trunks cut, application of an herbicide onto the cut stump immediately after downing the tree will aid in preventing new shoots from growing.

Herbicides work by disrupting one or more metabolic pathways in plants. The chemicals used affect processes exclusive to plants, such as photosynthesis or production of certain amino acids. A group of herbicides that is made of similar compounds is called an "herbicide family." The biochemical or physical mechanism which kills or suppresses the plant is called the "mode of action." Different weeds are susceptible to different herbicide families, so if one herbicide shows little or no result, an herbicide from another family may be more effective.

Education

1. Educate weed specialists and conservation leaders in the state about false-brome and Robert's geranium
2. Encourage basic research on these two species
3. Educate the public about invasive plants through:
   a. Boot and bike cleaning station at the Oak Creek gate
   b. Interpretive materials – posters and handouts at kiosks
   c. Field trips/talks
   d. Press coverage
   e. Demonstration projects

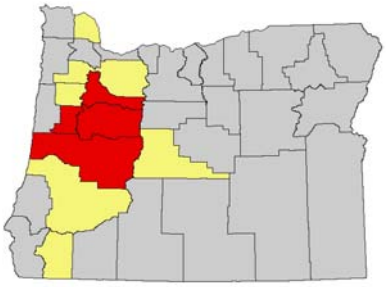
Monitoring

Measure percent coverage at permanent plot centers during periodic forest-wide survey of plant communities and invasive plants.

False-brome

Background

False-brome (*Brachypodium sylvaticum*) is native to Europe and is believed to have been first introduced to North America in Oregon in the 1930's; one of the earliest introductions was on the McDonald Forest. It has spread to other parts of Oregon from the initial introduction sites and has also been reported in California. It has broad ecological amplitude, thriving in both full sunshine and deep shade, and on elevations ranging from 300' to 3500.' Once established it can out-compete native vegetation. Regeneration success and tree growth may also be affected. False-brome can compromise the usefulness of McDonald-Dunn Forest for teaching, demonstration and research by eliminating native species and altering ecosystem processes. According to a preliminary habitat suitability model developed by the Siuslaw National Forest, much of Western Oregon may be vulnerable to invasion (http://www.appliedeco.org/BRSYweb/false_brome_habitat_2may05.pdf).



Distribution of false-brome in Oregon by county

Containment

Because McDonald-Dunn forest provides one of the major sources of false-brome seed that could be spread to other parts of western Oregon, a good containment strategy is essential. In order to reduce the amount of seed that is leaving the forest and infesting other areas, the following strategies will be used:

1. False-brome will be pre-treated with herbicides on units where logging will occur while false-brome seed is viable. In addition, all logging equipment will be pressure washed to remove false-brome seeds before it leaves the McDonald-Dunn Forest.
2. Before active road building or logging occurs, all roadside areas will be pre-treated with herbicides so that vehicles do not come in contact with false-brome seed.
3. Road and trailside areas throughout the forest will be actively managed to reduce the amount of seed that is coming into direct contact with recreationists and their pets, as well as vehicles associated with teaching, research and the management of the forest. Treatments might consist of periodic herbicide treatments followed by seeding with natives or non-invasive non-natives, annual mowing before seed becomes viable, mulching, torching, or some combination of methods.

4. Recreationists will be encouraged to remove seeds from themselves, their pets, and their bikes at the boot and bike wash station at the Oak Creek gate.
5. Opportunities for collaboration with adjacent landowners on containment and control will be sought whenever possible.

Control

Hand pulling may be an effective treatment for removal of small false-brome infestations, but it is time and labor-intensive, roots left in the soil may resprout, and it exposes the seed bank. Burning, grazing and mowing may be effective methods of removal over time, but mostly just help to prevent the grass from producing seed each year. Mowing and mulching with native grass straw have been successful (Blakeley-Smith 2006) as have herbicide applications (Clarke et al. 2004).

The highest priorities for control within the McDonald-Dunn Forest are the important ecological areas in the following order:

1. Butterfly Meadows and 100' weed-free buffer area
2. Oak savanna restoration areas with a high percent of native understory cover
3. Old-growth forests
4. Remnant prairie with a high percent of native cover
5. Isolated populations in the Soap Creek watershed
6. Oak savanna and prairie restoration areas with a high percent of false-brome

Other forests managed by the College of Forestry have become infested with false-brome by logging equipment, forest vehicles, and staff. The isolated populations on these forests should be treated with herbicides and monitored.

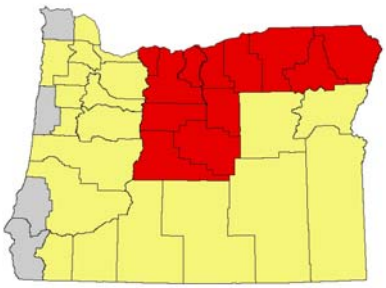
False-brome infestation

False-brome plant

Diffuse Knapweed

Background

Diffuse knapweed (*Centaurea diffusa*) is native to Europe and is believed to have been first introduced to North America in the early 1900's. It is a biennial or short-lived perennial species, with a long tap root. Before recent herbicide treatments by ODA, one of the largest known populations east of the Cascade Mountains was on McDonald Forest. It is an aggressive species that can infest large areas quickly. It increases production costs for ranchers, impairs the quality of wildlife habitat, and decreases plant diversity.



Distribution of diffuse knapweed in Oregon by county

Control

The key to controlling diffuse knapweed is to eliminate new seed production and deplete the existing seed bank. Hand pulling the plants is effective but labor and time-intensive. Spot treatments of herbicides are also effective. Two plant species that are shown to suppress knapweed are crested wheatgrass (*Agropyron cristatum*) and Russian wild-rye (*Elymus junceus*). There are also several insect

species that reduce either plant biomass or seed production. Diffuse knapweed seed production is 1000 times higher than necessary to maintain a stable population, so even if seed production is reduced by 95%, there may be no change in plant cover. Insects that target biomass are a better choice, because they will stress the plant constantly which will over time lead to a drop in knapweed population.

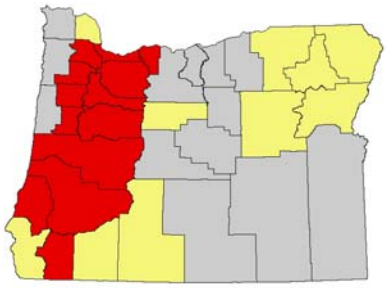
Diffuse knapweed infestation


Diffuse knapweed plant

Meadow Knapweed

Background

Meadow knapweed (*Centaurea pratensis*) is a native of Europe and was first recorded in Oregon in Lane County in 1918. It sprouts from a woody root crown and can grow up to 3 ½ feet tall. It invades industrial sites, tree farms, and grasslands, and has the potential to invade native prairie and oak savannah. It damages farmland and is not edible for livestock.


Distribution of meadow knapweed in Oregon by county

Control

Pulling or digging plants is effective for small areas, but is very labor intensive. Mowing is not effective, as plants that are periodically mowed will flower and produce seed on stalks below the mower blade height. There are several insects that are used for biological control. Herbicides are effective against meadow knapweed, and an integrated management plan that includes selective herbicides and biological control may show the greatest effectiveness for removal of meadow knapweed.

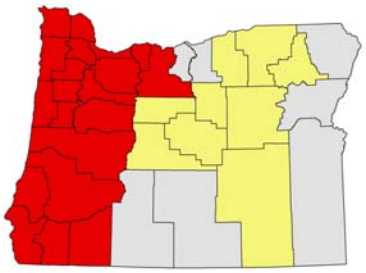

Meadow knapweed infestation


Meadow knapweed plant

Scot's Broom

Background

Scot's broom (*Cytisus scoparius*) is a large shrub in the pea family, and was originally introduced to North America from Europe as a soil stabilizer and as an ornamental for gardening. It was first recorded in Oregon in Benton County in 1892. Scot's broom is a pioneer species and quickly takes over native habitat. It invades both disturbed and undisturbed areas, and threatens the Oregon coast dune ecosystem. The seed bank can last for at least 50 years and adult plants are prolific seed producers. Scot's broom costs the timber industry millions of dollars each year in maintenance and lost timber production. Young Douglas-fir plantations are devastated by Scot's broom because it out-competes the young trees for water and sunlight.



Distribution of Scot's broom in Oregon by county

Control

There are many management options for removing Scot's broom. Keeping soil disturbance to a minimum and encouraging other plants to grow will help prevent Scot's broom from spreading further while it is being removed. Hand pulling or use of mechanized equipment to remove plants is effective but time consuming and labor intensive. Mowing areas of infestation is one way to quickly remove unwanted vegetation, but new shoots will sprout from stumps that are not treated with herbicide. Spot spraying the proper herbicides using full coverage can be effective at any time of the growing season. There are three insects that have been approved as biological control agents and are established in Oregon.

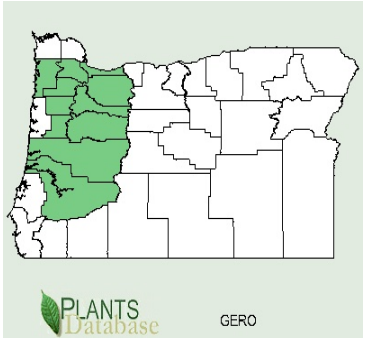
Scot's broom infestation

Scot's broom plant

Robert's Geranium

Background

Robert's geranium (*Geranium robertianum*) is a small herb that is highly adaptable to Pacific Northwest habitats, and quickly displaces native species, reducing plant biodiversity in the understory. It is native to Europe, Asia, and North Africa, and was introduced as an ornamental and for medicinal purposes. It was first seen in the early 1900s and has now spread throughout Oregon and Washington west of the Cascades. Robert's Geranium flowers in both spring and fall, and can have very high reproduction rates.



Control

Herbicides can help control this plant, but it is difficult to avoid damaging other plants associated with it. Hand pulling and mulching may be effective. There are several insects that feed on Robert's Geranium in its native habitat, but these have not been approved for use as control because of potential damage to other ornamental geraniums.

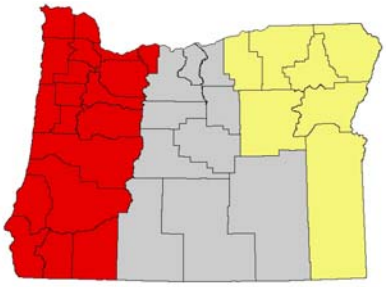
Robert's geranium infestation

Robert's geranium plant

English Ivy

Background

English ivy (*Hedera helix*) was introduced from Europe to be used as an ornamental, and has spread widely because it will grow in most soil types, sun or shade. It out-competes native understory plants, creating a thick mat on the forest floor. It can also choke out overstory trees. It grows throughout the year which helps it grow over native vegetation.



Distribution of English ivy in Oregon by county

Control

Cutting or pulling the vines provides some control but large root systems will resprout. English ivy has a waxy layer on the leaves, which makes it more difficult for herbicides to permeate the leaves. Keep ivy out of the trees to protect the trees and prevent seed production.

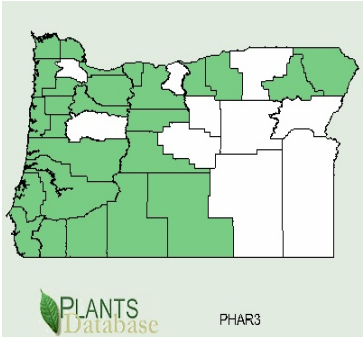
English ivy infestation

English ivy plant

Reed Canary Grass

Background

Reed canary grass (*Phalaris arundinacea*) is a vigorous sod-forming grass native to Europe and may be native to North America and Asia as well. Early collections from the Pacific Northwest that pre-date settlement by people of European ancestry suggest that it is a native. The more aggressive populations that now threaten native ecosystems are probably a mixture of agronomic cultivars and the native grass. It grows up to 2 m high and reproduces vegetatively from creeping rhizomes. Reed canary grass is most threatening to wetland and riparian areas, where it invades and dominates all other understory vegetation, and displaces native wildlife.



Distribution of reed canary grass in Oregon by county

Control

Because it is rhizomatous, control is difficult and may require treatment for several years. Removing it may also cause erosion problems so other species must be used to cover the area quickly. Prescribed burning and disking or plowing, especially in combination with one or more herbicide applications, is very effective at controlling reed canary grass. Removal of old vegetation before herbicide application ensures that the herbicide will contact new growth. An herbicide treatment early in the season followed by mechanical treatment may be effective, as are multiple herbicide treatments. There are no known biocontrol agents for reed canary grass.

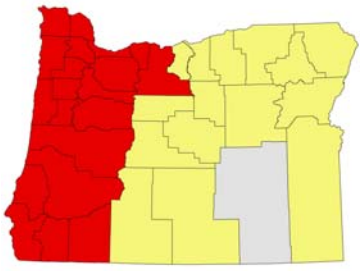
Reed canary grass infestation

Reed canary grass plant

Himalayan Blackberry

Background

Himalayan blackberry (*Rubus aremeniacus*) is actually a native of Europe that was first introduced to North America as a cultivar around 1885, and was first noted in Oregon in 1922 in Marion County. It forms impenetrable thickets and is well suited to the habitats of the Willamette Valley. It can reproduce vegetatively through roots formed at the cane apices, and by seed production. Birds and other animals eat the berries which enable it to spread long distances. Passing through the digestive tract of birds may improve germination. Plants can also regenerate from root stock which makes removal difficult. The trailing stems can grow up to 20 ft in one season.



Distribution of Himalayan blackberry in Oregon by county

Control

Removal of the cane is an important first step to control Himalayan blackberry. Mowing, pulling, or burning can accomplish this. Mulching or burning the slash piles ensures that resprouting will not occur from the cut canes. Mowing multiple times per season will be necessary to exhaust the reserve food supply in the large underground root system that Himalayan blackberry develops. Burning large areas will also remove the standing mature plants. Both mowing and burning should be followed up with stump herbicide treatments. Most native plants will not be able to outgrow blackberry sprout growth from stumps, but planting trees or large shrubs that could shade it out could help reduce infestation. Grazing is also successful for control, with the best results coming from use of sheep or goats. There are many herbicides that show moderate to good control, especially if used with one or more methods such as mowing. Several

different herbicide treatments are highly effective. A leaf rust fungus that targets wild blackberry species in North Africa, the Middle East, and Europe was recently discovered in the Pacific Northwest in 2005. It has been used for decades as a biocontrol agent in Chile, Australia, and New Zealand. The fungus (*Phragmidium violaceum*) attacks the leaves of the blackberry, causing defoliation. The youngest leaves are most susceptible, but it can also infect buds, unripe fruit, and the growing parts of the cane. Defoliation will allow other vegetation to persist underneath the canes and potentially compete with the blackberry plants. The rust has also been shown to prevent rooting from the cane tips which reduces the competitive advantage Himalayan blackberry usually holds over other vegetation. *P. violaceum* has been observed in several places on McDonald Forest. This rust alone will not kill large blackberry patches, but it will add stress to the plants so that with addition of other methods, control can be achieved.

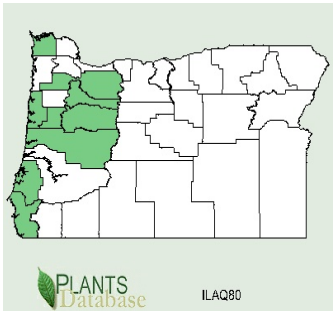
Himalayan blackberry infestation

Himalayan blackberry close-up

European Holly

Background

European holly (*Ilex aquifolium*) is native to southern Europe, northwest Africa, and southwest Asia. It is an evergreen tree that can grow to 23 m tall. It was brought to North America as an ornamental and now has the potential to become an invasive species. Holly damages forest habitats by consuming more nutrients than it replaces, mainly because its leaves are very slow to decompose. It out competes native plants by shadowing over the understory, and its brushy nature creates a thick bush that physically prevents other plants from growing underneath it. It can reproduce both by seed and vegetatively, which makes it hard to remove because the root system will continue to send up new sprouts even after the main trunk is cut.



Distribution of European holly in Oregon by county

Control

Spot treatment of herbicide on cut trunks is the most effective. Cutting and herbicide application are most effective during the late spring and summer, when the plant is active but rainfall is low.

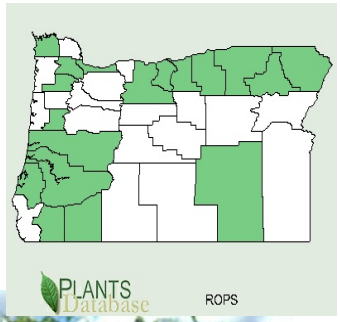
European holly tree

European holly branch

Black Locust

Background

Black locust (*Robinia pseudoacacia*) is a medium sized deciduous tree growing up to 25 m. It is native to the Midwest and eastern U.S. It was brought to the west coast for use in erosion control, windbreaks, afforestation, and mine reclamation in the early 1900s. It is a threat because it invades forest habitats spreading rapidly through vegetative growth.



Distribution of black locust in Oregon by county

Control

Cutting and burning are not effective methods because they stimulate growth of new sprouts. Herbicide applied to the cut trunks kills trees with the best success.

Black locust infestation

Black locust branch

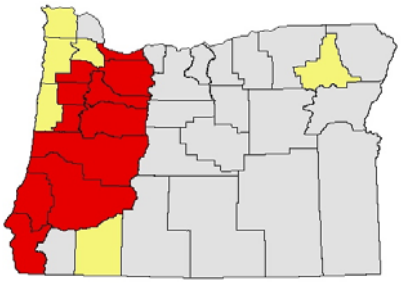
Blessed Milk Thistle

Background

Blessed Milk Thistle (*Silybum marianum*) is native to the Mediterranean and was introduced into Oregon in the late 1800's. It has distinctive white-mottled leaves and can grow 6' tall. It can outcompete other plant species in roadside or meadow areas. It is toxic to livestock.

Control

Manual control can be effective if it is complemented by sowing a competitive grass. The plant is the most susceptible to chemical treatment from the seedling to the rosette stages of growth.



Distribution of blessed milk thistle in Oregon by county

Detailed Control Prescriptions for Priority Weeds

Species	Mechanical	Chemical (chemical percentages based on volume)	IPM
Himalyan Blackberry	- Mow, pull, or burn to remove canes. Mow at least twice a year: June and September. - In small patches, grub roots in the winter and spring when soil is moist. -Graze infestations with sheep or goats. -Shading is the best long-term non-chemical approach to blackberry control - Mulching or burning the slash piles ensures that resprouting will not occur from the cut canes.	June through September (full leaf); metsulfuron 1 oz/100 gal + non-ionic or MSO/silicon blend surfactant ¼ -- ½ % August through October tryclopyr amine ¾ --1 ¼ + non-ionic or MSO/silicon blend surfactant ¼ -- ½ % Fall before hard frost tryclopyr ester ½ -- 1 % + MSO or oil surfactant ¼ -- ½ % Spray using reasonable coverage	-Mow in June and allow for regrowth. -Treat with tryclopyr amine or ester in the fall -Needs yearly treatment
Species	**Mechanical**	**Chemical**	**IPM**
Scot's Broom	-Cut large plants (stem greater than 1 inch) in the driest times of the year. -Pull small plants (less than 1 inch) by hand or with a weed wrench. - Burning can help reduce weed biomass but may encourage sprouting and may not kill large plants.	Can spray any time of growing season, but spring at onset of flowering is best. tryclopyr ester 1 – 1 ½ %+ MSO, oil, or MSO/silicon blend surfactant ¼ -- ½ % Spray using full coverage	-tryclopyr ester early spring -tryclopyr ester late fall treatments once desirable plants are dormant. - Keep soil disturbance to a minimum and encourage other plants to grow will help prevent Scot's broom from spreading further while it is being removed.
Species	**Mechanical**	**Chemical**	**IPM**
English Ivy	-Protect trees and prevent seed production by cutting vines around tree trunks. Clear Ivy 3 feet out from the base of the tree. -Vines can be rolled up like a carpet. -Goats and sheep love ivy, and can be used to clear areas prior to pulling of the roots.	Test during different seasons. Chopper 3% with MSO 10% tryclopyr amine 1 – 2 % + non-ionic or MSO/silicon blend surfactant 4 up to 20 qt/100 gal glyphosate 5% to max label rate + MSO or non-ionic surfactant ½ % or higher (5%)	-Cut ivy away from trees and apply foliar herbicide treatment to leaves on the ground for large infestations. - Cut the vines back and then apply herbicide for small infestations or re-treatments.

	- Cutting or pulling the vines provides some control but large root systems will resprout.	glyphosate 50% solution in water on cut stumps	
Species	**Mechanical**	**Chemical**	**IPM**
False-brome	-Mowing, burning, grazing can be used to remove/deplete annual seed production. -Hand pull small patches in April and early May. Mow and mulch (3-6 cm deep) with native straw, or clean, weed-free straw	<u>Spot Spray:</u> *Early spring* hexazinone 2 lb ai/acre *Throughout growing season* Glyphosate 2 % gal + sulfometuron 3oz/acre + non-ionic or MSO/silicon blend surfactant ¼ -- ½ % *Fall* Glyphosate 2 % gal + oryzalin ?? oz/100 gal + non-ionic or MSO/silicon blend surfactant ¼ -- ½ % fluazifop ¼ % +?? Note: oryzalin and fluazifop are not labeled for forestry use, so the products used must have "non-crop" labels in order to use them on invasive plants in the forest. <u>Broadcast:</u> glyphosate 2 qt/acre + sulfometuron 3 oz/acre + non-ionic or MSO/silicon blend surfactant 1-2 qt/100 gal	-Mow for several years to eliminate soil seed bank, then treat with herbicides. -Mow in early July, then treat with herbicides in the fall. -Mow April-June; mulch with native straw in June; seed with native grass at the time of mulching. (Do this for 1-2 years) -Treat with glyphosate and oryzalin together in October; re-treat in the spring with fluazifop. (Do this for 2-3 years. Allow at lease 6 months for soil activity to dissipate before reseeding.) - Burn in early fall; treat with herbicides after germination; retreat with herbicides to exhaust seed bank before reseeding -In areas with few native grasses, treat with foliar herbicides, reseed with forbs in the fall, retreat for several years with grass-specific herbicide
Species	**Mechanical**	**Chemical**	**IPM**
Diffuse and Meadow Knapweed	- Pulling or digging plants is effective for small areas	- May until flowering is best (before seed set) but could be treated any time during active growing season Glyphosate 2-5%+ non-ionic surfactant ¼ -- ½ % 2,4-D 2 % + clopyralid ¼ -- ½ %+ non-ionic or MSO/silicon blend ¼ -- ½ %	- There are several insects that reduce plant biomass or seed production - An integrated management plan that includes selective herbicides and biological control may show the greatest effectiveness for removal of meadow

		Aminopyralid (7 oz product / ac)+ non-ionic or MSO/silicon blend (1-2 qt/100 gal) Note: The smell of some 2,4-D products does not persist (e.g. “Hardball”).	knapweed.
Species	**Mechanical**	**Chemical**	**IPM**
Blessed Milk Thistle	- Manual control can be effective if it is complemented by sowing a competitive grass.	May until flowering is best (before seed set) but could be treated any time during active growing season Glyphosate 2-5% + nonionic surfactant ¼ -- ½ % 2,4-D 2% + clopyralid ¼ -- ½ %+ non-ionic or MSO/silicon blend ¼ -- ½ % Aminopyralid (7oz product / ac)+ non-ionic or MSO/silicon blend ¼ -- ½ %	
Species	**Mechanical**	**Chemical**	**IPM**
Black Locust		June through December (August, September, October are best times) Treat stumps with 50% glyphosate in water or 50% Garlon 3A in water Hypo hatchet with 50% imazypyr; 1 cut per 3” diameter	
Species	**Mechanical**	**Chemical**	**IPM**
European Holly		Carry a machete and squirt bottle; hack and squirt with glyphosate or imazapyr when encountered (or treat cut stumps) Note: hack and squirt is most effective during the late spring and summer.	
Species	**Mechanical**	**Chemical**	**IPM**
Reed Canary Grass	- Prescribed burning and disking or plowing, especially in combination with one or more herbicide applications, is very effective at controlling reed canary grass.	Upland areas: glyphosate 2-5% + non-ionic ¼ -- ½ % Riparian and streamside areas: Glyphosate labeled for aquatic use 2-5%; 5.4 lb/gal; no surfactant	- Control is difficult and may require treatment for several years. - Removing it may also cause erosion problems so other species must be used to cover the area

		Note: Removal of old vegetation before herbicide application ensures that the herbicide will contact new growth. Spray up to the water with aquatic herbicide but not in water without a DEQ discharge permit	quickly.
Species	**Mechanical**	**Chemical**	**IPM**
Robert's Geranium		Glyphosate 2-5% + non-ionic 2,4-D 2%	

General herbicide information

Herbicide	**Common Trade Name**	**Activity**	**Selectivity**
2,4-D	Hardball	foliar	grasses generally resistant
aminopyralid	Milestone	foliar	
clopyralid	Transline		
fluazifop	Fusilade DX	foliar	broadleaf and woody plants highly resistant
glyphosate	Round-up Accord Foresters' Rodeo	foliar	
hexazinone	Velpar	soil (some foliar)	conifers somewhat resistant
imazapyr	Arsenol Chopper	foliar and soil	conifers generally resistant
metsulfuron	Escort	foliar and soil	broad-spectrum; grasses can be tolerant
oryzalin	Surflan AS	soil (pre-emergent)	
sulfometuron	Oust	foliar and soil	broad-spectrum; woody perennials resistant
tryclopyr amine	Garlon 3A	foliar	grasses resistant
tryclopyr ester	Garlon 4	foliar	grasses resistant
Surfactant	**Common Trade Name**		
Non-ionic	R-11 Induce Activator 90		
Oil	Agridex Mor-act Herbimax		
MSO			
MSO/Silicon blend	Dyn-amic Syltac Phase		

Watch List

Early detection of new invasive plants and rapid response is important for stopping invasions while their populations are small. Our watch list is made up of species that have not been seen on McDonald-Dunn Forest, but that have begun invading other areas in western Oregon. Pictures of these species have been incorporated into an invasive plant brochure, and employees and visitors will be asked to watch for them.

Table 3. Watch list species

Family	Genus	Species	Common Name	State List	Biocontrol agents
Asteraceae	Centaurea	maculosa	spotted knapweed	B, T	Y
Asteraceae	Centaurea	solstitialis	yellow starthistle	B, T	Y
Fabaceae	Cytisus	striatus	Portuguese broom	B, T	
Boraginaceae	Echium	plantagineum	Paterson's curse	A	
Fabaceae	Genista	monspessulana	French broom	B	
Asteraceae	Hieracium	aurantiacum	orange hawkweed	A	
Scrophulariaceae	Hieracium	floribundum	yellow hawkweed	A, T	
Fabaceae	Spartium	junceum	Spanish broom	B	

In addition, it is possible that some non-native species that are currently on the forest could become invasive in the future (Table 4).

Table 4. All other known non-native vascular plants on the forest in 2006

Family	**Genus**	**Species**	**Common Name**	**State List**	**Biocontrol Agents**
Hippocastanaceae	Aesculus	hippocastaneum	horsechestnut		
Poaceae	Agrostis	tenuis	colonial bentgrass		
Poaceae	Aira	caryophyllea	silver hairgrass		
Liliaceae	Allium	vineale	crow garlic		
Poaceae	Alopecurus	pratensis	meadow foxtail		
Poaceae	Anthoxanthum	odoratum	sveet vernalgrass		
Asteraceae	Arctium	minus	common burdock		
Poaceae	Arrhenatherum	elatius	tall oat grass		
Poaceae	Avena	fatua	wild oats		
Asteraceae	Bellis	perennis	English daisy		
Poaceae	Briza	minor	little quaking-grass		
Poaceae	Bromus	sterilis	barren brome		
Poaceae	Bromus	tectorum	cheatgrass		
Poaceae	Bromus	secalinus	chess brome		
Poaceae	Bromus	commutatus	hairy brome		
Poaceae	Bromus	japonicus	Japanese brome		
Poaceae	Bromus	rigidus	ripgut brome		
Poaceae	Bromus	mollis	soft brome		
Callitrichaceae	Callitriche	stagnalis	pond water-starwort		
Asteraceae	Centaurea	cyanus	bachelor's button		Y
Gentianaceae	Centaurium	umbellatum	common centaury		
Caryophyllaceae	Cerastium	viscosum	sticky chickweed		
Asteraceae	Chrysanthemum	leucanthemum	oxeye-daisy		
Asteraceae	Cirsium	vulgare	bull thistle	B	Y
Asteracea	Cirsium	arvense	Canada thistle	B	Y
Brassicaceae	Conringia	orientalis	treacle hare's-ear		
Convolvulaceae	Convolvulus	sepium	hedge bindweed		
Rosaceae	Crataegus	monogyna	English hawthorn		
Asteraceae	Crepis	setosa	rough hawksbeard		
Asteraceae	Crepis	capillaris	smooth hawksbeard		
Poaceae	Cynosurus	cristatus	crested dogtail		
Poaceae	Cynosurus	echinatus	hedgehog dogtail		
Poaceae	Dactylis	glomerata	orchard-grass		
Apiaceae	Daucus	carota	queen anne's lace		
Caryophyllaceae	Dianthus	armeria	grass pink		
Scrophulariaceae	Digitalis	purpurea	foxglove		
Dipsacaceae	Dipsacus	sylvestris	teasel		
Geraniaceae	Erodium	cicutarium	stork's-bill		
Poaceae	Festuca	pratensis	meadow fescue		
Poaceae	Festuca	myuros	rat-tail fescue		

Rubiaceae	Galium	parisiense	wall-bedstraw		
Geraniaceae	Geranium	columbianum	long-stalked geranium		
Clusiaceae	Hypericum	perforatum	St. John's-wort	B	Y
Poaceae	Holcus	lanatus	common velvet-grass		
Poaceae	Hordeum	geniculatum	Mediterranean barley		
Asteraceae	Hypochaeris	radicata	hairy cat's-ear		
Asteraceae	Lactuca	muralis	wall lettuce		
Lamiaceae	Lamium	purpureum	red deadnettle		
Asteraceae	Lapsana	communis	nipplewort		
Fabaceae	Lathyrus	latifolius	perennial pea		
Fabaceae	Lathyrus	sphaericus	grass peavine		
Poaceae	Lolium	multiflorum	Australian ryegrass		
Poaceae	Lolium	perenne	perennial ryegrass		
Asteraceae	Matricaria	matricariodes	pneapple weed		
Asteraceae	Matricaria	chammomilla	wild chamomile		
Lamiaceae	Melissa	officinalis	lemon balm		
Laminaceae	Mentha	piperita	peppermint		
Boraginaceae	Myosotis	discolor	yellow & blue myosotis		
Scrophulariaceae	Parentucellia	viscosa	yellow parentucellia		
Poaceae	Phalaris	aquatica	Harding grass		
Poaceae	Phleum	pratense	common timothy		
Pineaceae	Pinus	sylvestris	Scot's pine		
Plantaginaceae	Plantago	lanceolata	buckhorn plantain		
Plantaginaceae	Plantago	major	broadleaf plantain		
Poaceae	Poa	compressa	Canada bluegrass		
Poaceae	Poa	pratensis	Kentucky bluegrass		
Rosaceae	Prunus	avium	mazzard cherry		
Rosaceae	Pyrus	malus	apple		
Rosaceae	Pyrus	communis	pear		
Ranunculaceae	Ranunculus	repens	creeping buttercup		
Rosaceae	Rosa	eglanteria	sweet-brier rose		
Rosaceae	Rubus	laciniatus	evergreen blackberry		
Polygonaceae	Rumex	conglomeratus	clustered dock		
Polygonaceae	Rumex	crispa	curly dock		
Polygonaceae	Rumex	acetosella	sheep sorrel		
Rosaceae	Sanguisorba	minor	small burnet		
Asteraceae	Senecio	jacobaea	tansy ragwort	B & T	Y
Rubiaceae	Sherardia	arvensis	blue field-madder		
Brassicacae	Sisymbrium	officinale	tumble mustard		
Solanaceae	Solanum	dulcamara	bittersweet nightshade		
Asteraceae	Sonchus	asper	prickly sow-thistle		
Caryophyllaceae	Stellaria	media	chickweed		
Poaceae	Taeniatherum	caput-medusae	medusahead wildrye	B	
Asteraceae	Taraxacum	officinale	dandelion		
Apiaceae	Torilis	purpurea	hedge-parsley		
Asteraceae	Tragopogon	porrifolius	purple salsify		
Fabaceae	Trifolium	campestre	field clover		
Fabaceae	Trifolium	pratense	red clover		
Fabaceae	Trifolium	subterraneum	subterranean clover		
Fabaceae	Trifolium	dubium	suckling clover		
Fabaceae	Trifolium	repens	white clover		
Poaceae	Triticum	aestivum	common wheat		
Scrophulariaceae	Verbascum	blatteria	moth mullein		
Fabaceae	Vicia	sativa	common vetch		
Fabaceae	Vicia	hirsuta	hairy vetch		
Fabaceae	Vicia	tetrasperma	slender vetch		
Fabaceae	Vicia	cracca	tufted vetch		

Literature Cited

Alley, David and Cindy McCain. 2002. McDonald-Dunn Forest ecology plot monitoring: 1989-2001. Northwest Oregon Ecology Group, Siuslaw National Forest, Corvallis.

Blakely-Smith, Matt. 2006. (?)

Camacho, Franciso J. and Nick Otting. 1997. The Flora of McDonald-Dunn Research Forest. On file, College Forests, Oregon State University, Corvallis.

Clarke et al. 2004. Control of *Brachypodium sylvaticum* and Restoration of Rare Native Upland Prairie Habitat at Butterfly Meadows, Benton County. Report Prepared for the Oregon State Weed Board

Hall, J.K. and P.B. Alaback. 1982. Preliminary Checklist of the vascular flora of McDonald and Paul Dunn state forests. Forest Research Laboratory, Oregon State University, Corvallis.

Hubbard, Connie J. 1991. A *Plant Association Classification for McDonald-Dunn Forest.* MS thesis. College of Forestry, Oregon State University, Corvallis.

Radosevich, Steven R., Bryan A. Endress and Catherine G. Parks. 2005. Defining a regional approach for invasive plant research and management.

Radosevich, Steven R., Jodie Holt and Claudio Ghersa. 1997. Weed ecology: implications for management. 2nd ed. John Wiley & Sons, Inc.

West, Neil E. 1963. Vegetation mapping project on the McDonald and Paul Dunn Forests. On file, College Forests, Oregon State University, Corvallis.