MULTNOMAH COUNTY

Integrated Vegetation Management Plan
For Right-of-Ways

August 2009

Land Use and Transportation Division - Road Services
Department of Community Services
Multnomah County

I. INTRODUCTION

The Integrated Vegetation Management Plan for Right-of-Ways (IVM) addresses safety, aesthetic, and environmental considerations related to roadside vegetation management.

The IVM is designed to provide a safe road system free of sight-hindering brush and limbs, to maintain adequate drainage and pollution control in drainage systems, and to control noxious or invasive weeds. Public safety and integrity of public facilities will be maintained, but with careful evaluation of impacts of disturbance to the environment.

Native vegetation provides important ecological functions in upland, wetland, and streamside areas. Maintaining and supporting desirable vegetation in sensitive areas is an important objective of the IVM, in addition to controlling unwanted vegetation throughout the right-of-way (ROW). The IVM combines different methods for vegetation control in an effective and efficient strategy towards this end.

The Road Maintenance Program of Multnomah County's Road Services Division (in cooperation with the Bridge Services Division) is responsible for maintaining 297 miles of roads, 26 vehicular bridges and 2 pedestrian bridges in four services districts (Figure 1). One Environmental Specialty Crew focuses on maintaining the municipal stormwater system, vegetation management, and litter control across districts.

- District 1 – West Multnomah County
- District 2 – Unincorporated pockets in and near Portland
- District 4 – County owned roads within Fairview, Troutdale, and Wood Village and surrounding areas
- District 5 – East Multnomah County

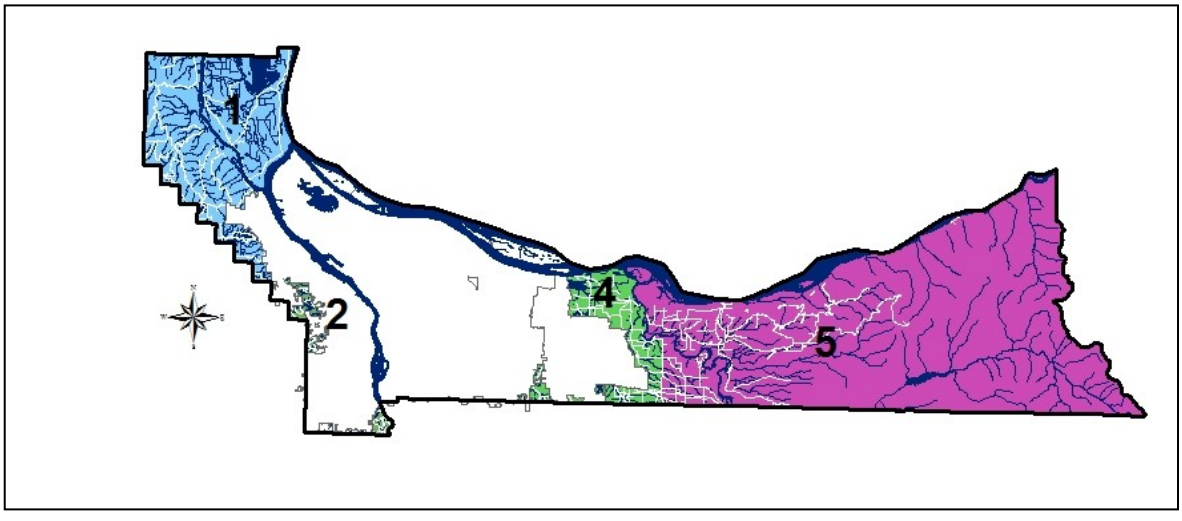

Figure 1. Map of the County road maintenance districts.

Plan Goals

The basic premise of the IVM is to plan and conduct vegetation maintenance activities in a way that discourages or eliminates unwanted vegetation and promotes desirable vegetation. This is achieved in a responsive and efficient manner that keeps roadways safe, while protecting natural resources. Toward this end, the IVM has several goals:

- Develop environmentally sound standards for roadside vegetation management.
- Develop vegetation management strategies that reduce the intensity of maintenance and operational costs.
- Develop an approach which considers a variety of vegetation control measures and minimizes chemical solutions.

Governing Laws and Regulations

In addition to Oregon road safety standards set by the Federal Highway Administration and the Oregon Department of Transportation, the IVM Program takes into consideration the requirements set out by federal, state and local regulation and policy for environmental protection. These include:

- Water quality standards (Clean Water Act)
- Drinking water standards (Safe Drinking Water Act)
- Impacts to Federally-protected species (Endangered Species Act)
- Protection of rare or sensitive plants (Columbia Gorge National Scenic Area requirements)

Interjurisdictional Coordination

Road Maintenance staffs a position to coordinate vegetation management internally among road maintenance staff, and with Interjurisdictional partners. The Vegetation Management Specialist maintains a commercial pesticide applicator license, and manages the daily activities of the Road Maintenance vegetation program, including herbicide application, staff training, and weed identification.

Multnomah County is a partner of the Clackamas, Clark, Multnomah, and Washington County ("Four County") Cooperative Weed Management Area (CWMA) through a memorandum of understanding. This is a program of the Northwest Weed Management Partnership, an informal multi-agency network of cooperators that includes several local, state and non-profit groups. The work of this group is the principle Interjurisdictional effort to identify, map, and control of harmful invasive weeds in the region. The CWMA objectives are:

1. Manage the CWMA through information sharing and relationship building.
2. Inventory and assess weeds using mapping and risk assessment methodology.
3. Conduct outreach to raise awareness about weeds among the wider public.

4. Sponsor effective and innovative weed control projects using best management practices and restoration techniques.

The Vegetation Management Specialist participates regularly in the CWMA, and works on local weed projects with the neighboring jurisdictions including the City of Portland, Clean Water Services, several neighborhood groups, Soil & Water Conservation Districts, the Nature Conservancy and other members of the CWMA.

II. RIGHT-OF WAY MAINTENANCE ZONES

County rights-of-way are divided into several zones for the purpose of assigning management objectives, maintenance needs and thresholds for triggering vegetation maintenance actions (Figure 2). Noxious weed species are controlled throughout all zones. Not all zones occur on every road.

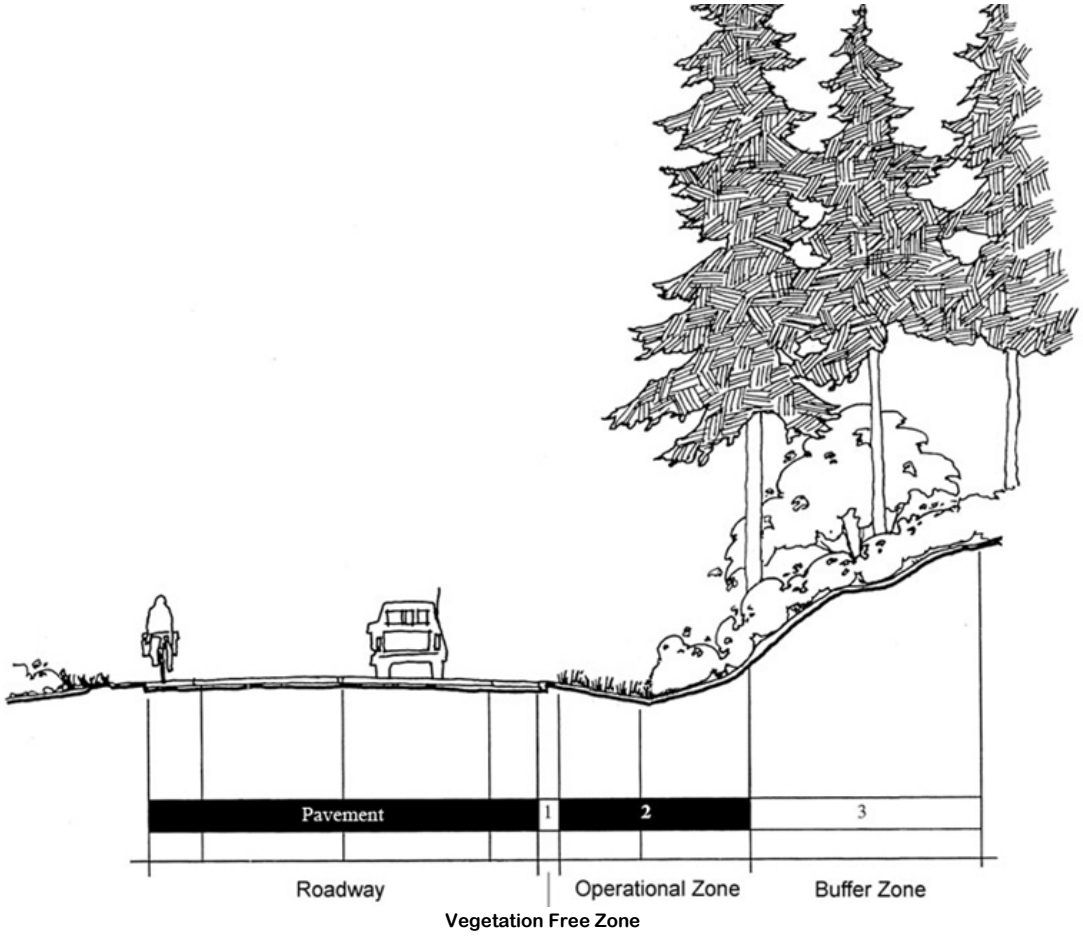

Figure 2. Right-of-way maintenance zones.

Vegetation Free Zone (Zone 1)

Zone 1 is kept free of vegetation to provide for key maintenance, operational, safety, and pavement and guardrail preservation needs. The zone may be as wide as necessary to meet operational needs. A Vegetation-Free Zone is typically maintained with the application of herbicides.

Objectives:

- Provide for surface drainage.
- Prevent pavement breakup by plants.
- Provide for visibility and maintenance of roadside hardware.
- Prevent fire starts.
- Prevent buildup of sand and windblown debris at pavement edge.

Corrective action levels:

- Vegetation height on shoulders exceeds 12 inches
- Preventative action may be taken when vegetation first appears on the shoulders.
- Vegetation mat on shoulders is impeding drainage of road surface or roadbed.

Operational Zone (Zone 2)

Zone 2 extends from the edge of Zone 1 or the pavement edge (if a Zone 1 is not present) to a width necessary to provide for safe errant vehicular recovery, maintain sight distance at corners and intersections, and provide for other operational, safety, and environmental functions. Zone 2 is typically maintained by mowing a single pass adjacent to the pavement and through selective removal of unwanted trees and brush beyond the mowing strip.

Objectives:

- Maintain a hazard free vehicle recovery zone
- Provide sight distance for passing and stopping
- Provide sight distance at intersections
- Prevent erosion with vegetation
- Maintain hydraulic capacity of ditches
- Control invasive or noxious weeds
- Accommodate utilities
- Preserve and conserve native plants and wildflowers

Corrective action levels:

- Invasive weeds on right of way are in the bolting or flowering stage.
- Vegetation in ditches begins to impede flow of water.
- Vegetation around guardrails, signs and culverts inhibits access for maintenance.

Transition/Buffer Zone (Zone 3)

In areas with sufficient right-of-way width, a Buffer or Transition Zone extends from Zone 2 to the right-of-way line to provide a buffer or transitional area between the highway facility and adjacent land uses. This area is maintained selectively, and to the greatest degree possible as a self-sustaining plant community, to minimize erosion as well as the growth of weeds and undesirable trees and brush.

Objectives:

- Blend and/or screen adjacent surroundings.
- Maintain low growing vegetation on non-drivable shoulders and ditch line to ROW back slope.
- Control weeds.
- Remove hazard trees.
- Manage trees to reduce shading in areas prone to roadway icing.
- Prevent erosion.
- Maintain and enhance visual quality.
- Preserve wetlands and wildlife habitat.
- Accommodate utilities.
- Preserve and conserve native plants and wildflowers.

Corrective action levels:

- Vegetation on back slope or cut banks is sufficiently tall to obstruct or nearly obstruct line of sight on corners and at intersections, or to obstruct road signs.
- Preventative action may be taken if tall growing species become visible in the buffer zone.

Special Maintenance Areas

Restricted Activity Areas (RAZ)

The County Road Maintenance program has defined Restricted Activity Zones (RAZ) in the Routine Maintenance and Operations Manual (RMOM). A RAZ is an area adjacent to natural streams, rivers, and wetlands where extra protective measures are needed. An area is designated as a RAZ if the routine road maintenance activities have a potential of impacting a waterway. The RAZ typically will extend one hundred fifty (150) feet either side of a stream or wetland; however the actual distance of a particular RAZ from a stream varies depending on the site conditions.

Special vegetation management considerations for the RAZ are given in the RMOM, including best management practices (BMP) for mowing, brushing, and hazard tree removal. The County does not spray non-aquatic approved herbicides within sixty (60) feet of fish-bearing streams or actively flowing cross culverts.

Water quality facilities

The County maintains a small number of vegetated water quality facilities. Road Maintenance maintains only one of these facilities, a grass-lined detention pond, which is mowed periodically. No herbicides are used at this water quality facility.

Owner-Maintained Right-of-Way Program areas

Owners of property adjacent to Multnomah County's right-of-way can request that their frontage not receive herbicide and/or mechanical treatment as part of the County's prescriptive maintenance program. The owners who wish to maintain their ROW frontage are required to meet current County road standards. Properties in the RAZ are notified of special restrictions if any apply.

The Owner Maintain program requires a contract with the County. The owner must submit an Owner Maintain Permit Agreement, and maintain their ROW frontage according to the conditions of the agreement. The Agreement can be modified to meet site specific conditions at the discretion of the Road Maintenance Manager.

III. VEGETATION MANAGEMENT METHODS

Multnomah County employs four principle methods to meet vegetation management goals: 1) Mechanical; 2) Biological; 3) Cultural; and 4) Chemical methods.

Multnomah County Best Management Practices for Vegetation Management focus on minimizing the disturbance to native vegetation and maintaining ground cover to prevent erosion. When possible and practical, Multnomah County will control vegetation through mechanical, biological, and cultural means before using chemical methods.

Mechanical Methods

Mechanical methods offer efficient short-term removal of vegetation in the ROW. All manner of heavy equipment and hand tools are used in the following activities:

Mowing – includes the use of drop down mowers and tractors, and push or walk-behind mowers, to maintain safety sight distances and visual clearance of sign controls, and to maintain a pleasing roadside for roadway users.

Brush mowing – involves the removal of vegetation along rural and urban roadsides using tractor-powered flail or rotary brush cutters to maintain safety sight distance as well as visual clearance of traffic control signs, to maintain safety "clear zones"

Hand-brushing and pruning – includes the selective removal of encroaching or overhanging vegetation. Manual work is a good alternative for sensitive areas or removing problem weeds, however, the labor intensity and time are factors for the use of this method.

Biological Methods

Insects and other natural predator can be used to control the noxious weed or unwanted vegetation. Predators usually come from the invasive plant's native habitat and are available commercially. Once established, they may support their own growth and expansion. They may attack different parts of plants at different times, but eventually may decrease seed production and growth rate. One or more biological control agents can be used at a time on a weed species. Biological control measures will be primarily led by the Oregon Department of Agriculture (ODA).

Cultural Methods

Cultural methods incorporate the use of native plant materials to meet objectives. By enhancing desirable plants through revegetation, shading, weed exclusion, or mulching, these plants can eventually out-compete or resist undesirable vegetation.

Chemical Methods

Chemical control methods are effective to stunt growth, thin vegetation and/or eliminate unwanted vegetation within a designated area. Herbicides may require multiple applications for hardy weed species. Chemical control of noxious weeds work best if used in conjunction with other control methods. Choice of herbicide depends on type of weeds, proximity to water, and season. An ODA pesticide applicator license is required to apply herbicides in most right of way situations.

IV. VEGETATION MANAGEMENT STRATEGY

Selecting Optimal Strategies

Road Maintenance considers a multi-faceted approach to reduce or eliminate undesirable vegetation. Strategies in each ROW maintenance zone consider the following factors when selecting the combination of control methods:

- Least hazardous to human health
- Minimal impact to non-target organisms
- Least damaging to the natural functions
- Best preserves desirable vegetation
- Most likely to produce permanent reduction of undesirable species
- Ability to carry out effectively
- Cost effectiveness in the short and long term

Management strategies

The following matrix describes the management strategy for the three maintenance zones in the ROW (Table 1). These prescriptive strategies are used County-wide as resources are available to meet the functional objectives for each zone.

The Integrated Pest Management Guide for Common Weeds from the Northwest Weed Management Partnership is used for treatment strategies for particular weeds of regional concern (Appendix A).

Adequate staff and equipment resources are needed to implement the management strategy and meet the functional objectives for each of the management areas. Resources are balanced with maintenance needs through annual work planning, however, limitations on those resources or unexpected maintenance needs (e.g., emergencies, extreme weather events, landslides) may not allow functional objectives to be met in all areas.

Vegetation maintenance is managed adaptively by establishing priority areas or projects, or by shifting strategies so that the IVM is aligned with the mission of the Road Services Division:

> *to manage and preserve the County Road infrastructure, and provide a safe and efficient transportation system that supports economic and community vitality*.

Priorities are given to high use roadways, problem areas, and sensitive areas as determined by the Road Maintenance Manager. Strategies are monitored and evaluated to ensure effective, efficient and responsive implementation, as discussed below.

V. HERBICIDE SELECTION AND USE

Herbicides are efficient and effective tools for vegetation management and weed control. However, Road Maintenance recognizes there may be potential impacts to health and the environment, and minimizes herbicide use wherever possible. Road Maintenance uses herbicides two ways:

- to maintain the vegetation-free zone at the edge of the pavement where necessary and to maintain vegetation free areas around signposts and other fixtures in the ROW
- to selectively control and eliminate undesirable plants

Herbicide Selection and Use

Multnomah County only uses herbicides that are registered by the Environmental Protection Agency (EPA) and the Oregon Department of Agriculture (ODA). All new chemicals used by the County are vetted through the New Chemical Review Process (Administrative Procedure RSK-21). This process allows review of the use, storage and toxicity of chemical, to ensure that the least hazardous product sufficient for the intended use is identified. The Northwest Weed Management Partnership identifies herbicides effective for selected noxious weeds in the IPM Guide to common weeds (Appendix A).

Table 1. Vegetation management strategies for right-of-way maintenance zones.

	Management Method			
	Mechanical	***Chemical***	***Biological***	***Cultural***
Zone 1: Vegetation Free	Not usually considered in this zone.	Application of a combination post- and pre-emergent blanket spray in April, May or June. September or October application of post-and pre-emergent herbicides can help reduce spring growth.	Not usually considered in this zone.	Not usually considered in this zone.
Zone 2: Operational	One pass with tractor-mounted mower is used to clear area just beyond shoulder. Hand operated equipment is used to clear vegetation around culvert openings, utility poles, signposts and other fixtures in the operational zone Manual and heavy equipment are used to remove hazard or potential problem trees and shrubs	Broadcast sprays of selective herbicides are used to target invasive or non-desirable weeds while leaving grasses intact. Spot spraying with backpacks and pickup mounted tanks target specific weeds while leaving neighboring vegetation unharmed.	Biological alternatives are considered for use in this zone. We monitor for favorable predators and do not interfere if they are working. Monitor what ODA is doing, as they are the main users of biological controls in the ROW.	Consider seeding/planting for erosion control after re-grading for slides/washouts. Time of year, extent of disturbance, and sensitivity of habitat are major considerations for planting.
Zone 3: Transition/ Buffer	Manual and heavy equipment are used to remove hazard or potential problem trees and shrubs.	Spot spraying with backpacks and pickup mounted tanks target specific weeds while leaving neighboring vegetation unharmed		Consider seeding/planting for erosion control after re-grading for slides/washouts.
Restricted Activity Zones (RAZ)	Mowing near streams and wetlands as identified in the RMOM,	Prohibit chemical application 60’ from streams and wetlands.		Consider seeding/planting after disturbance.

Herbicides are applied in accordance with the standards set forth by the Oregon Department of Agriculture, the product's label, and the guidance in this plan. Multnomah County presently uses a Norstar Spray System for herbicide applications. This system meets or exceeds current state and federal standards.

The selection of an herbicide includes the consideration of the following factors:

- Weed or plant species
    - Grasses
    - Broadleaf plants
    - Woody plants
    - Brush (less than 10 feet tall)
    - Trees (over 10 feet tall)
- Location of weed species
- Length of control
- Type of herbicide (selective or nonselective)
- Mode of action (contact or translocation)
- Weather (rain, air and road temperatures, wind direction and speed)
- Soil conditions
- Adjacent vegetation and land use
- Designated sensitive areas (Restricted Activity Zones as defined in the Routine Road Maintenance and Operations Manual)
- New Chemical Review Process (RSK-21)

Personnel Training

Multnomah County Transportation personnel who apply or supervise the application of pesticides will be licensed by the Oregon Department of Agriculture and follow the rules set out in the Oregon Pesticide Control Law (ORS 634*).*

Oregon Department of Agriculture Recertification - The Oregon Department of Agriculture has passed legislation that requires 40 hours of Department of Agriculture approved courses every 5 years in order to recertify State of Oregon Pesticide Licenses. This legislation also states that a maximum of 15 credits shall be accredited in any given year.

Training Commitment - All persons responsible for supervising the Vegetation Management Program, its application and applying of herbicides will attend educational classes, seminars and meetings to enhance and upgrade their knowledge of vegetation management, alternatives and the selection and safe application of herbicides.

An effort will be made to seek out alternative vegetation management courses. Those individuals involved in Multnomah County's Vegetation Management Program will enhance their vegetation management techniques by attending the appropriate courses as available.

VI. MONITORING, EVALUATION AND REPORTING

Monitoring and evaluation is an on-going activity and practice. Road maintenance crews routinely scan the ROW for hazards posed by vegetation, and opportunities to correct potential hazards from occurring. The public are encouraged to report road vegetation hazards, and in some cases, with public notice, Road Maintenance may rely on the public to notify the County of such hazards.

The County follows Early Detection and Rapid Response methods for weed control and shares information through the Four County Cooperative Weed Management Area partnership. Identified weeds are reported to ODA and the mapped through the Weedmapper program (www.weedmapper.org). Response measures for weed species are coordinated through the partnership following the control methods in Appendix A.

Initial herbicide activity and possible injury to adjacent vegetation can be determined 2 to 4 weeks after application. Total vegetation control treatments can be evaluated after 6 to 8 weeks and observed through the end of the season. Adjustments in rates, products, timing of herbicide applications and even decisions not to apply herbicide should be made based on the objectives for each zone, and changes recorded in the spray log.

Herbicide use reporting

Records of all herbicide applications are required by Oregon law (ORS 634.146). Pesticide operators shall prepare and maintain records on forms approved by the State Department of Agriculture. Records include:

- Property owner
- Location of the land or property on which the pesticide was applied
- Date and time of application
- Pesticide supplier
- trade name and the strength of such pesticides
- amount or concentration
- The specific property, crop or crops to which the pesticide was applied
- Equipment, device or apparatus used
- Names of the pesticide applicator or pesticide trainees

The record retention is three years from the date of application of pesticides, shall be available during business hours for review and inspection by the department.

Vegetation Management related injury and property damage documentation.

All personal property damage allegedly resulting from Multnomah County employees and / or equipment during roadside vegetation maintenance is and will be documented and handled by Multnomah County's Risk Management.

Appendix A

Integrated Pest Management (IPM) Guide for Common Weeds

(Revised September 15th, 2008, Northwest Weed Management Partnership, Contact: vgholm1@verizon.net)

Disclaimer: This document is a basic guide and assumes no liability toward product efficacy, loss of non-targeted plants, or personal safety issues. Always follow label instructions, wear proper safety gear, and avoid herbicide drift. If in doubt as to control practices, consult a licensed treatment contractor.

Species	Mechanical	Chemical	IPM	Notes/Tips
Blackberry	-Mow at least twice a year: June and September. - In small patches, grub roots in the winter through early summer when soil is moist enough to allow you to dig. Be sure to dig enough to remove root collar. -Re-seed area with native grasses, trees, and shrubs. -Be persistent! New vines are always showing up. -Shading is the best long-term non-chemical approach to blackberry control	-Treating in fall will bring you the best results. -Treat with Crossbow or Garlon 3A 1% in the late summer or fall, usually in September/October. Glyphosate at 2% is also effective in early October before first frosts. Frost events cause plant dormancy and negate any effect from glyphosate. In mixed stands of blackberries and snowberries (common in riparian areas) you can spray over the top of both in the fall using Garlon 3A without any ill effect on snowberries.	-Mow in June and allow for regrowth. -Treat with Garlon 3A or Crossbow in September.	- A rust that stunts blackberry growth was accidentally introduced to the United States. The rust in spreading, but the impact of the rust appears to be dependent on local climate (i.e., dry weather is not conducive to the rust).
Species	**Mechanical**	**Chemical**	**IPM**	**Notes/Tips**
Scotch Broom	-Mowing is sometimes done to knock down large Scotch Broom patches, but should be avoided when seed pods are ripe. Also, keep in mind there is a good chance that seeds already on the ground will be spread by mowing. -Mowing typically results in dense, multi-stemmed regrowth: great for spraying, not so great for "lop and leave." -Cutting large plants (stem greater than 1/2 inch) is most effective in the driest times of the year. -Pull smaller plants (less than 1/2 inch) by hand or with a weed wrench.	-If possible, spray Scotch broom after it blooms but before leaf drop. -Water stress in late summer can cause reduced herbicide effectiveness. -Garlon 3A or 4, Glyphosate, and Crossbow are all effective. Be careful of surrounding vegetation! -Garlon 3A and Milestone mixed are very effective and don't require complete coverage of plant for total control. Care must be taken around trees and shrubs due to Milestone's soil activity. Calibrate sprayer well and watch your rates. -Treat new seedlings every year.	-Mow in early spring. -Treat regrowth in fall or the following spring with Garlon or Crossbow. -You can also use Roundup for early fall treatments, but be careful of surrounding vegetation! -Cut stumps often don't need herbicide treatment if they are an inch in diameter or bigger. Mid-late summer cutting is best.	-Be sure to clean all equipment used at the site. -Don't use contaminated gravel. Ask the supplier if the stockpiled gravel is free of broom plants. If they don't know ask to check out the piles. -Don't mow Scotch broom when seed pods are ripe. -Pulling large plants with a weed wrench creates ideal growing conditions for seed bank – consider cutting instead. -A battery powered "Saws All" is a great tool for cutting large stems.

Species	Mechanical	Chemical	IPM	Notes/Tips
Pasture Weeds (broad-leaf weeds in grass plantations. Includes: tansy ragwort, teasel, thistles, dock, St. John's wort, *et al*)	-IMPORTANT: Mow before seed formation. -Except for Canada thistle, hand digging is feasible for small infestations. -Cut and bag all seed heads, and burn or dispose of them to prevent spread of seeds.	-IMPORTANT: Spring application is critical. Apply herbicides BEFORE plants flower. -The following herbicides are effective: 2,4-D, Weedmaster, Garlon 3A, Curtail, Stinger, Milestone -Stinger and Curtail are effective on Canada thistle when plants are short (less that 6") to full height. Glyphosate is only effective when plants are in late bud to flower stage or on fall regrowth. -If you want to save clover, use MCPA. All others will eliminate clovers. -Milestone is very effective on all stages at very low rates. (check label)	-Introduce goats with other grazers. Goats prefer broad leaved plants. Don't over graze. - If you miss spring spray time, you can mow in early summer and spray in the fall. This approach works well for Canada thistle and tansy. -Keep the grass competitive by maintaining grass fertility.	-There may be a biocontrol agent already present, but some don't have a large effect. - No tansy ragwort Bugs? Don't panic - the bugs will come! Biocontrol agents cycle with the plant population and will become more abundant and effective as plant becomes more abundant. -Cut and bag tansy ragwort and teasel.
Species	**Mechanical**	**Chemical**	**IPM**	**Notes/Tips**
English Ivy	-Protect trees and prevent seed production by cutting vines around tree trunks. Clear ivy three feet out from the base of the tree. -Using rakes and shovels vines can be pulled and rolled down a slope like a carpet. -Goats and sheep love ivy, and can be used to clear areas prior to pulling of the roots.	--Use Crossbow or Garlon 3A with a good surfactant during dry periods in late winter or early spring before native plants leaf out or emerge. -You will not notice effects until months later, so be patient!	-Cut ivy away from trees and apply foliar herbicide treatment to leaves on the ground. -Cut ivy trunks back to ground and paint or spot spray them with Garlon.	- If you do nothing else, keep ivy out of the trees!! -Cut the climbing vines, taking a good chunk out of them so they don't grow back together. This also ensures you don't miss any of the small vines that might be mixed in hidden in the larger ones.
Species	**Mechanical**	**Chemical**	**IPM**	**Notes/Tips**
Parking lot weeds (Puncture vine, prostrate knotweed, annual bluegrass, *et al*)	-Apply early season flaming. -Hand pull large weeds early in season. -Apply fresh gravel on a regular basis.	-A wide range of herbicide products can be used to initially knock down the vegetation. Tank mix Glyphosate with a residual product to get season-long control. -Try using vinegar based weed products on individual plants.	Pull/hoe when you can; if things get away from you, apply herbicides. -Smothering with fresh gravel over a residual treatment helps sustain longer control.	-Control early and stick to it, as seasonal plants (some plants are summer annuals and some are winter annuals and sprout at different times of the year) and new species are introduced.

Species	Mechanical	Chemical	IPM	Notes/Tips
False Brome	-Mowing can be used to remove/deplete annual seed production. -Hand pulling small patches is best in April and early May. Mulching with clean, weed free straw works great to suppress false brome	-Broadcast application of Poast (grass specific), or a glyphosate-based herbicide such as Roundup, is effective in the mid summer through fall. -You can apply also apply herbicides (except Poast) in fall after first rains	-To reduce the amount of herbicide used, mow for several years to eliminate soil seed bank. Then treat with herbicide. -You can also mow in early July, and then treat with Roundup in the fall.	False brome is spreading fast. Slow the spread by making sure clothing and equipment are free of seeds before you leave an infested site. Put up informational signs at trailheads to urge hikers to clean clothes, pets, and OHVs.
Species	**Mechanical/Manual**	**Chemical**	**IPM**	**Notes/Tips**
Garlic Mustard	Mowing is **not** an effective control because plants will still bolt and seed Mowing spreads garlic mustard seed like wildfire - do not mow when seed pods are present (May - Sept.) <u>Hand pulling</u> Easiest during early bolt (2nd year). Difficult during rosette stage (first year) except for small patches Multiple years are needed to exhaust seed bank Pull at base to avoid breaking stem All pulled plants should be bagged and removed from site (will set seed and/or re-root)	Use products that contain glyphosate or Tricloypr To avoid damaging native forbs, spray the rosette stage during late winter/early spring If not sure how to identify rosette stage, you can spray during flowering Fall application to the rosettes (after some rain events so plants are growing again) may also be effective Sprays at height of summer will not do much Use aquatic formulations when spraying near any body of water	Combination of chemical and hand pulling is very effective - pulling bolted plants and spraying rosettes right after pulling	Once seed passes from milk into dough stage it will still be viable if sprayed Consider impact of crews once seed is present! Clean boots and clothing of any seeds!!!!!

<u>Important Notes:</u>

- Always read the entire label before using any herbicide. Wear safety gear and mix herbicides in a safe environment.
- A surfactant and indicator dye will help with control and efficacy. Note regarding surfactants: Just as with herbicides, read label directions! Some surfactants are appropriate for use with certain herbicides but not others. Also, if using a surfactant on or near water, read label directions to see if the surfactant you are using is approved for aquatic environments.
- Glyphosate-based products, such as Roundup and Rodeo are non-selective -- they will kill <u>all</u> green plants!
- Herbicides typically work best when applied on temperate (~ 60 - 72 degrees) non-windy days followed by 12 hours of no rain. If temps are cooler and/or there has been limited rainfall, the effects of herbicide application will take longer to become apparent.
- Plant material disposal: Dry and/or burn pulled or cut plant material. Dry the plant material on a tarp or plastic barrier to prevent soil contact with roots.
- Once weeds are reduced or eradicated it is critical to plant the treated area, preferably with natives. Open ground, or one with sparse vegetation, is very likely to come back as a first-class weed patch!