Integrated Pest Management Plan for Outdoor Landscapes

Grounds Management

University of Washington

Seattle Campus

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Contents

Introduction

Integrated Pest Management is an adaptive approach to handling pest problems while ensuring environmental and human safety. This Integrated Pest Management Plan was developed as a guide for decision making and a reference for current Grounds Management practices. As a living document, it should be updated as changes to the program are made and new information becomes available.

Approach Summary

The Seattle campus of the University of Washington spans approximately 643 acres, of which there are an estimated 83 acres of turf, 41 acres of bed space, and 110 acres of natural areas. Each area of campus presents unique Integrated Pest Management (IPM) challenges. Accordingly, IPM strategies are tailored to target specific pests and locations.

The first step in the UW IPM program is establishment of tolerance and maintenance levels for pests that vary depending on the priority and aesthetics of each area. Gardener Leads work with Grounds Management Supervisors to develop these criteria for their zones. Landscaped areas including planting beds and turf have been mapped and assigned thresholds and maintenance priorities.

Prevention, **monitoring/detection**, **evaluation** and **response** are the next steps in the UW IPM program. Known or potential pests are prevented using cultural practices, no prophylactic pesticide spraying occurs. When a pest has been **detected** and exceeds the established level of tolerance, a management approach is chosen based on an **evaluation** of the priority, size and topography of the area, the species in question, resources available, proximity to environmentally or culturally sensitive areas, cost, timing, and best management practices if available. Cultural, manual and mechanical methods are always preferred over the use of chemicals, which are only employed as a last resort.

Scouting for pests and employing rapid detection and response reduces the needs to rely heavily on chemical means of control. When chemicals are used, care is taken regarding the method, location, rate, and timing of the application to minimize the risk

of non-target contamination via runoff or drift. Applicators are trained in IPM techniques and hold Washington State Pesticide Applicator licenses.

Decision-Making Criteria

When a pest has been identified and exceeds the established level of tolerance, the following criteria should considered before a management approach is chosen: the priority, size and topography of the area, the pest species in question, resources available, proximity to environmentally or culturally sensitive areas such as waterways and storm drains, and the cost and time of the available and effective best management practices. Cultural, manual and mechanical methods are always preferred over the use of chemicals, which are only employed as a last resort. Only aquatically labeled pesticides are to be used on a site that is proximate to surface water.

Specific Pest Approaches

Weeds in Beds and Natural Areas

Preventing the establishment of noxious and invasive weed species is a priority of the University of Washington's IPM program. Mechanical and physical methods are preferred IPM strategies for weed management. Hand pulling, mowing, dead-heading (to prevent the spread of seeds), and sheet mulching are done on a regular basis. Wood chips are accumulated from local arborists and campus tree pruning, and are an important tool for weed suppression as they are slower to decompose than commercial mulch.

The Washington State Noxious Weed Board administers the State Noxious Weed List. Weeds designated by this list are required to be controlled (RCW 17.10). The King County Noxious Weed Board monitors and ensures compliance locally. The University of Washington has several designated weeds for which we are working toward eradication. They are summarized in Table 1 and further described in the section below.

Table 1. Designated noxious weeds required for control on UW property

Common Name	Latin Name	Weed Class	Control timing	Area sqft	Location Description	First Noted
Garlic Mustard	*Alliaria petiolata*	A	Sprayed with glyphosate from fall through spring. Pulled when flowering: April-May.	3500	1. Along path which heads W from Burke Gilman trail about 100' S of NE 45th St overpass. This continues along the overpass and up the hill towards McCarty Hall. 2. In wooded area across street west of McCarty and Haggett Halls between trail and street.	5/10/2002
Milk Thistle	*Silybum marianum*	A	Cut flower heads in this case.	10	Medicinal Herb Garden We have an agreement that we display a sign explaining noxious weed status and cut flower head off.	6/14/1999
Purple Loosestrife	*Lythrum salicaria*	B	Remove flowers and/or spray with glyphosate when flowering - June through October.	3405	Down by waterfront activity center from Montlake Cut, north along the shore and on islands off shore. On hillside to the north of the Montlake Cut, west of the Montlake Bridge.	9/13/2001
Garden Loosestrife	*Lysimachia vulgaris*	B	Remove plants when flowering - June through October.	23630	At Agua Verde/Sakuma Park	8/4/2004
Spanish Broom	*Spartium junceum*	A	Pull out with weed wrench. Cut stump (spray with glyphosate immediately after cutting.) Flowers in May, seed set in August.	260	Along north side of Montlake Cut west of Montlake Bridge, behind UW Medical Center and Experimental Ed. Bldg. Can access from Medical Center side or from path right along water.	6/8/1998
Common Bugloss	*Anchusa officinalis*	B	Flowers beginning in June, sets seed in August. Can be pulled out.	0	On the hillside east of the UW Botany Greenhouse above the Burke-Gilman trail. A few separate patches.	5/17/1999
French Broom	*Genista monspessulana*	A	Pull out with weed wrench or cut stump Flowers in May, seed set in August.	200,000	Along north side of Montlake Cut east of Montlake Bridge	2010

For each high priority weed, a Weed Management Plans is developed for locations where control is being sought (see appendix A).

Rubus armeniacus – Himalayan blackberry

Himalayan blackberry is the most widespread weed on campus. It is not a designated noxious weed, but is recommended for control. It thrives in sunny or partly shaded slopes.

Treatment plans should consider bird nesting and feeding and may be best

Manual removal can be best performed in the winter, when soil is soft and most of the roots can be removed fairly easily. Cutting stems without chemical treatment gives the best results in the fall when plants are fruiting.

Chemical treatment can be performed in the winter, summer and fall by mowing or hand cutting followed immediately by spot spraying or painting with 50%-100% amine formulation of triclopyr (Garlon 3A). Foliar sprays are not recommended due to the likelihood of off-target damage.

Polygonum spp – Knotweed

In King County knotweed is not typically required for control, but it is strongly recommended. There are several populations throughout campus and in recent years there have been increased efforts to prioritize removal of this plant and to refine the management approach. A summary of populations and treatments to date can be found in Appendix C.

Prevention is achieved by controlling existing populations and ensuring that the transport of viable seed and vegetation does not happen.

Manual treatment requires either removal of above-ground growth throughout the growing season (2x/month) or covering populations in a tarp or other impenetrable material in an attempt to suffocate the plant.

The preferred methods on campus are:

For small populations: injection of aquatically labeled glyphosate using the J/K injector gun

For larger populations: Foliar treatment from late July-September using 1% aquatically labeled imazapyr with .25% non-ionic aquatically labeled surfactant is recommended. Cutting back large amounts of biomass in the early season to stunt growth for easier access between July-September has been effective. Care must be taken to avoid removal of any living plant material unless placed in a sealed bag due to the ease of vegetative reproduction.

Any method will necessitate follow-up in subsequent years.

Convulvulus arvensis – Field bindweed

Field bindweed is a Class C noxious weed. Control is recommended but not required. It is a ubiquitous in many flower beds on campus and is very difficult to control. Because it dies back in the winter, it is only possible to assess the effectiveness of treatment during the following growth season.

Prevention is achieved by controlling existing populations and inhibiting the transport of viable seed and vegetation.

Manual control requires diligent removal of as much above and belowground biomass as possible.

Chemical The tendency for this weed to intertwine with desirable ornamentals means that care must be taken to avoid off-target damage. Foliar treatment with glyphosate is the only way to get adequate uptake of herbicide, and should be performed when plants are near flowering (late summer). Vegetation can be removed from valuable plants and sprayed on the ground.

Genista monspessulana – French broom

French broom is a Class A noxious weed required for control in the state of Washington. The only known population in Washington is located on the north slope of the Montlake Cut to the east of the Montlake Bridge. See the noxious weed management plan, Appendix D, for a detailed treatment history.

Prevention is achieved by controlling the existing population and preventing further reproduction. There has also been an attempt to create an inhospitable environment by planting trees at the site. French broom thrives in sunny, hot, exposed conditions.

Manual removal could be effective for seedlings by hand or larger plants with the use of a weed wrench. Disturbance of the soil may however stimulate germination of a well-established seed bank.

Chemical treatment is thought to be most effective in the spring or early fall, when plants are actively growing or translocating resources back to the roots. Cut-stump treatments using either glyphosate or triclopyr concentrate have been attempted and will be further evaluated.

Spartium junceaum – Spanish broom

Spanish broom is a Class A noxious weed required for control in the state of Washington. There is on population on the north slope of the Montlake Cut to the west of the Montlake Bridge. Plants have been seen growing near the water's edge and above the slope at the edge of the lawn.

Prevention is achieved by controlling the existing population and preventing further reproduction.

Manual removal could be effective for seedlings by hand or larger plants with the use of a weed wrench. Disturbance of the soil may however stimulate germination of a well-established seed bank.

Chemical treatment is thought to be most effective in the spring or early fall, when plants are actively growing or translocating resources back to the roots. Cut-stump treatments using triclopyr concentrate has been performed in recent years. Foliar spray is not recommended due to limited leaf surface area.

Clematis vitalba – Old man's beard

Old man's beard is a Class C noxious weed that is recommended but not required for control. It appears all over campus and creates a problem when infestations cover and choke out desirable plants.

Prevention is achieved by controlling existing populations and inhibiting the transport of viable seed and vegetation.

Manual control requires diligent removal of as much above and belowground biomass as possible.

Chemical: The tendency for this weed to intertwine with desirable ornamentals means that care must be taken to avoid off-target damage. The best method is to let grow plants grow (vigorous healthy plants die best) and at late summer or just before flowering treat with glyphosate. Vegetation can be removed from valuable plants and sprayed on the ground. It is also possible to "trap" clematis by using bamboo poles or fences to get it to climb or disentangle and spray on a tarp. Cut-stump methods can also be applied using 50-100% glyphosate or triclopyr in the spring or late summer.

Lythrum salicaria – Purple loosetrife

Purple loosestrife thrives in moist/wet environments near the shore. Populations exist above the Montlake Cut, west of the bridge, along the shore near the Waterfront Activity Center, and intermittently along the Clark Road Canal and border between area 5 and the Union Bay Natural Area.

Prevention is achieved by controlling the existing population and preventing further reproduction.

Biological control has been attempted by UBNA using *Galerucella* beetles. Some plants must be tolerated in order to support this agent, and there appears to be a cycle of impact.

Manual removal can be effective for small infestations. Digging and bagging of the whole plant is necessary. Flower heads should always be removed to prevent spread of seed.

Chemical treatment can be performed while the plants are actively growing. Foliar treatment using the appropriate non-selective herbicide for the site is most effective. Note that for applications performed in or over open water a permit will be required.

Alliaria petiolata – Garlic mustard

Garlic mustard is a Class A noxious weed that is required to be controlled. It has been found in two places on campus. No plants have been seen at the wooded area across street west of McCarty and Haggett Halls between the trail and the street for several years, but it should continue to be monitored. The site along the path that heads west from the Burke Gilman trail about 100' S of NE 45th St overpass is under ongoing treatment. The infestation continues along the overpass and up the hill towards McCarty Hall.

Prevention is achieved by controlling the existing population and preventing further reproduction.

Manual methods are easily employed when plants are visible and blooming in April and May . They can be pulled or dug up.
Small seedlings can be pulled up also, but with large flushes it can be difficult to remove all roots.

Chemical treatment is effective for large flushes of seedlings by using a foliar treatment during the growing season.

Cytisus scoparius – Scotch broom

Scotch broom is not a regulated weed, but it is a widespread nuisance that should be controlled.

Prevention is achieved by preventing reproduction of existing plants and by removing seedlings before they reach maturity.

Manual control is effective using a weed wrench or by hand pulling with smaller plants. It is important to remove the entire root. This is easiest to accomplish during the wet season.

Chemical control can be achieved with a cut stump treatment and 50-100% of triclopyr or glyphosate.

Buddleia davidii – Butterfly bush

Butterfly bush is Class B noxious weed that is not required but recommended for control in King County. It was once planted as an ornamental on campus. Today it is recognized as a nuisance that seeds-around and is invading natural areas. Most of the parent plants have been removed.

Prevention is achieved by limiting reproduction of plants and removing seedlings before they reach reproductive age.

Manual removal can be accomplished using a weed wrench or by hand pulling smaller plants.

Chemical treatment is most effective for larger plants. The cut stump method using 50-100% triclopyr is preferred.

Hedera helix – English ivy

English ivy is widespread and was planted extensively on campus. It is generally undesirable but tolerated in areas where an alternative planting plan is not yet feasible. Removal is attempted when possible.

Prevention: Ivy should not be planted and invasion can be prevented by controlling the edges of infestations to decrease the likelihood of spread. Pruning off or removing seed heads reduces spread. Prevention of damage to trees and shrubs is the highest priority. When ivy begins growing up and over desirable ornamentals, it should be removed.

Manual removal is most effective. Hand pulling, especially in the wet season, is not difficult. Care should be taken to remove as much root as possible, with areas around desirable ornamentals prioritized.

Chemical treatment is difficult due to the thick waxy cuticle and not recommended.

Phalaris arundinacea – Reed canarygrass

Reed canarygrass is a Class C invasive grass in King County. Control is recommended but not required. The focus of control is a population on campus is located at the Clark Road mitigation site along the canal. In addition to the population in the Clark Road site, there are other populations throughout the Union Bay Natural Area along the canal, and along the ditches on the west side of the Canal Road next to the track, soccer and baseball facilities. It is also prevalent along Lake Washington from there to the Waterfront Activities Center.

Prevention is achieved by removing inflorescences and prioritizing treatment and the edges of the infestation to limit spread.

Manual removal is not effective alone, but cutting back or mowing plants in the fall or summer in combination with a chemical application following regrowth.

Chemical: effective options include a 2.5% application of glyphosate or 1% imazapyr with .25% spreader/sticker. To avoid standing water, plants should be mowed in the fall and with a chemical application in the spring, or mowed in the summer with a chemical application in the late summer or fall before rains return. About 1ft of growth for grasses is ideal for treating grasses. Applications near the water should be performed with an aquatically labeled formulation of herbicide and any surfactants used.

Other woody weeds

Woody shrubs such as English holly and volunteer laurels or cotoneasters are a nuisance. These can be manually removed when small by hand digging or using a weed wrench. Cut stump treatment using 50-100% triclopyr is effective for mature plants.

Other herbaceous broadleaf weeds

Prevention requires significant effort to create a non-competitive environment by avoiding open beds and bare soil. Sheet mulching can be an effective way to discourage germination. Care also must be taken to remove plants before they reach reproductive age in order to reduce the build-up of a viable seedbank.

Manual removal can be performed by hand or with any preferred tool such as a weed wrench or hori hori. It is important to remove as much of the root as possible. Flame weeders can also be used, but are most effective when plants are at the small seedling stage.

Chemical treatment is most effective in the spring, when weeds are soft and actively growing. Drought-stressed plants are less responsive to chemical applications. A 2-3% solution of glyphosate is sufficient.

Other grasses

Prevention: Well-maintained bed edges and adequate mulching prevent encroachment from nearby lawns.

Manual removal can be effective for small infestations of grasses and works best for clumping varieties. Rhizomatous grasses are difficult to completely remove.

Chemical treatment can be difficult because grasses often grow mixed with desirable groundcovers and shrubs. Non-selective herbicides such as glyphosate can be used at the 2-3% concentration when non-target damage is not a concern. Selective herbicides with the active ingredient fluozifop (Ornamec in our inventory) target grasses only, but are variably effective. Any herbicide is best applied when grasses are 8-12 inches high in June, July or fall.

Weeds in Lawns

Lawns have been designated into 3 priority levels. Levels 1, 2 and 3 correspond to weed tolerance thresholds of x%, x%, and x% respectively. When a lawn meets or exceeds its tolerance threshold, the time has come to take action. A list and map of this

classification is in development in collaboration with Dennis Mullen, Cesar Escobar and Clarence Geyen.

Prevention: The goal of the turf management program is to discourage weeds by regularly aerating and fertilizing lawns and mowing at an appropriate height.

Manual: There is evidence that weeds were removed from lawns by hand in the early days of the University of Washington. This method is not an efficient use of time.

Chemical: Spot-spray rather than broadcast applications are preferred. High priority turf areas are occasionally spot sprayed for creeping buttercup (*Ranunculus repens*), dandelion (*Taraxacum officinale*), plantain (*Plantago major*) and white clover (*Trifolium repens*). Speedzone (carfentrazone-ethyl, 2, 4-D, mecoprop-p acid, and dicamba acid) is used for selective post emergent broadleaf weed treatment in turf areas. These treatments are generally performed by contract sprayers who are supervised by the Grounds Integrated Pest Management Coordinator.

Pre-emergent chemicals are used sparingly and only in areas where mechanical methods or post emergent chemical applications have not been successful in controlling weed establishment. Gallery 75 DF (isoxaben) and Oxydiazon 2G (oxydiazon) (formerly known as Ronstar) are the pre-emergent herbicides kept in inventory.

Weeds in Parking Lots, Gravel, and Cracks

Prevention: Where possible, it is helpful to limit the availability of favorable weed substrate in parking lots, gravel, bricks, and sidewalks. This can be done by removing organic debris before it accumulates and decomposes. In some circumstances, application of a weed barrier such as landscape fabric or a tarp can be applied below gravel.

Manual control can be achieved by hand pulling or employing preferred tool such as a hori hori or hoop hoe. Flame weeders can be used effectively when plants are very young--at or near the cotyledon stage; plants with four or more leaves will regrow.

Chemical: Glyphosate can be applied in a spot treatment at a 2-3% concentration. This is most effective when weeds are young and actively growing. Fall is also a good time to treat perennials.

Pests of Ornamental Trees and Shrubs

Cultural methods are the main approach to preventing pests on trees and shrubs. Trees are pruned to remove diseased to reduce the spread of disease and to promote air circulation. Susceptible trees are not planted where another tree has died from a contagious disease. Irrigation is used carefully in cases where it may increase susceptibility to disease. Problems are also managed by maintaining a diversity of tree and shrub species; with over 813 species in the landscape, many are resistant to one or more diseases.

Anthracnose

Is a general term that refers to any of a number of fungal diseases affecting trees, shrubs and even vegetable crops. They prefer moist conditions and thrive in our wet climate.

Prevention is the best approach to anthracnose is to maintain a variety of resistant tree species where each specimen is given ample air circulation and infected branches are removed, and to avoid wetting foliage during irrigation. A helpful guide to anthracnose can be found here.

Fenusa ulmi - Elm leaf miner

Larvae of the elm sawfly, known as elm leaf miners, cause damage to elms by feeding on new leaf growth. Affected leaves will appear brown and crispy, and may eventually fall off with new leaves emerging later in the season. Repeated infection by leaf miners is

thought to weaken elm trees, perhaps making them more susceptible to other problems such as Dutch elm disease. At present, no measures are taken to reduce impacts of leaf miners, as systemic insecticides are the only available treatment.

Verticillium spp – Verticillium wilt

Is a fungal disease that causes premature wilting, yellowing and dropping of a wide number of plant species.

Prevention: Verticillium wilt is difficult to control, so prevention and reduction of spread is important. This is achieved by not planting susceptible trees where another has died of Verticillium wilt, by not transplanting potentially infected soil, by removing infected branches and avoiding drought stress. More information about this disease and resistant cultivars can be found here and here.

Neofusicoccum arbuti - Pacific madrone canker

is a fungus that causes twig dieback and trunk necrosis. Once a tree has been infected, it is difficult to control.

Prevention: With early detection, spread can be prevented by pruning affected twigs and branches. Infection is best prevented by maintaining healthy and vigorous trees. It is best to avoid the following: frequent shallow irrigation, bark damage, watering directly on the trunk, soil compaction or root disturbance.

Aphids and adelgids.

Trees and shrubs are occasionally affected by aphids or other insect pests such as adelgids. These are managed by promoting plant health and resistance, and allowing for natural predators to keep populations in check.

Monilinia sp. – Brown rot

Ornamental cherry trees throughout campus are affected by brown rot, a fungal disease that affects *Prunus* species. It causes premature browning and wilting of flowers and

leaves and eventual twig cankering. The impact is most dramatic during and after wet a spring.

Prevention: measures include raking fallen leaves, flowers and fruits and avoiding irrigation that sprays directly on the plants.

Manual removal of infected twigs and branches reduces the spread of the disease, and opens up the tree canopy to promote air circulation.

Chemical: In cases where damage to important ornamental collections, such as the quad cherry trees, would cause an intolerable reduction in bloom, a spring application of fungicide Myclobutanil may be used.

Enarmonia formosana - Cherry Bark Tortrix

Is a non-native moth that feeds on species in the Rosaceae and causes premature wilting and dieback of the tree canopy. It also makes trees more susceptible to other diseases by creating open wounds. Cherry Bark Tortrix (CBT) is diagnosed by the presence of orange frass tubes.

Biological : A beneficial parasitoid wasp, Trichogramma sp., is thought to provide natural control of CBT, however these wasps are not necessarily widespread and have not yet been detected on campus. Lynell Tanigoshi of the WSU Extension is a local expert on CBT, and is willing to serve as a resource (tanigosh@wsu.edu).

Chemical: Until 2011, control of CBT consisted of near annual fall applications of pyrethroids to the cherry trees on the Quad. Recent research suggests that intervals of up to five years between applications can be sufficient. It should be noted that use of pyrethroids is not compatible with reliance on or promotion of beneficial insects, as they are also targeted by the pesticides.

Ophiostoma spp. - Dutch elm disease

Is a fungal disease that is fatal to non-resistant elm trees and is the pest that receives the most intensive management on campus.

Prevention: Maintaining healthy trees is key to promoting resistance of Dutch elm disease.

Chemical: Each spring most elms on campus are treated with Dutch Trig, an inoculant. Once every three years, ten exceptional elms are chosen to receive a macroinjection of Arbortech, a more costly preventative treatment. These treatments are intended to prevent the spread of Dutch elm disease, which would otherwise be devastating to an iconic collection of trees on campus. Candidates for Arbortech are determined using the University of Washington tree ranking system, which takes into account the species, size, structure, condition, placement and historical or cultural significance of the trees.

Guidelines for Pesticide Use

Table 2. List of limited-use pesticides that are considered High Risk by Salmon Safe

Product	High Risk Ingredients	Target Pests	Application Method
TENGARD SFR	permethrin	cherry bark tortrix	broadcast
Speedzone	carfentrezone ethyl, dicamba, 2,4-D	broadleaf weeds in high priority lawns	spot spray
Garlon 3A, Garlon 4	triclopyr	invasive plants	cut stump, injection

Buffer zone width and restrictions for use of pesticides near water

Several federal and local laws regulate the use of pesticides on (aquatic applications) or near the water. Grounds Management activities do not extend to aquatic applications. If the need arises, the shop will need to acquire a permit through the Washington Department of Ecology.

Invasive plants are the only actively managed pest concern along waterways on campus. Most of the invasive species along shorelines are removed mechanically. However, erosion is a concern in areas with steep or unstable slopes such as the Montlake Cut. In

those cases, digging weeds is not a good option. Targeted pesticide applications such as injection or cut-stump treatments are preferred.
The Washington State Critical Areas Ordinance (administered by King County) typically requires a 20m buffer along shorelines in which pesticide applications are prohibited except for the treatment of listed noxious weeds. However, the University of Washington qualifies for an exemption from the CAO for small-scale vegetation maintenance as long as the application is performed in a manner and time with minimal risk for drift or runoff, an aquatically labeled pesticide is used, and the application is performed by a certified applicator (see appendix B).
The Environmental Protection Agency requires between 1-20m of buffer for applications of specified pesticides near salmon-supporting waters. Treatments of state listed noxious weeds are exempt.
Pesticides regulated by this law are listed here.

Precautions taken to prevent pesticide drift

All chemical applications are performed in a manner that minimizes drift and runoff. Broadcast applications of liquid or granular pesticides are done when wind does not exceed 10mph. Applications of liquid herbicides are done during appropriate temperatures when there is little chance of precipitation--in accordance with state guidelines. Garlon 4 is used only during cooler temperatures because this ester formulation volatilizes when it is warm, potentially damaging non-target plants. Run off of chemicals is prevented by limiting applications to days when chemicals have ample time to dry. When using a sprayer, a heavier and larger droplet size is preferred, with the applicator wand being held close to the target weed. Cutting and painting weed stems with concentrated herbicide or the injection of herbicide into knotweed canes also prevents run-off and drift. The injection method is done using the JK International injection system.

Some of the storm drains on campus lead directly to the lake and the locations of all storm drains and catch basins have been mapped using (GIS) and Global Positioning Systems (GPS). Cut-and-paint methods or the injection method using an aquatically labeled pesticide is preferred in these sensitive areas.

Pesticide applicator licensing requirements and training

All permanent gardeners are required to obtain a pesticide applicator license issued by the Washington State Department of Agriculture (WSDA) within 4 months of their hire date. New applicators are supervised during their initial applications to ensure correct mixing procedures and worker safety.

Licensed employees attend annual continuing education events to accumulate 40 credits every five years and maintain their certification. Educational opportunities are available throughout the year at shop meetings and at WSDA approved certification seminars. Some of the topics include pest identification, pest and pesticide risk and management, pest and pesticide laws, prevention and IPM techniques, safety and alternatives methods to pesticides.

Contract Pesticide Applications

Contract applications are limited. They are performed on weekends, school breaks, or at night when unlikely to impact public use of the area. A WSDA licensed pesticide applicator from Grounds Management is always on site to supervise the contractor and ensure compliance with the UW IPM Plan and Salmon-Safe standards.

Contractors perform the following functions. Brown rot on the ornamental cherry trees in the quad is treated when needed and feasible via a fall application of 4 ounces of myclobutanil using a boom sprayer. Cherry bark tortrix is treated via a spring application of permethrin using a boom sprayer and a total of 8 ounces of the pesticide. The cycle of this application is expected to be every five years, with monitoring performed annually between applications. On rare occasions, broadleaf weeds in high-priority turf lawns are sprayed by contractors using Speedzone.

Pesticide storage, rinsate, and disposal policies

All pesticides are stored in a locked pesticide cabinet that is surrounded by an eight foot high locked gate and are inventoried once a year to determine usage. Obsolete chemicals are labeled as hazardous materials and then picked up by UW Environmental Health and Safety in order to be disposed of appropriately.

Rinsates are collected into a 30-gallon disposal drum and then disposed of by UW Environmental Health and Safety or they are poured into a labeled sprayer to be used in a future mix.

Equipment used for herbicide application is triple-rinsed after use and returned to the pesticide shed. The rinsing takes place only on the mixing table inside the pesticide cage, where all rinse-water can be captured in the disposal drum. When the tank is getting close to full, the IPM Coordinator is responsible for completing a Routine Chemical Waste Collection Request with UW Environmental Health & Safety.

The form can be completed at http://www.ehs.washington.edu/forms/epo/routinepickup.php. The following information is entered:

First Name:	
Last Name:	
Email:	
Department:	Grounds Maintenance
Box Number:	352166
Work Phone:	5-1407
Location:	Plant Operations Annex 4
Routine Number:	3009
Request Date:	
Comments:	I will need a replacement 30 gal drum

Pesticide tracking system

Pre-Application Reports: A clipboard with green pre-application spreadsheets is kept at the top, right end, of the shop mailboxes. This must be completed before a pesticide application is made in case there are any questions or phone calls while the applicator is in the field.

Application Reports: In 2012, Grounds Management transitioned from a hard-copy record-keeping system to an online database using Google Forms. The form can be found here.

Records comply with Washington State application recordkeeping laws and collect all of the following information:

Date of application, Weather Conditions (including wind speed and direction), Location of treatment site, Target plant or pests, Brand/ specific name of pesticide, EPA registration, Total amount of product used, Concentration of product used, Area of application, Rate of application, Name and license number of applicator

Database: Until the summer of 2012, pesticide application records were hand written and then entered into a Microsoft Access database. This archived database can be found at *I:\groups\fac\mad\grounds\Grounds_Maintenance\IPM\Pesticide\Pesticide Application Reports\Pesticide_App.mdb*. Paper reports are to be kept in the purple binder on the IPM office bookshelf labeled "Pesticide Reports" for seven years, as required by Washington State law (See Engrossed Senate Bill 5009: http://www.leg.wa.gov/pub/billinfo/1991-92/Pdf/Bills/Senate%20Bills/5009.E.pdf).

The current database using Google Forms is accessible to gardeners in the field or in the office and does not require manual data entry. The full database is available at

https://docs.google.com/spreadsheet/ccc?key=0AmY1SOmYfRpTdG9kdkY0cHVTdHd5VnRubHdvU2ZZSXc#gid=0

This database can be used to quickly access information, monitor inventory, run reports about annual pesticide use and species treated. Gardeners can use this database to evaluate the efficacy of treatment methods and to review treatment histories of particular sites.

Appendix A: Weed Management Plan Template

IPM Coordinator:
Date Created:
Latest Update:

Campus-wide Plan: Y / N
If no, Campus Zone:

Problem/Concern: **Objectives:**
Best Management Practices: **Informational Resources:**
Plan of Action (Including Activities + Dates, and Follow=up + Dates):
Evaluation of effectiveness:

Appendix B: Critical Areas Ordinance Exemption

"8/16/2010

Good afternoon Hillary,

This is to follow up on our conversation regarding invasive weed management in an Environmentally Critical Area. The work you described to control French broom appears to qualify for an Environmentally Critical Areas Exemption and therefore permits or approvals from Seattle DPD would not be required, provided no other activity triggering the need for a permit or approval is conducted as part vegetation management work. The specific Exemption that the work you described would qualify for is under SMC 25.09.045 J:

J. Normal and routine (a) pruning, (b) *tree and vegetation maintenance and management*, and (c) revegetation are exempt from the provisions of this chapter when they do not result in substantial disturbance of environmentally critical areas or buffers and when they are carried out in parks, public utility right of ways, *and publicly owned open spaces by the public agencies*, including City agencies, that are responsible for them.

Further, public agencies are permitted to make their own exemption determination evaluation per SMC 25.09.045.A.3.b

b. City agencies taking the action under any subsection of this section and *the public agency taking the action under subsection J* do not need to make an application to the Director provided that if no application is made, they shall comply with all provisions of this Section 25.09.045, *make all determinations required to be made by the Director, including required conditions, and shall maintain records documenting compliance with all provisions.*

I briefly discussed this situation with our Shoreline Planner and he wanted to make sure that a herbicide approved for use near water would be used and applied by a licensed applicator. SMC 25.09.060 L describes conditions in which pesticide use is typically permitted within 50 feet of a shoreline.

Please don't hesitate to get back to me if you have further questions

Seth Amrhein
Senior Environmental Planner
Seattle Department of Planning and Development
206-386-1981"

Appendix C: Knotweed Inventory and Treatment History

I:\groups\fac\mad\grounds\Grounds_Maintenance\IPM_Sustainability\Pests and Diseases\Critical Weeds\Weed Management Plans\Knotweed

DO NOT dispose of live knotweed debris in the mulch pile! Bag it and put it in the trash.

Herbicide - Stem Injection

Watch this video for instruction on injection gun use for chemical treatment:
http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/invasive-knotweeds/knotweed-control-video.aspx

The Clark County (WA) Weed Management Department reports obtaining 100% control in one treatment by injecting 5ml of 100% Aquamaster or Round Up Pro into a lower node of each stem of a given clump. More than 20 patches were treated. A 3/16th inch or less diameter hole is made through both sides of the stem and herbicide is injected downwards into one of the holes using a large bore needle. Two holes are necessary so the herbicide can displace water present in the stem. It is important to treat every stem to eradicate the patch.

Known Knotweed Sites on Campus

Area 1 – "A", "B", "C", "D" & "E" on Target Map
Photos at E:\My Documents\My Pictures\IPM\Knotweed\Zone1_Knotweed

- "A" is going to take a large amount of work – the area is a hillside full of invasive plants and will likely need to be a big project for clearing the whole area before treatment if possible, but survey and treat as aggressively as possible. A clearing of the hillside was mentioned as a potential winter 2010-11 project. Consult with Dennis and Jerry.
    - All canes were cut and left in place July 5th 2012.
    - Regrouth (3-4ft high!) was foliarly treated with 1% imapapyr (Polaris) and .25% spreader/sticker on 7/31/2012
- "B" can be controlled fairly easily. It includes one or two spots on an elevated bed above the sidewalk just below the W-42 parking lot.
    - Injectable stems treated with Aquamaster 8/26/10
    - Could not find 7/31/2012
- "C" is a contained area within a courtyard. Access is difficult, but the population is isolated which should help with control. Check surrounding areas for escaped roots/shoots.
    - Dead canes removed and living canes injected on half the population with glyphosate 9/2/2010, follow up on remaining canes soon.
    -

    - Very little regrowth, foliarly treated with 1% imapapyr (Polaris) and .25% spreader/sticker on July 31st 2012
- "D" is a small population, growing under trees and in ivy along the Burke-Gilman trail.
    - Treated 7/27/10 glyphosate stem injection on canes that were large enough, foliar treatment on smaller plants.
    - Dead canes removed and foliar retreatment with glyphosate on small canes 8/26/10.
    - Regrowth foliarly treated with 1% imapapyr (Polaris) and .25% spreader/sticker on July 31st 2012
- "E" is in and around Sakuma Park, by Agua Verde. As of April, 2010, Dave Turet plans to manually cut down knotweed canes due to the proximity to the water. Aquamaster is approved for aquatic use and is preferred for injections so close to the water.
    - Injectable canes treated with Aquamaster 8/26/10, other stems cut to ground.
    - No canes large enough for injection, foliar spray unwise given the business/patronage of the site. 7/31/2012
- "O" is in the planting bed outside of the West Campus Parking Garage. Stems are fairly small.
    - Treated 7/27/10 foliar spray with glyphosate.
    - Remaining stems and as much root as possible removed 8/26/10.
    - Could not find 7/31/2012.
- "P" is coming out of a crack between the sidewalk and the Publications Services Building on the south side.
    - Cut to ground 8/26/10 and stems treated with glyphosate concentrate.
    - Foliarly treated with 1% imapapyr (Polaris) and .25% spreader/sticker on July 31st 2012

<u>Area 3 – "H" on Target Map</u>
Photos at E:\My Documents\My Pictures\IPM\Knotweed\Zone3_Knotweed

- Courtyard of Arts Building
- Canes were injected – 4/29/08 (App. #1252)
- Margaret has been monitoring and managing, cutting down in spring 2010
- Watch and treat/manage accordingly
    - Foliarly treated with 1% imapapyr (Polaris) and .25% spreader/sticker on July 31st 2012

<u>Area 4 – "F", "I" & "J" on Target Map</u>
Photos at E:\My Documents\My Pictures\IPM\Knotweed\Zone4_Knotweed

- "F" is in the raised bed on the West end of Mary Gates Hall. As of April, 2010, Jessie is planning to keep the area cut down until injection time.
    - Foliarly treated with 1% imapapyr (Polaris) and .25% spreader/sticker on July 31st 2012
- "J" is at the North end of N-25 Parking lot, by soil pile
    - Canes were injected – 4/29/08 (App. #1253) and 7/30/08 (App. #1304)
    - Follow up with monitoring and injection/ foliar spray

    - Manual removal may be difficult as canes are growing out of concrete foundation
    - 6/2010 it looks like total control may be achieved, but there is also some growing within the laurel hedge across the street toward motor pool.
    - Lots of regrowth spring 2012, contaminated soil pile in bin. Foliarly treated both sides of Pend Oreill with 1% imapapyr (Polaris) and .25% spreader/sticker on July 31st 2012
- "I" is behind the stairs to the east of the Grounds Shop – no treatment history (?)

Area 5 – "G", "K," "L," & "N" "Q" "R" "S" T" U" on Target Map

Photos at E:\My Documents\My Pictures\IPM\Knotweed\Zone5_Knotweed\

- Area "G" is growing amongst lots of blackberries and other invasives, on a slope by the water. Too large and dense for injection to be practical/legal (to do it all we would surely exceed the label rate). Right now it is also too tall to treat foliarly without a lot of collateral damage. In a similar area on north campus we bent/cut back stems and left them in place early this summer, then foliarly treated the regrowth a couple of weeks ago with imazapyr. If this approach is effective I'll recommend we do it at the Dempsey site next year. The IPM Coordinator and the appropriate gardeners/CUH staff could work together to physically knock it back early in the season so that foliar treatment by a certified applicator is feasible in July/August.
- Area "K"
    - By Golf driving range
    - Canes were injected – 8/12/08 (App. #1312), 10/30/08 (App. #1350), and 5/16/09 (App. #1400)
    - The area also appears to have also been sheet mulched
    - Watch and treat/ manage accordingly
    - Foliar spray with glyphosate 7/9/2010
    - Very little regrowth, foliarly treated with 1% imapapyr (Polaris) and .25% spreader/sticker on July 31st 2012
- Area "R"
    - SE corner of baseball field (left center field)
    - Discovered 6/12 , contacted ICA to be sure they don't cut or remove material
    - Injected 8/29/2012 with Aquamaster concentrate
- Area "L"
    - By EH&S
    - Very large canes – dense population
    - Does not appear to be any history of treatment
    - Treat aggressively Summer 2010
    - Foliar spray with glyphosate 7/9/2010
    - Short regrowth, foliarly treated with 1% imapapyr (Polaris) and .25% spreader/sticker on July 31st 2012
- Area "N"
    - On west side of road along fence as you leave E-1 parking lot
    - Small population

    - Foliar spray with glyphosate 7/9/2010
    - Foliarly treated with 1% imapapyr (Polaris) and .25% spreader/sticker on July 31st 2012
- Area "T"
    - S of bridge canal road along canal between Area 5/UBNA
    - Discovered 6/12, will be treated 8/12
    - Foliarly treated with 1% imapapyr (Polaris) and .25% spreader/sticker on July 31st 2012

- Area "Q"
    - S of baseball field along ditch.
    - Discovered 8/2012
    - Injected with Aquamaster concentrate on 8/29/2012

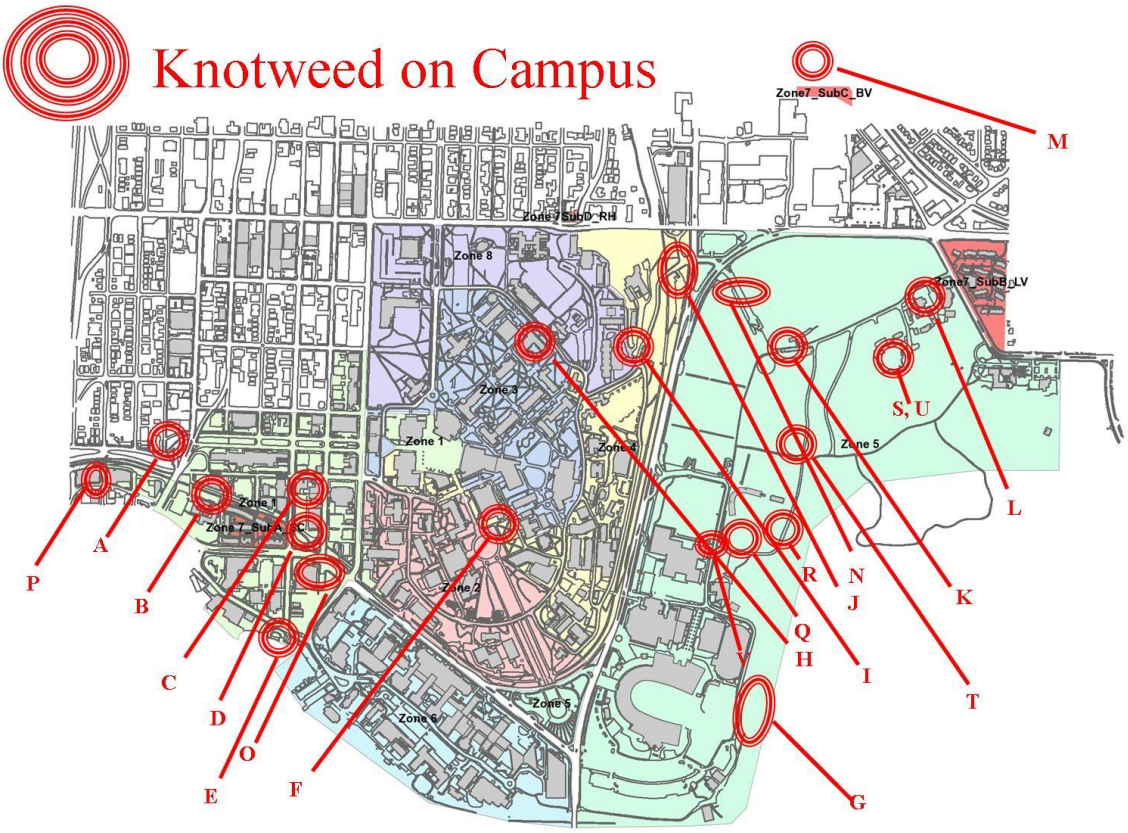
- Area "S"
    - NW corner of Corp Yard 2, discovered 8/2012
    - Injected with Aquamaster concentrate on 8/29/2012

- Area "U"
    - South end of Corp Yard 2, discovered 8/2012, large population along ecology blocks
- Area "V"
    - SE end of IMA Field #3, discovered 9/2012
    - Foliar spray with glyphosate 3oz/gal 9/13/2012

<u>Area 7 – "M" on Target Map</u>

Photos at E:\My Documents\My Pictures\IPM\Knotweed\Zone7_Knotweed

- Back corner of trail behind Blakely housing
- Canes were injected – 7/1/09 (App. #1289)
- Area will likely need follow-up – small populations exist on adjacent property
- Monitor and treat accordingly



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Last Updated: 09/012012

Appendix D: French Broom Management Plan

Problem/ Concern: French Broom

IPM Coordinator: Hillary Burgess **Campus-wide Plan:** N

Date Created: 04/02/2010 **Latest Update:** 8/27/10 **If no, Campus Zone:** 5

Problem/Concern:

French broom, *Genista monspessulanum (Cytissus monspessulanus, Teline monspessulana*) was identified in early 2010 growing on the SE slope of the Montlake cut. French broom is not listed as a noxious weed in Washington State. However, it is listed in Oregon and California, and is considered a "monitor" species in Washington, due to uncertainty about its winter hardiness. The microclimate on the SE slope of the Montlake cut has provided an environment in which the plants have developed a strong population that has reportedly existed for several years. Management concerns include difficulty of access (steep slope, adjacent to water), limited chemical options due to proximity to water, and difficult collection of debris for the same reasons.

Best Management Practices:

As with other broom species, the best method for removal of a French broom infestation depends on climate, topography, age and size of the infestation, importance of impact to nontarget species, and type, quantity, and duration of resources available to remove and control broom at the site. All methods require appropriate timing and follow-up monitoring. Because of the seed bank, monitoring removal sites to locate and kill new seedlings is essential. Location and treatment of re-sprouts is also necessary. Sites should be examined annually following broom seed germination (usually late spring) for 5 to 10 years, and every 2 years thereafter.

Mechanical – The weed wrench, hand-pulling, removal with tools is an effective technique for the complete removal of French broom. Some soil disturbance will occur with the removal, which may favor new seedlings or deeply bury seeds in the soil. Generally, a flush of broom seedlings may occur directly beneath the previously canopied area, which will need to be controlled. Cutting the shrubs may prevent seed production, but resprouts need to be managed.

Mulching with 3 to 4 inches (8-10 cm) of straw (certified weed-free) during winter or spring (before seedlings are over an inch tall) may prevent broom seedling emergence. A controlled study by the Habitat Restoration Team in California demonstrated that mulching with rice straw was 99% effective in preventing French broom seedlings from emerging through straw throughout the germination period from December to April.

Chemical – Foliar spray is undesirable due to proximity to water. An herbicide labeled for aquatic use would be most appropriate, with an application technique that minimizes risk of drift or runoff. Both triclopyr ester and amine formulations have been shown to be effective in a basal bark treatment. Wildwork.org reports that a cut stump treatment with glyphosate or triclopyr are effective in preventing re-sprouts.

Informational Resources:
California Dept. of Food and Agriculture - http://www.cdfa.ca.gov/phpps/ipc/weedinfo/brooms.htm
USDA Forest Service - http://www.fs.fed.us/database/feis/plants/shrub/genmon/all.html
Wildwork.org - http://www.wildwork.org/webdocs/How_to_Eliminate_French_Broom.pdf

Objectives:

- Prevent existing French broom from setting seed in 2010
- Remove above-ground vegetation to improve access for management
- Remove existing plants to prevent re-growth
- Monitor and control over time to exhaust the seed bank and eliminate the population

Plan of Action (Including Activities + Dates, and Follow up + Dates):

1. Remove above-ground French broom before it sets seed using weed wrench for small/accessible plants, and cutting for those too large or difficult to dig out. Mark any cut stumps with fluorescent paint so they can be located for follow-up.
   Date: April 2010
   Labor required: ?
   Challenges to be addressed: We will need to secure a barge or some other method for collecting and removing the debris from this difficult site.

2. Once the majority of the material is removed, cut and paint with the aquatic label of triclopyr or glyphosate. The best results will be after seeds have begun to develop and energy is returning to the roots, in late summer. Both herbicides will be used, and the effectiveness of each will be evaluated. Approval of the work by King County DPD pertaining to the Critical Areas Ordinance (see correspondence) is based on the following conditions: the selected herbicide must be an aquatic label and application must be performed by a licensed herbicide applicator.
   Date:
   Labor required:
   Challenges to be addressed:

3. Examine site annually following broom seed germination (usually late spring) for 5 to 10 years, and every 2 years thereafter, and treat mechanically whenever possible.

Evaluation of Effectiveness:
Monitor and record the condition of the population after control treatments and then after subsequent annual reviews.