Integrated Control of Scotch Broom: Techniques and Strategies

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Introduction

Scotch broom continues to be a pest plant on Ft. Lewis and throughout western Washington. On Ft. Lewis, Scotch broom degrades open training lands. It also eliminates many of the natural resources from these lands. Both native plants and animals are displaced by the dense monocultures that Scotch broom forms. In addition, Scotch broom adds nitrogen to the soils and increases fire intensities. Both of these actions alter natural processes and can lead to the invasion of additional pest plants. Overall, Scotch broom is a severe threat that degrades both natural resources and military training. The effective and efficient control of this pest is a priority.

The control of Scotch broom requires a long-term effort. Scotch broom seeds can survive in the soil for several decades. This means that regular follow-up treatments must be applied and that Scotch broom plants must be controlled before they begin to set seed in their third year of life. In addition, younger Scotch broom has the ability to re-sprout when cut. This makes the complete control of younger Scotch broom more difficult. The combination of long seed life and the re-sprouting of young plants require an integrated strategy that utilizes a variety of control techniques performed on a consistent basis.

There are two keys to a successful Scotch broom control program. The first is to minimize the amount of seed produced, which can be accomplished by using reliable control efforts every 2-3 years. The second is to maximize mortality rates matching control techniques to the density and size of the broom plants. Regular application of effective techniques will result in the rapid decline of the extent population of Scotch broom on a site. Along with this decline, the amount of resources applied in each control effort can also be reduced. Eventually, control of only a limited amount of seed sprouting out of the seed bank will be needed.

Control Techniques

There is a range of possible control techniques for Scotch broom. Mechanical techniques such as pulling and cutting are widely used. Prescribed fire has been used effectively on some sites, most notably at Ft. Lewis. Control with herbicides is not widely used, but holds promise to effectively control Scotch broom when other techniques are not effective.

Mechanical Control – Mechanical control includes a variety of techniques that vary in their intensity and efficiency. Cutting mature Scotch broom with a tractor-pulled rotary mower is quite effective. It is used most often on larger sites, where control needs to be accomplished over tens or hundreds of acres. Several different sizes of tractors and rotary cutters can be used. Smaller tractors with 6ft cutters have been used successfully on a range of habitats including within oak woodlands and on the Mima mounds.

Cutting is most effective on thickets of mature Scotch broom plants, where mortality is nearly 100%. If cutting younger plants, control is most effective in the summer months, when drought will stress the cut plants and re-sprouting is kept down to a minimum.

If the amount of Scotch broom to be cut is small or the terrain is too difficult for tractors, then hand-held motorized brush cutters or manual loppers can also be used. Volunteers can be trained to use these brush cutters safely, and a group of volunteers can cover quite a bit of area during a single workday.

One concern with cutting of Scotch broom is disposal of the biomass. Due to its ability to fix nitrogen, Scotch broom biomass becomes a source of nitrogen in a natural system that is low in available nitrogen. When practical, disposing of Scotch broom plants off-site, through burning or chipping, is preferred. However, with rotary mowers, off-site disposal is not possible since the broom is mulched into the grassland. The possible addition of nitrogen to prairies with this type of cutting is a concern. Elevated nitrogen levels may facilitate the establishment of some pest plants, such as pasture grasses.

A more intensive method of mechanical control is pulling individual plants by hand or with the assistance of a Weed Wrench. The Weed Wrench is essentially a clamp with a lever and makes pulling small to medium sized Scotch broom quite easy. Hand-pulling is best applied to small, low density plants. It is most cost efficient when volunteers or prison laborers are used, or the area to be treated is small.

A final technique of mechanical control is tilling or disking. This technique is suitable only if no desirable vegetation occurs on the site. It is best used after initial control efforts have eliminated larger Scotch broom and a cohort of Scotch broom seedlings has emerged. The tilling can also prepare the site for transplantation of plugs or direct seeding of native plants.

The cost of mechanical control is variable. Costs in the $50 to $100 per acre range are typical for cutting with a tractor, though a recent control of several hundred acres on Ft. Lewis cost less than $30 per acre. The cost of other methods is dependent on the type of labor used. Prison crews can be cost effective.

Prescribed Fire - Fire has been used effectively at several locations in the South Puget Sound. The largest and most effective program is at Ft. Lewis. Burning typically occurs during two seasons, late winter and early summer. Conditions for an effective winter burn typically occur in February, when rains stop for a week or two and vegetation has yet to begin growing. The summer burning season is limited by regulation, but fire can be applied both before and after burn bans are in effect. This typically occurs in mid to late July and then again in September.

Prescribed fire can be quite cost efficient, though this depends on what type of fire protection is mandated, and the amount of protection needed at the fire site. At Ft. Lewis, prescribed fires have proved to be a very economical management strategy, while at other sites; prescribed fires have been extremely expensive.

Scotch broom mortality from a prescribed fire can be quite high, even for younger plants. This is especially true for summer burns, when mortality rates can be as high as 90% or greater. Fire is best applied to larger areas, especially areas where control barriers such as roads are in place.

A problem with burning is that many scheduled burns are not implemented due to weather, safety or air quality concerns. If the specific conditions of a burn permit are not met, then the fire cannot be ignited or must be extinguished. Many prescribed fires are not completed because of these limitations. When fire is planned as a control technique, back-up control efforts must be in place in case the fire is not conducted.

Fire also stimulates the germination of Scotch broom seeds from the seed bank. Though this is generally undesirable, it does have the effect of depleting that seed bank more rapidly. This feature can therefore be beneficial when the seed bank is large and would remain a severe problem for a decade or more.

Planning for prescribed fires must take into consideration the effects on invertebrate populations and the plant community. Fires that are too frequent or too large can have serious long-term impacts. In is generally understood that, less than 1/3 of a site, preferably less, should be burned during any single event. Extra consideration should be taken when rare invertebrates, such as some prairie butterflies are known to exist from the site.

Herbicide Control - Scotch broom control with herbicides has not been widely used on South Puget Sound prairies. Concerns about impacts of herbicide drift onto desired native plants and potential direct impacts on invertebrates, especially rare butterflies have limited herbicide use. In addition, county, state and federal regulations strongly regulate the application of herbicides.

Several techniques have been developed to minimize these concerns. Fall application of selective herbicides has proven successful at Mima Mounds Natural Area. Application occurs after most native species have senesced and prior to the on-set of fall rains. Herbicides such as Crossbow and Garlon have been applied with backpack sprayers onto dense patches of 2-3 year old Scotch broom. The combination of selective herbicide, the late season and the application technique minimizes damage to native species. Unfortunately, the Scotch broom mortality is slow, with some plants not dying until the following spring.

A second control technique using herbicides is application of Round-up using the WeedSweep wipe-on applicator. In this case, even though a non-selective herbicide is used, the application method minimizes application to non-targeted plants. This is accomplished with a tractor-pulled aluminum bar that wipes on the herbicide. The height of the bar is adjusted to be above desired vegetation but below the height of the Scotch broom. The bar is then dragged across the Scotch broom and full-strength Roundup is wiped from the bar onto the Scotch broom. For more information on this equipment visit: www.weedsweep.com.

The technique has several advantages. First it uses a herbicide that has been approved for use at several sites. Second, the seasonal timing of application is unimportant; it can be used during the active growing season without damage to desired native plants. Third, the technique is cost efficient since labor costs are minimized. Finally, due to its efficiency, the technique can be used over larger areas.

Trials with the WeedSweep system at the Glacial Heritage Preserve have proven extremely successful on patches of Scotch broom. Mortality has been good and damage to non-targeted vegetation has been minimal. In continuous, dense stands of Scotch broom it has been less successful, though mortality rates of 50-75% have been obtained. The wipe-on technique is best used with younger Scotch broom in the one and a half to three year old range. It is not really suitable for older broom, especially since mechanical methods have proved to be more effective on them.

Finally, another herbicide application method is basal bark treatments, where small amounts of concentrated herbicide are applied to the base of each plant. With careful application, mortality is nearly 100%. Yet this technique is very labor intensive and its strategic value is minimal. It would be best used to kill older plants that occur at very low densities. This might occur in an area where other control efforts have left a few big plants, or possibly in a new area where control has not taken place.

Matching Techniques to Density and Distribution of Scotch Broom

Matching of effective control techniques to the density and distribution of Scotch broom is critical to a successful program. Matching techniques are typically designed based on the average of the entire area to be treated. Once the density of Scotch broom declines, matching on a finer scale can be more productive. At Mima Mounds NAP, treatment techniques varied between the mounds and their interspaces. On mounds, densities of Scotch broom were high, and backpack spraying of herbicide was used. In the interspaces, densities were low and prison labor was used to hand pull the Scotch broom. Both of these actions took place before plants were big enough to set seed.

A matrix of Scotch broom age and density with suitable control techniques gives guidelines for individual control efforts (Table 1). Integrating these techniques is needed for a successful strategy. An example strategy is outlined below.

Table 1. Recommended control techniques for a range of Scotch broom densities and ages.

	Mature	Young	Seedling
High Density	Mowing with tractor. Mortality can be extremely high, but be ready for germination from seed bank.	Fire or Mowing. This is when fire is most effective. Mowing is less preferred since mortality will be lower.	Fire, if sufficient fine fuels are available. Broadcast herbicide in fall could be possibility

Moderate Density	Mowing with tractor or brush cuttting with hand-held machines.	Fire, Mowing or Wipe-on Herbicide. Fire and herbicide would have highest mortality.	Fire, same conditions as above.
Low Density	Basal bark herbicide, pulling, manual cutting are all options.	Herbicide might be preferred. Fire would be alternative. Would like 100% mortality at this stage.	Hand pulling or wait to control.

Restoration

In some cases merely controlling Scotch broom will not result in a healthy habitat. This is true when dense patches of broom have eliminated the native understory. Restoration of these areas should be an integral part of the pest control effort. Reestablishing native cover not only increases the value of the habitat, but also minimizes the amount of open habitat that could be invaded by other pest plants. This last point is extremely important, since there are other pest plants, such as knapweed, that can invade these open areas and result in control problems just as bad as those caused by Scotch broom.

The restoration techniques can be simple and targeted. If patches are small in size then planting of native grass plugs is cheap and reliable. If the area is bigger, than using a seed drill with native grasses is an option.

Example Strategy

Maintaining consistent, appropriate control efforts is key to a successful integrated program. Scotch broom control will not be successful if control only occurs once the plants have formed another dense stand of mature plants. Each treatment area has different characteristics such as: terrain, density and age of Scotch broom, condition of native vegetation and presence of rare species, which will affect the choice of control technique. Below is a generalized example of Scotch broom control. Use the example not as a rote methodology but as a working example to modify and improve for your specific project goals and conditions.

Table 2. Example strategy for integrated control of Scotch broom.

	Status	Treatment
Year 1	Old Scotch broom forms moderately dense stand, though understory of native species is still present.	Mechanical control – Cutting with tractor-pulled rotary cutter.
Year 2	Seedlings from seed bank germinate; densities can be extremely high if broom has been present on-site for extended period.	Treatment of seedlings is not feasible, due to presence of native vegetation.
Year 3	Broom will extend above grassland vegetation.	Treatment is possible with late season mowing or wipe-on herbicide. Prescribed fire is also alternative.
Year 4	If no treatment last year, then treatment is mandatory this year. Scotch broom is large enough to interfere with functioning of grassland, and will begin to set seed.	Wide variety of treatments is possible, though they may vary with density. If high density, then herbicide is not preferred. With lower density, herbicide or fire is preferred to obtain high mortality.
Year 5	Hopefully fewer seedlings are occurring	Treat mature plants prior to seed set.

	within a matrix of mature plants that were not killed last year.	Technique dependent on density – can range from hand-pulling to cutting with tractor. Initiation of restoration actions appropriate.
Year 6	Density of Scotch broom markedly decreased and has become patchy.	Fire could be applied to entire area or different techniques will target specific densities within treatment area. On low density areas, hand-pulling or other high mortality technique should be used. If high-density areas are small then herbicide could be used, otherwise cut high-density areas in summer.
Year 7	Broom continues to decline, though seedlings from seed bank will continue to emerge, as will re-sprouting from cut plants that survived.	Follow-up on few adult individuals if they are going to set seed. Conduct restoration actions as appropriate.
Year 8 and on-going	Diffusion of broom and at generally low densities.	Periodic control is still needed to prevent seed set and to minimize input to the seed bank. Technique should ensure mortality and match density of broom on the site. This type of follow-up control may be needed for a decade or more due to continued germination from the seed bank.