Camassia Natural Area Restoration Project

and

Phase 3 Ivy Control Experiment Final Report

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Introduction

Despite the surrounding urban landscape, and its relatively small size, the 27 acre Camassia Natural Area supports several important plant associations, high plant diversity and abundant wildlife. The preserve contains more than 300 native plant species including the imperiled species pale larkspur *(Delphinium leucophaeum)* and white-topped aster (*Aster curtus).* The preserve contains approximately 15 acres of Oregon white oak woodland and savanna which are identified as priority habitats by Metro Parks and Greenspaces, The Nature Conservancy and the Oregon Department of Fish and Wildlife among others. At least partially because of its urban location, one of the primary threats to Camassia are invasive species such as English ivy, Himalayan blackberry, Scotch broom, English holly, and several other less prominent escaped horticultural species.

Before restoration began at Camassia the meadows were becoming dominated by mature Scotch broom and the forested areas were being overrun by Himalayan blackberry and English ivy. In nearly half of the forested areas in the preserve, English ivy was the dominant ground cover. Because many sites in the region face similar management challenges The Nature Conservancy saw good potential to leverage the knowledge we could gain doing experiment based restoration to empower wider regional action for invasive species control. We designed the Camassia Restoration Project to help inform other land management professionals and the public about management options for invasive plants. The project utilized an integrated approach to restoration that linked on the ground control efforts on system modifying weeds to research, outreach, and science education programs. The approach explored the efficacy of various control measures and incorporated service learning, public outreach, and significant volunteer labor.

Although invasives control at Camassia targeted three main species: English ivy (*Hedera helix)*, Himalayan blackberry (*Rubus armeniacus/discolor)*, and Scotch broom (*Cytisus scoparius*), the research component focused on English ivy. Other invasives such as English holly (*Ilex aquifolium*), privet (*Ligustrum sinense*), and multiflora rose (*Rosa multiflora*) were identified and removed from Camassia in spot locations.

Control of English Ivy

English ivy is the most common invasive species found at Camassia and the primary focus of this project because of its near ubiquity in the Portland metropolitan area. Before the Camassia Restoration Project began in earnest in 2001, well over 10 acres of the preserve had 50% or greater ivy ground cover. Our two part strategy consisted of landscape scale ivy removal primarily accomplished through volunteer and youth crew labor, and a multi-phased controlled experiment designed to determine the relative costs and effectiveness of herbicide treatment versus manual control. The two parts of the strategy are discussed separately below and are referred to as “landscape scale ivy removal” and “ivy control experiments” respectively.

Landscape Scale Ivy Removal

Methods

English ivy was controlled on the landscape level at Camassia primarily through manual removal by volunteers and youth / AmeriCorps type work crews. Because of the high cover of poison oak (*Toxicodendron diversilobum*) in many areas of the preserve, however, spot herbicide treatments were used in certain areas.

Typically, ivy was first cut from the base of trees, and then cleared from the ground. Crews and volunteers were trained to work systematically through a well defined area to remove as much of the ivy vines and roots as possible (Figure 1.0). Pulled ivy was usually piled and left to mulch on site, but was occasionally hauled out of the preserve and taken to a composting facility.

After the initial ivy removal, occasional follow-up removal was performed by adopt-a-plot volunteers. These volunteers monitor and remove any returning ivy.

Figure 1.0 AmeriCorps crew hand clearing ivy

Herbicide Treatment Methods (Phase 3 only)

Herbicide treatments of ivy were performed on clear days in January in order to minimize damage to most native plants. A mix of glyphosate and R-11 surfactant was used, (5% Rodeo and 1% R-11). This mixture was applied to approximately half an acre of ivy covered ground. Another mixture of 3% Rodeo, 2% Garlon 3A, and 1% R-11 was applied to an area around one tenth of an acre. Herbicide treatment for earlier phases, which varied slightly from the protocols described here, is reported in earlier reports submitted to the USFWS (also available from The Nature Conservancy, Portland, OR).

Figure 2.0 Herbicide application on a hillside with mixed English ivy and poison oak

Results

Between 2001 and 2005, the hand removal of ivy by youth crews, volunteers and staff lead to the clearing of nearly 7.5 acres of ivy from the preserve (see the Priority Invasive Weed Control Areas 2001-2005 map included in appendix 1.0). At many sites, even without planting, removal of ivy resulted in a strong return of native plants. Trillium (*Trillium ovatum*) false Solomon's seal (*Smilacina racemosa*) and Indian hellebore (*Veratrum viride*) typically appeared in the spring after initial ivy clearing (see Figure 3.0). Sites with a long history of ivy cover or ivy cover with an additional blackberry overstory typically require at least supplemental planting.

Figure 3.0 Native vegetation returns to an area hand cleared of ivy.
Top photo was taken December 2001, bottom photo June 2002.

Despite careful initial clearing, hand-pulled sites typically need follow-up clearing within 2 years after the initial clearing is accomplished. The two pullings combined typically leave a site with only scattered ivy plants coming from deep rooted individuals or new seedlings totaling 2% cover or less.

The areas of the preserve that were treated with herbicide also show strongly positive results. In these areas, little ivy remains. While damage to native plants is generally slight, licorice fern can be particularly vulnerable to winter applications of herbicide. The areas sprayed with Rodeo, Garlon 3A, and R-11 appear to have resulted in better ivy control than the areas sprayed with only Rodeo and R-11, especially under very cold conditions.

Ivy Control Experiments

Introduction
Perhaps because it had generally been considered a desirable landscaping plant, at the inception of the Camassia Restoration Project there were few publications on ivy control and those that existed generally focused on growing season application of herbicides. Although many individuals and groups are experienced in hand removal of ivy, and Jim Schiller of the City of Portland parks program had initiated work testing Round-up and Li-700 on ivy, at the onset of this project we could find no actual data on either the efficiency or effectiveness of manual removal, and no data comparing the recovery rate of native species following manual or chemical treatments.

In 2001 The Nature Conservancy began a series of experiments designed to test several control strategies at Camassia. The initial study (Phase 1) used small plots with near total ivy cover to determine if herbicides could be used effectively on ivy in the winter, and compared the time required to conduct manual control (hand-pulling) to herbicide control. Triclopyr (Garlon 3a) and Glyphosate (Rodeo) based herbicides were used at different rates with various surfactants (see earlier reports for details). The study also considered the broader costs of landscape level control of ivy when comparing hand removal and herbicide treatments. In 2002, a second study (Phase 2) was initiated to test the efficacy of different herbicide treatments over larger areas with more remnant native vegetation. In 2003, in order to further bolster the data, a third study (Phase 3) began that compared hand pulling to herbicide treatments.

Methods
For a summary of all ivy experiments conducted at Camassia see Table 1.0.

Table 1.0 Camassia Ivy Control Experiment Summary

Experiment	Period of Initial Treatment	Area of Plots (m^2)	Number of Plots	Methods Tested
Phase 1	February 2001	9	5	Manual Pull
			5	Manual Pull + 5% Rodeo follow-up spray
			5	5% Garlon / 2.5% Bronc / 1% Hasten
			5	5% Rodeo / 5% Scythe / 1% Hasten
Phase 2	February, 2002	100	2	5% Rodeo 5% Scythe 1% Hasten
			2	2% Rodeo 2% Scythe 1% Hasten
			1	2% Rodeo 1% Scythe 1% Hasten
			1	5% Rodeo 2% Scythe 1% Hasten
Phase 3	January, 2004	100	3	No treatment (Control)
			3	2% Rodeo / 1% R-ll
	January 2005	Plotless areas		Rodeo + R-11 and Garlon+Rodeo +Hasten
Group Ivy Pulls	November, 2001	106-387	9	Manual Pull

In Phase 1, five groups of four, $9m^2$ plots were subjectively located in areas with reasonably consistent ivy coverage within the Camassia Natural Area. Plant communities included mixed oak-fir (*Q. garryana* - *P. menziesii*) woodlands and fir (*Pseudotsuga menziesii* - *Abies grandis* - *Acer macrophyllum*) forest. Four treatments (one glyphosate herbicide treatment with 5% Rodeo + 5% Scythe (pelargonic acid); one triclopyr mixture with 5% Garlon 3a (triclopyr) + 1% Bronc (ammonium nitrate) + 1% Hasten (vegetable oil penetrant); one manual treatment; one integrated manual + followup 5% Rodeo spray) were randomly assigned to one plot in each of the 5 groups i.e. 5 replications per treatment. Two plots in each group of 4 were carefully hand-cleared by one or two individuals between February 21st and 28th, 2001. We attempted to minimize disturbance to remnant native vegetation while removing all ivy roots. Removed ivy was placed into yard waste bags. The time it took to work on each plot was recorded. Leaves were dry during herbicide application and air temperature was 55-60° F. Heavy rains occurred 24 hours after the initial treatment. Pre and post treatment ivy cover was visually estimated by averaging 3-5 independent estimates in all 20 plots. Pre-treatment data was collected February 18th and 20th, 2001. At 10 randomly selected 9m2 plots we collected 100 vegetation data points using a point-intercept sampling frame (see Figure 4.0). The remaining ivy at the integrated manual + follow herbicide plots was sprayed in February of 2002. Post-treatment data collection and photo-monitoring occurred at all plots in June 2001, 2002, 2003, 2004 and 2005. Pre and post-treatment photographs of all Phase 1 plots can be found in appendix 2.0.

Figure 4.0 Collecting vegetation cover data with the point-intercept sampling frame.

Phase 2 consisted of six $100m^2$ plots and focused exclusively on ivy control with the use of herbicides. Phase 2 utilized Rodeo sprays and surfactants at varying rates (Table 1.0). All plots were sprayed February 26th and 27th, 2002. Point intercept data sampling and photo-monitoring occurred at each plot before treatment and then every subsequent June. Pre and post-treatment photographs of all Phase 2 plots can be found in the appendix section 3.0.

Phase 3 consisted of three groups of two $100m^2$ plots and focused on foliar glyphosate application with R-11 surfactant. One plot in each group was randomly assigned as the herbicide treatment while the other paired plot was left untreated (control). Initial data was collected June

24th and 25th, 2003. In August of 2003, a fire burned part of the preserve containing plots 3A and 3B, leaving only one corner of plot 3A with remaining ivy and other vegetation.
On January 20th, 2004 foliar spray treatments were conducted on three of the plots including the unburned corner of plot 3A. The time and amount of herbicide required to spray each treatment plot was recorded. Point intercept data sampling and photo-monitoring occurred at each plot before treatment and then again in June 2004 and June 2005. Pre and post-treatment photographs of all Phase 3 plots can be found in the appendix section 4.0.

The group ivy pull experiment consisted of 9 manual pull plots ranging in size from $106m^2$ – $387m^2$. Plots were scattered throughout the preserve and varied in terrain, initial ivy cover (28 - 80%), plant association and amount of remnant native vegetation. A two day AmeriCorps volunteer event in November 2001 was organized where teams systematically hand pulled ivy in given plots. The removed ivy was bagged and weighed for each plot. The number of people and time required to clear each plot was also carefully recorded. Pre and post visual ivy cover estimates were taken and photo-monitoring was performed at each plot.

Ivy Control Experiment Results

Phase 1

Follow up point intercept sampling data revealed that all ivy treatment methods tested in Phase 1 yielded excellent ivy control (95% average ivy cover reduction) over a 4 year period (Figure 5.0). Herbicide plot results 21 months (November 2002) after the initial treatment, ranged from 94.7% decrease (from 61% to 3% in absolute cover) using Rodeo to a 99.8% decrease (from 72% to 1% absolute cover) using Garlon. By 2005, decrease in ivy cover was 90.0 % in Rodeo plots and 100.0% in Garlon plots. Manual treatment produced a 95.8% average decrease (from 69% to 3% absolute cover) 21 months after treatment; and by 2005 the average decrease in ivy cover was 98.1% for manual treatment plots. (See appendix 2.0 for the complete photo series for Phase 1).

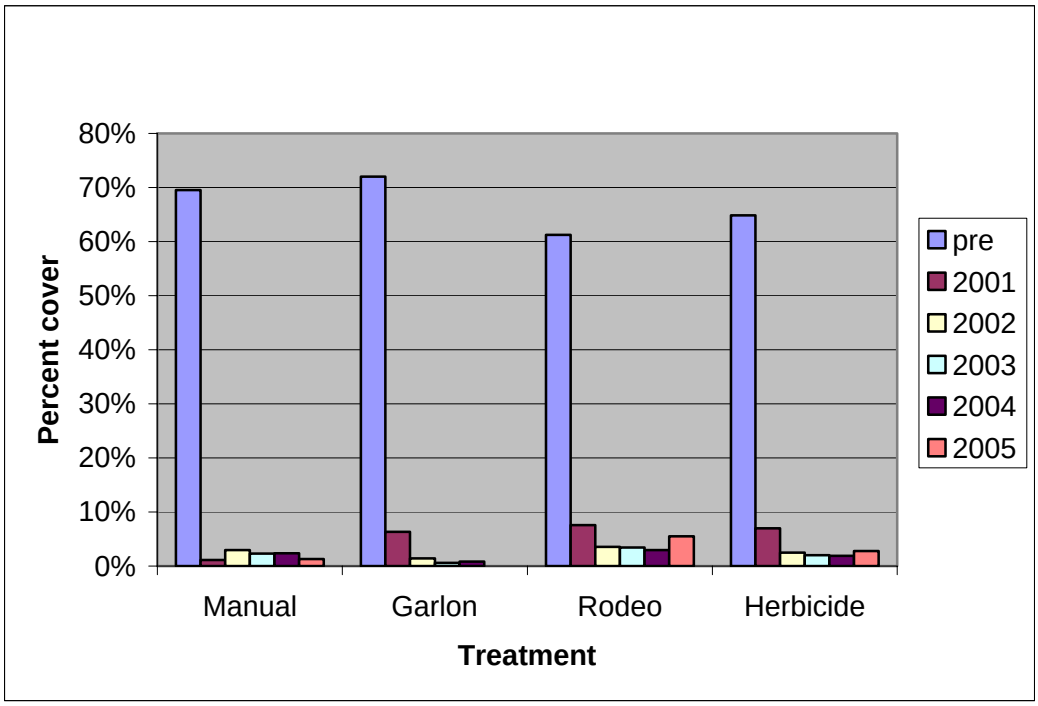

Figure 5.0 Percent Ivy cover over time at Phase 1 plots grouped by treatment

Sampling also showed that the native vegetation is recovering with all Phase 1 treatment methods (Figure 6.0). By 2005, all Phase 1 treatment groups had average native vegetation cover changes between 75% and 270%. Garlon plots actually showed a slight decrease in native vegetation (30% absolute cover in 2001 down to 23% in 2005), while Rodeo treatments increased from 10% cover in 2001 to 23% in 2005 (a 217% increase). The manual control group yielded the highest increase in native vegetation cover (from 16% to 43%, a 270% increase) after 4 years from the initial clearing. The manual treatment group apparently exhibited the fastest rate of native vegetation recovery, while native vegetation recovery was slower but still apparent in the herbicide plots.

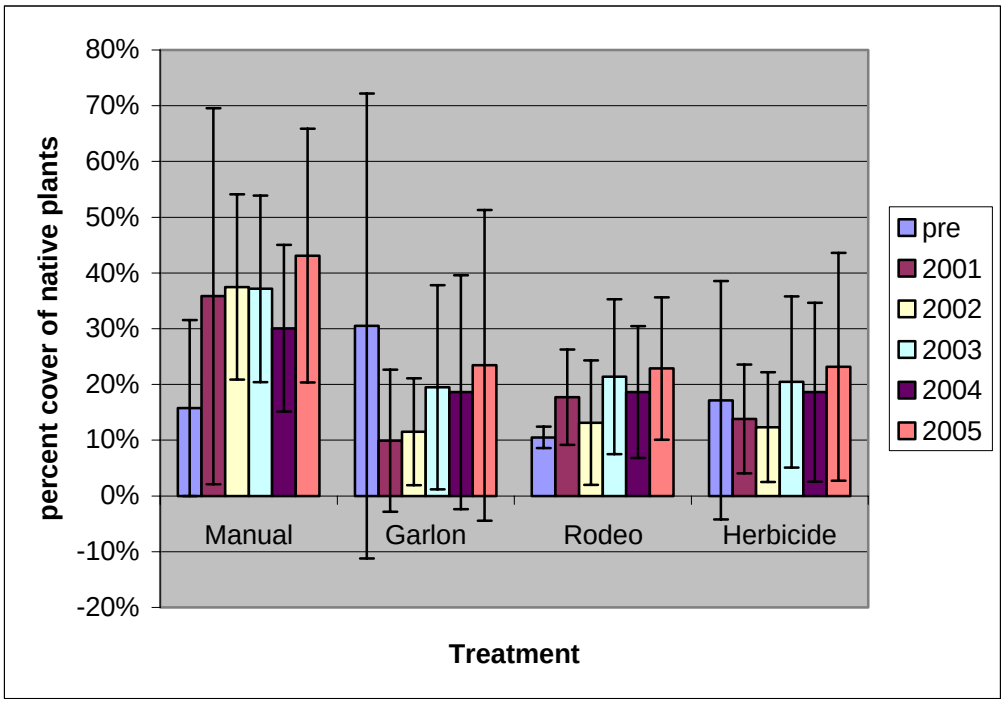

Figure 6.0 Native plant percent cover over time at Phase 1 plots grouped by treatment

Phase 2

The average pretreatment ivy cover of 72% (std dev = 11%) for all Phase 2 plots was reduced by 97.8% after 3 years to 1.57% (std dev = 2%) ivy cover in 2005. No significant difference in percentage ivy cover reduction was observed between the 2% glyphosate (96.8% ivy cover reduction) and 5% glyphosate (98.9% ivy cover reduction) treatment mixtures after 4 years. (Figure 7.0 and Figure 8.0 show the vegetation cover results grouped by the 2% and 5% glyphosate treatment mixtures respectively). The 2% Rodeo + 2% Scythe + 1% Hasten treatment group contained the highest initial ivy cover plot (84% ivy cover pre treatment), and was reduced by 94% to just 5% ivy cover by 2005. Several plots (treatments varied) that started with 60% to 70% ivy cover had no ivy when sampled in 2005. (See the appendix section 3.0 for the complete photo series for all Phase 2 plots).

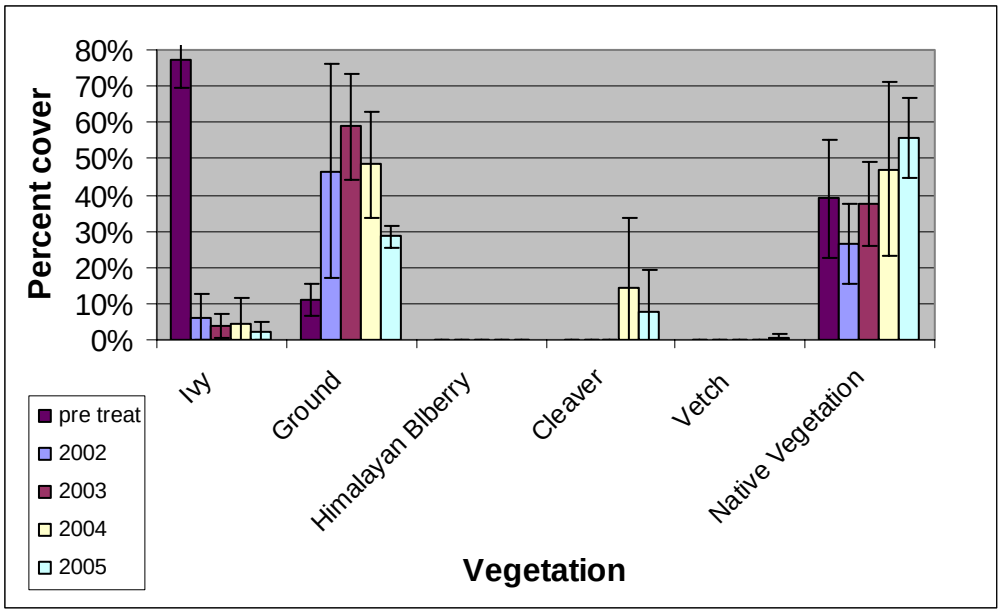

Figure 7.0 Average vegetation percent cover over time for Phase 2 plots treated with 2% glyphosate mixtures

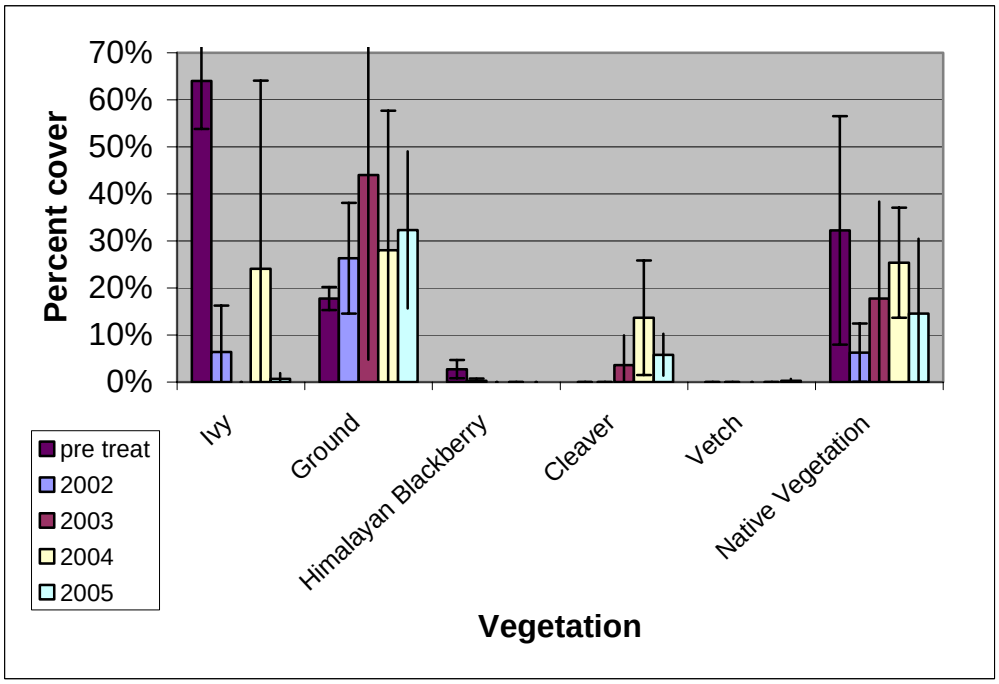

Figure 8.0 Average vegetation percent cover over time for Phase 2 plots treated with 5% glyphosate mixtures

Native vegetation recovered within most plots, albeit slowly. The average pretreatment native vegetation cover of 36.2% (std dev = 20%) for all Phase 2 plots returned to 35.15% (std dev = 26%) in 2005, three years after the treatments. The native vegetation in the plots treated with the 2% glyphosate mixtures faired much better with an average of 55.7% (std dev = 11%) native vegetation cover (43% increase in cover after 3 years) in 2005 as compared to an average 14.5% (std dev = 16%) native vegetation cover (55% decrease in cover after 3 years) in the 5%

glyphosate mixture plots in 2005. The winter herbicide application spared many deciduous native plants; however, licorice ferns (*Polypodium glycyrriza*) are active during winter months, and were noticeably damaged by the spray. Shrubs such as snowberry (*Symphoricarpos albus*) and Oregon grape (*Mahonia nervosa*) typically weathered the treatments with little or no damage, and many winter dormant native perennial forbs returned the following spring (see Figure 9.0).

Figure 9.0. Oregon grape, snowberry, and star flowered false Solomon's seals grow among dead and some surviving ivy leaves within a Phase 2 test plot, approximately 4 months after herbicide treatment.

Phase 3

The average initial ivy percent cover for the six Phase 3 plots was 51.3%, ranging from 28% ivy cover up to 70% cover. The average initial native vegetation cover for the plots was 35.4%, ranging from 22% up to 46% cover.

Since half of the study plots were controls, and one of the treatment plots was partially burned, it is difficult to draw any firm conclusion about the efficacy of the 2% Rodeo, 2% R-11 spray treatment. However, the burned plots had positive control results (1% ivy cover in June 2005) and a high return of native vegetation (66% cover in June 2005) (Figure 10.0).

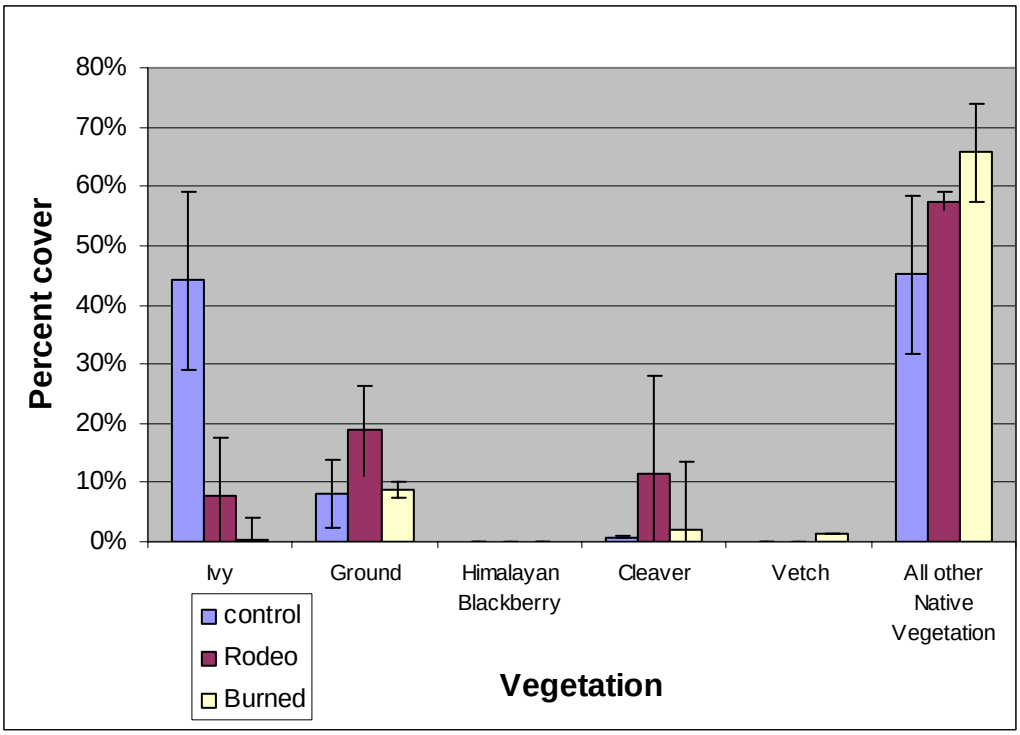

Figure 10.0 Average vegetation percent cover in June 2005 (16 months after treatment) for Phase 2 treatments.

The control plots averaged 44% ivy cover and 45% native vegetation cover in June 2005. Excluding the burned plots, the two 2% Rodeo + 1% R11 treatment plots ivy cover was reduced by an average of 84.9%, ranging from 1% (Plot 1B) to 15% ivy cover (Plot 2A) recorded in 2005. An average of 50.9% increase in native cover (56.3% to 58.7% absolute ivy cover values recorded in 2005) was also observed in the two 2% Rodeo + 1% R11 treatment plots 16 months after the treatment. The average cover percentage for vegetation within these herbicide plots is also displayed over time in Figure 11.0.

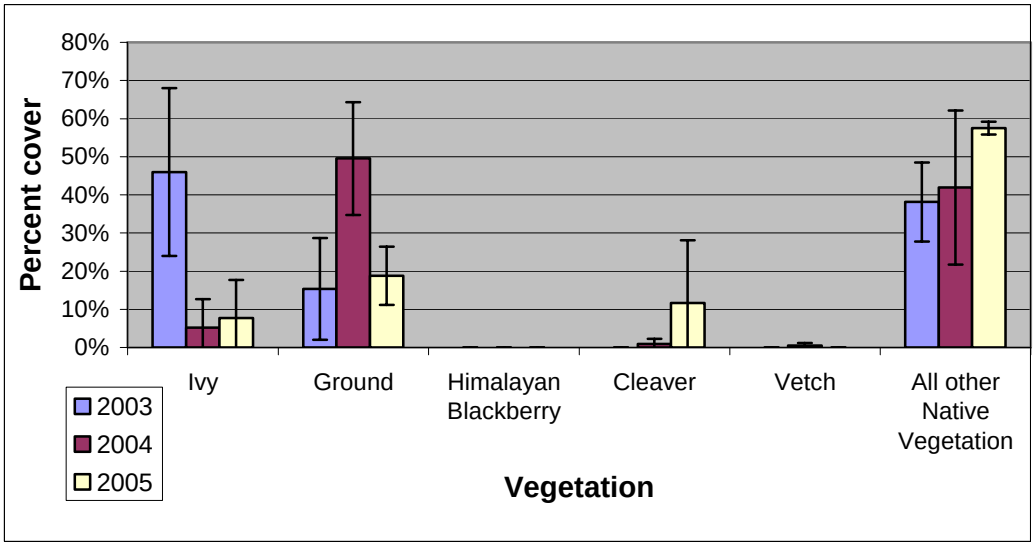

Figure 11.0 Average vegetation percent cover over time for Phase 3 herbicide treatment group.

The reason for this wide variation in remaining ivy cover between these two herbicide treatment plots is unclear. Some of this discrepancy could be attributed to variability in the herbicide applicator; it is possible that one plot was sprayed more thoroughly than the other. Environmental factors such as canopy cover, soil conditions, topography, and the vegetation matrix within the plots may have also influenced the efficacy of the treatments. (See the appendix section 4.0 for the complete photo series for all Phase 3 plots.)

Plot 1B (treated with 2% Rodeo + 1% R11) does provide an excellent example of safe, effective herbicide application that nearly eliminated English ivy from the plot (1% in June 2005). Native ferns, Oregon grape, and poison oak can all be found growing within the plot (see Figure 12.0), while its neighboring control plot (plot 1A, Figure 13.0) has these native plants mixed in with heavy ivy cover (55% in June 2005).

Figure 12.0 and 13.0 Plot 1A on the left had no treatment (control), and Plot 1B on the right 16 months after 2% glyphosate + 1% R11 foliar spray treatment.

Results of timed treatments and implications on ivy control costs

Time data for initial manual removal and herbicide treatment of ivy was collected during several of the ivy experiments and volunteer work events to build a clearer picture of the overall costs involved in these two control methods. The Phase 1, $9m^2$ plots took an average of 2 hours to clear by hand (900 hours/acre) vs. roughly 2 minutes to foliar spot spray (14 hours/acre). The Group Ivy Pull experiment yielded an extrapolated range of 400 hrs/acre to 1600 hrs/acre to manually remove ivy from plots with 28% to 80% ivy cover over varying terrain. Each Phase 3 plot (approx. $100m^2$) took two applicators 20 minutes (15 hrs/acre) to spot spray. (Note all of these data collected represent actual treatment time and do not include breaks or travel to the sites.)

These ivy control time data we collected are consistent with those determined by other regional organizations and agencies. Minimum wage labor (NOTE: $7.05 / hour based on 2004 levels, but some organizations use a figure as high as $17.55 per hour), herbicide costs (amounts range from 5-25 gallons of herbicide mix per acre) and replanting costs provided by the City of Portland's Bureau of Environmental Services were then used to calculate overall costs of controlling ivy using manual (hand pulling) versus foliar herbicide spray treatment (Figure 14.0). The overall cost of manual control for 1 acre of an ivy infested site was estimated at $6,800 or nearly 3 times the cost of the herbicide approach estimated at $2300 per acre even including 70% additional replanting cost as compared to manual control. These numbers do not include follow up treatments or the cost of organizing the control efforts, both of which are likely to be substantially higher for manual based control efforts. These numbers do, however, provide a reasonable starting point to evaluating the overall costs and implications of controlling ivy on a larger scale.

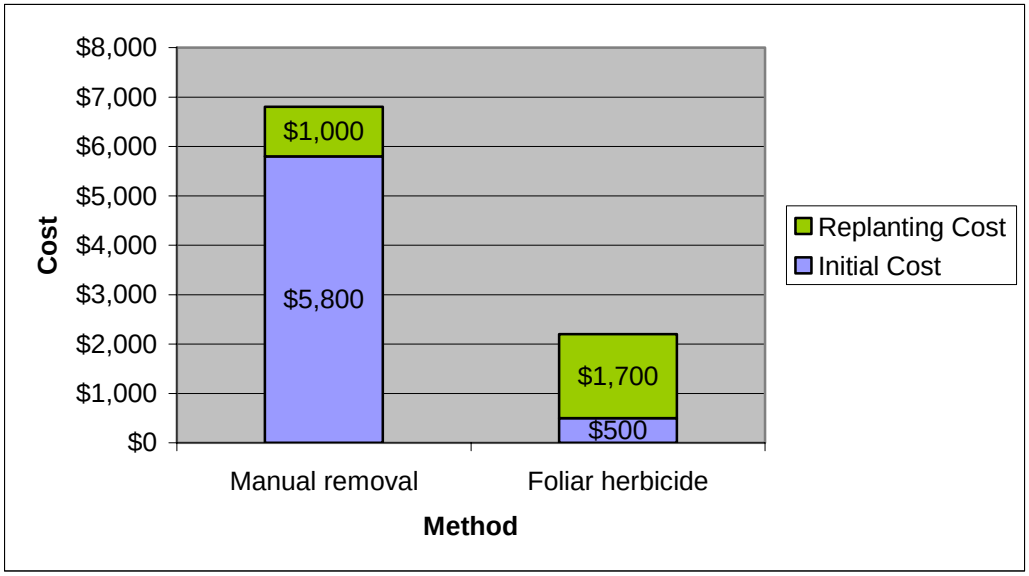

Figure 14.0 Comparison of estimated costs per acre of ivy control for manual removal vs. foliar herbicide approaches

Control of Himalayan Blackberry

Methods

Where it becomes established, Himalayan blackberry dominates and replaces native vegetation, creates dense thickets and prevents the passage of wildlife. Because Himalayan blackberry thrives in disturbed areas with good light, the worst infestations are at Camassia's borders, which have been heavily altered by development. However, there are small scattered blackberry infestations inside the preserve. We chose to address these smaller infestations before beginning work on the larger infestations.

We have been able to achieve eradication of many small scattered patches of Himalayan blackberry through manual removal performed by independent volunteers. Larger patches were controlled through a combination of manual removal and herbicide applications. For patches with considerable remaining native vegetation, we chose to manually remove all blackberry canes. Initial work was performed by youth crews utilizing loppers, and machetes to cut and pile the blackberry canes. Shovels or pulaskis were then used to remove rootballs.

For patches with little or no remaining native vegetation we utilized a cut and spray technique. For these patches, staff or youth crews cut blackberry canes down to a foot above the ground during the early summer. In the early fall, staff members returned to spray the re-growth with a spray solution of 3% Garlon 3A (triclopyr) and 2% Rodeo (glyphosate), with 1% R-11. Follow up manual removal was performed by volunteers until no blackberries remained.

Because some patches of Himalayan blackberry were so well established, no native seedbank remained in the soil and no native plants naturally grew back. In order to provide competition for non-native species, The Nature Conservancy chose to replant some priority areas with native vegetation. In some areas, staff scattered native blue wild rye (*Elymus glaucus*) seed. In 2005, one priority area was cleared of blackberry and completely replanted with native vegetation. Native plants came from a local nursery and were planted in late November with the help of local youth crews.

Results

One half acre of land infested with Himalayan blackberry was cleared during the winters and springs of 2003, 2004 and 2005 (see map in appendix 1.0). The areas replanted with native flora occupy around 0.4 acres.

Himalayan blackberry has been found in some of our restoration planting areas. However, it is at a level where only occasional volunteer maintenance is needed for native vegetation to thrive.

Control of Scotch Broom

Methods

Camassia's meadows were once full of mature Scotch broom. Thanks to the efforts of staff and volunteers, the meadows have returned to their open character, and control of the plant only requires occasional volunteer maintenance. No plants on the preserve have grown large enough to produce seeds within the past 6 years.

Since all of the mature Scotch broom plants have been removed, almost all of the plants still growing on the preserve are pulled by hand. This is done almost completely by volunteers who walk the open meadow areas and pull up any immature seedlings. This will continue into the future until the Scotch broom seed bank is depleted.

Only in an area burned by wildfire in August of 2003 have TNC staff and a local youth crew been needed to control Scotch broom. The fire germinated thousands of Scotch broom seeds, resulting in a flush of new seedlings. Two full days with youth teams and one day with TNC staff were needed to remove the plants.

Results

Each year, all flowering Scotch broom plants in the 10 acres of meadows and open oak woodlands are removed by volunteers. Immature plants are removed on a time allowing basis.

The burned area with thick broom cover occupied approximately 0.5 acres, about 90% of which was successfully cleared. More work in that area will have to continue with volunteers. The work to remove Scotch broom has benefited many important native plants within the oak savanna habitat at Camassia.

Community Involvement

Since the inception of the project The Nature Conservancy has been committed to both increasing community support for conservation work and to leveraging region-wide action to address the threat of invasive species. We have become involved with the community through four main avenues; firstly, we have implemented a highly successful volunteer adopt-a-plot program; secondly, we have formed long-term working relationships with several service-learning groups which have contributed enormously to the on-the-ground restoration work; thirdly, we have reached out to the local community and to Camassia's neighbors by advising them on vegetation management and by removing invasive plants from properties adjacent to our own; and lastly, we have presented the results of our ivy control experiment to numerous conservation and land management professionals.

In 2002 The Nature Conservancy recognized that Camassia's many visitors represented an enormous potential volunteer labor pool. That year, we implemented an adopt-a-plot program in which a volunteer could become the steward of a particular area of the preserve. As a result of this program, we now have 18 adopt-a-plot volunteers who have contributed over 2,000 hours removing invasive species and assisting in stewardship of the preserve.

The Nature Conservancy has created strong working relationships with many local service-learning groups. These organizations provide groups of 6-12 high school aged youth to work on restoration projects. During each work day, The Nature Conservancy includes an educational component focusing on local ecology, nature awareness, or scientific methodology. Working with such youth provides an excellent means of achieving conservation objectives while increasing ecological knowledge within the larger public. The Nature Conservancy has worked with the Multnomah Youth Corps, Youth Employability Support Services, Northwest Service Academy AmeriCorps, West Linn High School, Clackamas County Environmental Youth Corps, and Alpha High School. These groups have included over 100 individuals and have contributed over 1741 hours of work since July of 2004.

The Nature Conservancy recognized that restoring only its own property will not reduce the threat of invasive species and has therefore helped to restore its neighbor's properties through information sharing and by removing invasive species free of charge. Our neighbors on Windsor Terrace and Chestnut Street, as well as West Linn High School, have all received contributions of time, labor and information from The Nature Conservancy.

We have worked to share information with the broader public by creating a brochure for visitors of Camassia (see appendix 6.0), as well as by presenting the results of our ivy control experiment to numerous conferences, working groups, and conservation organizations (see the table in appendix 5.0 for a complete list of the various events where we have presented). The PowerPoint presentation "Control of English Ivy at a Landscape Scale, Lessons from the Field" has been presented at several conferences and meetings (see appendix 7.0). The sharing of this information has helped to leverage significant regional support and action for the control of English ivy.

Conclusions and Future Plans

The work that was accomplished over the past several years at Camassia has not only improved the habitat on the preserve, it has had a beneficial impact on areas far beyond the borders of Camassia. The numerous presentations, tours, and exportation of ideas and lessons learned from our work have assisted other land managers on how to best control invasive species on other properties.

We have confirmed that hand clearing invasive species can be rewarding, educational, and effective at restoring once degraded habitat. We have also learned that careful herbicide application can be an extremely effective restoration tool for areas degraded by English ivy if used properly. While both of these approaches are effective, they have very different costs as exhibited in the preceding results section. These figures show a large cost difference between treatment approaches, something we have highlighted in public presentations. An example of this can be found in the "Control of English Ivy at a Landscape Scale, Lessons From the Field" PowerPoint presentation included in the digital version of the appendix. The cost comparison has generated a lot of discussion, and should give land managers additional information to consider when approaching ivy control options.

While the adage that there is never one "best" weed control method is certainly true, we now recommend incorporating the careful use of herbicides for English ivy control projects in which the area is large and invasive species cover is very high. We continue to endorse and utilize manual control for small sites, and especially areas with substantial native vegetation and relatively low ground cover of ivy.

The restoration work recently accomplished at Camassia has positioned us to now focus on the remaining, and most challenging areas that are still in need of invasive species removal. The Nature Conservancy will continue to seek funding for restoration work at the Camassia Natural Area. There are plans for Douglas fir removal within the Oregon white oak savanna habitat at Camassia in order to preserve this declining habitat. Adopt-a-plot volunteers will continue to maintain cleared areas and work in currently unrestored areas as well. West Linn High School's Ecology class will conduct restoration along one of the creeks on the preserve, visitors will continue to come enjoy the preserve, and flora and fauna should continue to flourish at the Camassia Natural Area for years to come.