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MEMORANDUM –
GLENWOOD PRESERVE THISTLE CONTROL TRIALS
SPRING 2012 – WINTER 2012 / 2013

Introduction

The Glenwood Preserve, located in Scotts Valley, California, consists of approximately 160 acres of various habitat types, including non-native annual grassland, wetland, riparian, native grassland, coyote bush scrub, and mixed evergreen forest. The Preserve is being managed by the Land Trust of Santa Cruz County (LTSCC) to preserve sensitive habitats and suitable conditions for the continued population viability of a number of special status insect and plant species on site. As invasive plant species have the potential to interfere with these goals, Central Coast Wilds (CCW) was contracted to implement control trials on one of the most widespread invasive species on the preserve, Italian thistle (*Carduus pycnocephalus*). The following is a memorandum memorializing the implementation methods and results of these trails, as well as discussing the implications of these results on plans for Italian thistle control on the Glenwood preserve.

Methods

Trail methodology was developed by Tanya Baxter (LTSCC) and Jon Laslett (CCW). A patch of Italian thistle was selected for the trials on the south west side of the large pond on the property. Figure 1 below shows the location of the trials on the preserve. This site was selected as it is permanently fenced off from the horses that graze the preserve, as aminopyralid, one of the herbicides to be tested in the trials, has been shown to be persistent in manure. Thus this herbicide could possibly be spread to non-target native plants through the manure of horses which consume aminopyralid treated weeds.

The patch was sectioned off into 5 plots for treatment, approximately 12 feet by 15 feet each. A 6th plot, as a control, was delineated as well, though this plot was limited by the available fenced and Italian thistle covered area to 7 feet by 15 feet. A schematic layout of these plots is shown in the inset map in Figure 1 below. Plot corners were marked on the upslope side with red pin flags and orange spray painted rebar, and on the down slope side by the fence posts of the existing barbed wire fence.

Ocular estimates of Italian thistle cover in each plot were taken before treatment on 4/24/12 by Tanya Baxter and Jon Laslett, and are included as Table 1 below. Treatment by plot information is also included in Table 1 below. Dilutions used in the treatments are included as Table 2 below.

PLOT COVER AND TREATMENT

Plot #	% Cover of Italian Thistle	Treatment Type
1	45.00%	Glyphosate Only
2	70.00%	Aminopyralid Only
3	85.00%	Cut and Glyphosate
4	60.00%	Cut and Aminopyralid
5	50.00%	Cut only
6	80.00%	Control (No Treatment)

Table 1: Cover of Italian thistle and treatment type per plot.

DILUTION RATES

Material	Dilution Rate
Glyphosate (as Rodeo)	3 ml per Gallon
Aminopyralid (as Milestone VM +)	2.66 oz per Gallon
Blazon Blue (Indicator Dye)	1 oz per Gallon

Table 2: Dilution rates for chemicals used in Italian thistle treatments.

Treatment of the plots was conducted on 4/27/2012 by Jon Laslett (CCW). Conditions were sunny and warm with light winds. Treatments per plot were as follows:

- Plot 1 was treated with glyphosate (as Rodeo manufactured by Dow Agrosciences) only.
- Plot 2 was treated with aminopyralid (as Milestone VM + manufactured by Dow Agrosciences) only.
- Plot 3 was cut as low as possible without causing soil disturbance (~3 inches) with a Stihl FS 250 weed whip, then treated with glyphosate (as Rodeo manufactured by Dow Agrosciences).
- Plot 4 was cut as low as possible without causing soil disturbance (~3 inches) with a Stihl FS 250 weed whip, then treated with aminopyralid (as Milestone VM + manufactured by Dow Agrosciences).
- Plot 5 was cut as low as possible without causing soil disturbance (~3 inches) with a Stihl FS 250 weed whip, and no herbicide was applied.
- Plot 6 received no treatment as a control.

All herbicide was applied with a Solo brand piston pump 4 gallon backpack sprayer, and Blazon Blue indicator dye was used to ensure even coverage.

Before and after photos of each plot are included as Photos 1 – 12 below.

Photo 1: Plot 1, before treatment, 4/27/12

Photo 2: Plot 2, before treatment, 4/27/12

Photo 3: Plot 3, before treatment, 4/27/12

Photo 4: Plot 4, before treatment, 4/27/12

Photo 5: Plot 5, before treatment, 4/27/12

Photo 6: Plot 6, before treatment, 4/27/12

Photo 7: Plot 1, after treatment, 4/27/12

Photo 8: Plot 2, after treatment, 4/27/12

Photo 9: Plot 3, after treatment, 4/27/12

Photo 10: Plot 4, after treatment, 4/27/12

Photo 11: Plot 5, after treatment, 4/27/12

Photo 12: Plot 6, after treatment, 4/27/12

Monitoring Visit 5/1/12

On May 1, 2012, Jon Laslett from CCW visited the site to make observations of and photo document the test plots. Conditions were sunny and warm with light winds. Flowering was observed to have continued in all un-cut plants, though only one plant, in Plot 6, was observed to have produced seed. Observations per plot were as follows:

- Plot 1 (glyphosate only) – Some minor wilting was observed in a few individual plants, some yellowing was observed in ~20% of plants. An overview of Plot 1 can be seen in Photo 13, and a close up of the yellowing can be seen in Photo 14.
- Plot 2 (aminopyralid only) – Significant wilting was observed in almost all plants. Some yellowing was observed as well, in ~10% of plants. An overview of Plot 2 can be seen in Photo 15, and a close up of the wilting can be seen in Photo 16.
- Plot 3 (cut and glyphosate) – Minimal regrowth from cut plants was observed, 2 small plants appeared to have grown up through the cut thistle debris laying on the soil surface. An overview of Plot 3 can be seen in Photo 17, and a close up of the regrowth can be seen in Photo 18.
- Plot 4 (cut and aminopyralid) – Minimal regrowth from cut plants was observed, 5 small plants appeared to have grown up through the cut thistle debris laying on the soil surface. All regrowth appeared to be exhibiting wilting similar to uncut plants in plot 2. An overview of Plot 4 can be seen in Photo 19, and a close up of the wilting regrowth can be seen in Photo 20.
- Plot 5 (cut only) – Minimal regrowth from cut plants was observed, 6 small plants appeared to have grown up through the cut thistle debris laying on the soil surface. Re-growth appeared healthy and was flowering. An overview of Plot 5 can be seen in Photo 21, and a close up of the regrowth can be seen in Photo 22.
- Plot 6 (no treatment, control) – All plants appeared healthy and growing. New flowering was observed from the previous visit, and one plant was observed to have one flower head turning white. An overview of Plot 6 can be seen in Photo 23.

Photo 13: Plot 1, 5/1/12

Photo 14: Plot 2, 5/1/12

Photo 15: Plot 3, 5/1/12

Photo 16: Plot 4, 5/1/12

Photo 17: Plot 5, 5/1/12

Photo 18: Plot 6, 5/1/12

Photo 19: Plot 1, close up view, 5/1/12

Photo 20: Plot 2, close up view, 5/1/12

Photo 21: Plot 3, close up view, 5/1/12

Photo 22: Plot 4, close up view, 5/1/12

Photo 22: Plot 5, close up view, 5/1/12

Monitoring Visit 5/7/12

On May 7, 2012, Jon Laslett from CCW visited the site to make observations of and photo document the test plots. Conditions were sunny and warm with light to moderate winds. Flowering was observed to have continued in all un-cut plants. Observations per plot were as follows:

- Plot 1 (glyphosate only) – Some minor wilting was observed in a few individual plants, increased from the previous visit. Yellowing had increased as well, and was observed in ~100% of plants. Many flowers had turned from purple to white, but upon dissection of 2 of the most mature looking flowers no apparently mature seeds were observed. An overview of Plot 1 can be seen in Photo 24.
- Plot 2 (aminopyralid only) – Significant wilting was observed in almost all plants, and wilting had increased since the previous visit. Increased yellowing was observed as well. The flowers in this plot remained purple, and upon dissection of 2 flowers no apparently mature seeds were observed. An overview of Plot 2 can be seen in Photo 25.
- Plot 3 (cut and glyphosate) – The cut stems were observed to have turned brown, and the resprouts observed during the last visit had turned yellow. An overview of Plot 3 can be seen in Photo 26.
- Plot 4 (cut and aminopyralid) – The cut stems were observed to have turned brown, and the resprouts observed during the last visit had wilted in a similar fashion to the plants in plot 2. A few of these resprouts (~3) had purple flowers. An overview of Plot 3 can be seen in Photo 27.
- Plot 5 (cut only) – Minimal but slightly increased regrowth from cut plants was observed compared to the previous visit, ~10 small plants appeared to have grown up through the cut thistle debris laying on the soil surface. Re-growth appeared healthy and approximately half of the plants were flowering. An overview of Plot 5 can be seen in Photo 28.
- Plot 6 (no treatment, control) – All plants appeared healthy and had continued to grow since the last visit. New flowering was observed from the previous visit, and many flower heads were turning white. An overview of Plot 6 can be seen in Photo 29. Upon dissection of 2 of the most mature looking flowers no apparently mature seeds were observed.

Photo 24: Plot 1, 5/7/12

Photo 25: Plot 2, 5/7/12

Photo 26: Plot 3, 5/7/12

Photo 27: Plot 4, 5/7/12

Photo 28: Plot 5, 5/7/12

Photo 28: Plot 6, 5/7/12

Monitoring Visit 5/22/12

On May 22, 2012, Jon Laslett from CCW visited the site to make observations of and photo document the test plots. Conditions were sunny and warm with strong winds. Observations per plot were as follows:

- Plot 1 (glyphosate only) – All thistles and grass in this plot were dead as of this visit. Dissection of a few of the flowers on the dead thistles revealed only immature seeds. An overview of Plot 1 can be seen in Photo 29.
- Plot 2 (aminopyralid only) – Wilting and "twisting" of thistle had progressed from the previous visit, with most thistles appearing to be on their way to dying. Upon dissection of 2 flowers no apparently mature seeds were observed. An overview of Plot 2 can be seen in Photo 30.
- Plot 3 (cut and glyphosate) – No living thistle was observed in this plot during this visit. Previously observed reprouts had died between this visit and the previous. An overview of Plot 3 can be seen in Photo 31.
- Plot 4 (cut and aminopyralid) – The cut stems were observed to have remained brown and dead. 8 thistle re-spouts were observed, and were flowering. An overview of Plot 3 can be seen in Photo 32.
- Plot 5 (cut only) – ~120 resprouts were observed, nearly all quite small but healthy and flowering. Mature and likely viable seeds were observed on some of these resporuts. An overview of Plot 5 can be seen in Photo 33.
- Plot 6 (no treatment, control) – All plants appeared healthy and had continued to grow and flower since the last visit. Plants were observed to be ~6' tall and many flowers were found to contain mature seed. Seed production in this plot, while not quantified formally, was likely between one and two orders of magnitude greater than plot 5. An overview of Plot 6 can be seen in Photo 34.

Photo 29: Plot 1, 5/22/12

Photo 30: Plot 2, 5/22/12

Photo 31: Plot 3, 5/22/12

Photo 32: Plot 4, 5/22/12

Photo 33: Plot 5, 5/22/12

Photo 34: Plot 6, 5/22/12

Monitoring Visit 5/31/12

On May 31, 2012, Jon Laslett from CCW visited the site to make observations of and photo document the test plots. Conditions were sunny and warm with light to moderate winds. Observations per plot were as follows:

- Plot 1 (glyphosate only) – All thistles and grass remained dead as of this visit. Dissection of a few of the flowers on the dead thistles revealed only immature seeds. An overview of Plot 1 can be seen in Photo 35.
- Plot 2 (aminopyralid only) – Wilting and "twisting" of thistle had progressed further from the previous visit. While extensive yellowing was observed, some green was still present in the plants. Upon dissection of 2 flowers no apparently mature seeds were observed. An overview of Plot 2 can be seen in Photo 36.
- Plot 3 (cut and glyphosate) – No living thistle was observed in this plot during this visit. An overview of Plot 3 can be seen in Photo 37.
- Plot 4 (cut and aminopyralid) – The cut stems were observed to have remained brown and dead. 8 thistle re-spouts were observed, appeared healthy, and were flowering. Flowers did not appearto be mature. An overview of Plot 3 can be seen in Photo 38.
- Plot 5 (cut only) – ~100 resprouts were observed, seemed healthy and were flowering. Mature and likely viable seeds were observed on some of these resporuts. An overview of Plot 5 can be seen in Photo 39.
- Plot 6 (no treatment, control) – All plants appeared healthy and had continued to grow and flower since the last visit. Plants were observed to be ~7' tall or more in some cases and many flowers were found to contain mature seed. Seed production in this plot, while not quantified formally, continued to appear to be between one and two orders of magnitude greater than plot 5. An overview of Plot 6 can be seen in Photo 40.

Photo 35: Plot 1, 5/31/12

Photo 36: Plot 2, 5/31/12

Photo 37: Plot 3, 5/31/12

Photo 38: Plot 4, 5/31/12

Photo 39: Plot 5, 5/31/12

Photo 40: Plot 6, 5/31/12

Monitoring Visit 1/23/13

On January 23, 2013, Jon Laslett from CCW visited the site to make observations of and photo document the test plots. Conditions were overcast and cool with calm winds. Observations per plot were as follows:

- Plot 1 (glyphosate only) – Thistle rosettes had appeared throughout the plot. In general, they varied in size from 1 inch to 5 inches in diameter, with an average of approximately 3 inch diameters. Percent cover of thistle rosettes in this plot was estimated at between 5% and 10%. An overview of Plot 1 can be seen in Photo 41.
- Plot 2 (aminopyralid only) – Thistle rosettes had appeared throughout the plot. In general, they varied in size from 1 inch to 5 inches in diameter, with an average of approximately 3 inch diameters. Percent cover of thistle rosettes in this plot was estimated to be less than 5% and 10%. An overview of Plot 2 can be seen in Photo 42.
- Plot 3 (cut and glyphosate) – Thistle rosettes had appeared throughout the plot. In general, they varied in size from 1 inch to 5 inches in diameter, with an average of approximately 3 inch diameters. Percent cover of thistle rosettes in this plot was estimated at between 10% and 20%. An overview of Plot 3 can be seen in Photo 43.
- Plot 4 (cut and aminopyralid) – Thistle rosettes had appeared throughout the plot. In general, they varied in size from 1 inch to 5 inches in diameter, with an average of approximately 3 inch diameters. Percent cover of thistle rosettes in this plot was estimated at between 10% and 20%. An overview of Plot 3 can be seen in Photo 44.
- Plot 5 (cut only) – Thistle rosettes had appeared throughout the plot. In general, they varied in size from 1 inch to 5 inches in diameter, with an average of approximately 3 inch diameters. Percent cover of thistle rosettes in this plot was estimated at between 40% and 50%. An overview of Plot 5 can be seen in Photo 45.
- Thistle rosettes had appeared throughout the plot. In general, they varied in size from 1 inch to 5 inches in diameter, with an average of approximately 3 inch diameters. Percent cover of thistle rosettes in this plot was estimated at between 70% and 80%. An overview of Plot 6 can be seen in Photo 46.

Photo 41: Plot 1, 1/23/13

Photo 42: Plot 2, 1/23/13

Photo 43: Plot 3, 1/23/13

Photo 44: Plot 4, 1/23/13

Photo 45: Plot 5, 1/23/13

Photo 46: Plot 6, 1/23/13

Discussion and Recommendations

While these trials suffer from certain scientific limitations in regards to replication and quantitative results, the qualitative observations present a very clear picture. Surfactant free glyphosate (as Rodeo) at a dilution rate of 3 ml per gallon provided the quickest kill of Italian thistle.

Aminopyralid (as Milestone VM +) at a dilution rate of 2.66 oz per gallon also seemed to prevent seed set, though the rate of decline and death amongst the treated plants was much slower. Additionally, aminopyralid has been shown to be persistent in manure. Due to the risk of grazers spreading herbicide through their manure to the special status plant populations on the Glenwood preserve, and the apparent efficacy of glyphosate, surfactant free glyphosate becomes, in my opinion, the most attractive chemical control option for Italian thistle on the preserve.

Cutting before treating did not seem to have an impact on mortality of the treated plants or on estimated seed production when compared with treating alone. Cutting alone seemed to reduce seed set significantly when compared with the control plot, but still resulted in viable seed production.

During the January 2013 visit, a slightly higher estimated percent cover of thistle seedlings was seen in plots 3 and 4 (the cut and treat plots for glyphosate and aminopyralid respectively) when compared with plots 1 and 2 (the treat only plots for glyphosate and aminopyralid respectively). I do not believe this to a result of seed production within the plots, as all 4 plots produced little to no seed. It is, in my opinion, most likely a result of the greater proximity of plots 3 and 4 to plot 6, the control plot, which produced prodigious amounts of seed. It is also possible that the plant skeletons in plots 1 and 2 prevented seed contact when compared with the cut plots (3 and 4).

Based on the results of the trial, and assuming thistle eradication is considered to be a high priority management concern at the Glenwood preserve, I recommend that surfactant free glyphosate be considered as the most effective approach to eradicating living Italian thistle and preventing seed set. To implement a spray program, I recommend the following course of action:

- Reach out to stakeholders (grazing managers, special status species experts, etc.) to ensure a surfactant free glyphosate program will not adversely impact their spheres of concern and expertise on the property. In particular, seek guidance on appropriate spraying setbacks from special status insect habitat.
- Have a qualified botanist identify special status plant populations in the field with pin flagging to ensure zero take on these populations.
- Begin spraying as soon as possible to get the Italian thistles while they are in the small rosette phase, to reduce the total volume of herbicide needed for effective coverage. Spraying should focus on large thistle populations in open areas as a priority to most effectively reduce total seed set across the preserve. Spray crews should be trained in native plant identification to avid impacts to desirable native

vegetation, and standard guidelines for responsible herbicide application should be followed diligently.

- Follow up with a second round of spraying later in the season, perhaps in late March or early April, depending on weather, to control late germinating individuals.
- Weed whip thistles prior to seed set in areas deemed unsuitable for herbicide use in order to reduce seed production.
- Be prepared financially and otherwise to continue a relatively intensive spraying program for a number of years. Cal-IPC reports that Italian thistle seeds may remain viable in the soil for 8 to 10 years, and reinvasion from outside the preserve or from isolated individuals within the preserve (of which there are many under the oak canopies) is likely to take place.

Please do not hesitate to contact me with any questions. I can be reached by phone at (831) 750-0113, or by email at jlaslett@centralcoastwilds.com.

Sincerely,

Jon Laslett

Jon Laslett
Sr. Project Manager / Ecologist
Central Coast Wilds
Ecological Concerns Inc.