NID Integrated Vegetation Management Pilot Project

Phase 1 Report

Background

In the summer of 2017, NID took early steps to begin expanding its integrated vegetation management\(^1\) (IVM) practices. Vegetation management is a critical element of canal and reservoir maintenance—it ensures adequate water flows for human consumption, irrigation, and fire suppression. If left untreated, excessive vegetation can choke canals as encroaching plants restrict flow, reduce storage, and impact water quality and public health. Obstructed canals can also cause flooding and erosion and provide breeding grounds for mosquitoes and other vectors.

Over the last 40 years, NID has used RoundUp (whose key ingredient is glyphosate) as a primary vegetation management tool. It is effective, cost-efficient and until recently was thought to be a safe product. In July 2017, the Office of Environmental Health Hazard Assessment placed glyphosate on California’s Proposition 65 list of chemicals known to cause cancer. This has led some cities to ban glyphosate’s use in public spaces. Additionally, NID has received complaints regarding the use of glyphosate on lands adjacent to organic farms.

NID embarked on a process to develop and field test alternative strategies to vegetation management, and to refine and expand its IVM program. As part of this process, NID convened the Vegetation Management Working Group, which comprises local farmers, ranchers, representatives of the agricultural industry and others (such as the Placer and Nevada County Ag Commissioners and the Nevada County Resource Conservation District). This group continues to meet periodically. Soon after first convening this group, NID was encouraged to apply for a Department of Pesticide Regulation Research Program Grant to support a field study aimed at identifying effective glyphosate alternatives.

The District hired Amigo Bob Cantisano (of Organic Ag Advisors), Don Bartel (of Sierra Consulting and IPM), and Keri Rinne (a grant writer and communications consultant) to assist NID staff members Brian Powell, Brian Morris, and Neysa King with designing the field study and preparing the grant proposal.

Although the grant was not awarded, the process of developing the application helped the District to establish the IVM team and catalyzed the field study efforts. As part of

\(^1\) Integrated Vegetation Management (IVM) is generally defined as the practice of using appropriate, environmentally sound, and cost-effective control methods, which can include a combination of chemical, biological, cultural, mechanical, and/or manual treatments.
the grant application development, the District designed a pilot study to field test organic chemical, biological and mechanical treatment methods. The study design included application, data collection, and data analysis regarding the efficacy and costs of each method, with a goal of developing a comprehensive IVM program to guide terrestrial vegetation management. NID determined that it would implement a scaled-down version of the field study developed for the grant proposal. Botanist Daniel Nicholson joined the IVM team to assist with monitoring and assessment. The team began implementing the first field study phase in spring 2018.

**Phase 1 Field Study**

Phase 1 of the field study was implemented at two sites, Tarr Canal, downstream of McCourtney Road, and Newtown Canal off Bitney Springs Road. Most treatments were applied at the Tarr Canal site, including two mechanical methods and nine organic herbicides (listed below). Goat grazing was tested along Newtown Canal.

The Tarr Canal site included 48 plots, each measuring 10 feet by 10 feet, which allowed for four replicates of each treatment and one control plot (also replicated four times).

The organic herbicides tested were:

1. A.D.I.O.S. (sodium chloride)
2. Axxe (ammonium nonanoate)
3. Avenger Concentrate (d-limonene)
4. Weed-A-Way (lemongrass and clove oil)
5. Weed Zap (clove and cinnamon oil)
6. Finalsan (ammonium soap)
7. Suppress EC (cupressic acid)
8. Opportune (microbial compound)
9. Marrone (microbial compound)

The two mechanical methods tested included mowing and an abrasion tool recommended by Amigo Cantisano, which uses crushed walnut shells to blast plants. The team had planned to test a steamer unit as well, but this did not occur as the equipment was not available during Phase 1.

Testing began on April 3, 2018, when the IVM team and Working Group members gathered at the Tarr study site for the first application of the organic herbicides. Don Bartel conducted a second application of one product (Marrone) on April 9. The site was monitored (see details below) for 28 days, after which Don Bartel recommended that no further treatment or monitoring occur as the plants had grown beyond the point
at which herbicides would be effective. NID staff mowed the site and tracked costs to include in treatment comparisons.

The goat grazing was tested in July 2018. Brad Fowler of The Goat Works grazed approximately 100 goats and sheep for 16 days along 1 mile of canal running through Nevada City School of the Arts on Bitney Springs Road. Brad used electric fencing to contain the animals on the first ¾-mile of the canal. He erected fencing on both sides of the canal, and used supplemental feeding on the top of the berm in some areas to concentrate animal impact to the vegetation adjacent to the canal. For three days, along the last quarter-mile of the study site, Brad herded the animals with dogs along the berm without using any fencing (the animals were kept in a pen on-site at night). This was the most effective approach in terms of vegetation control, but it was also the costliest in terms of man power. Brad recommended that if grazing is tested in Phase 2, at least twice as many animals should be used and herded each day (and kept in night pens). He also recommended two sessions to be most effective, one in the spring and the second in the summer.

**Phase 1 Monitoring and Data Analysis**

Prior to the April 3 treatment, Daniel Nicholson evaluated the plots to gather data regarding plant species and basal cover. For each plot, Daniel completed a list of species present (including USDA plant codes, nativity, form, and other factors for each species). He also began photo monitoring. Both Daniel and Don gathered data on three site visits—at 7 days, 14 days, and 28 days post-treatment. (The monitoring protocol includes further detail.)

Daniel identified annual and perennial grasses and forbs at the Tarr site and during each visit, completed a data sheet for each plot that included: plot number, date, location, weather, and visit number. Data sheets also included the top two dominant species and their percentage of cover in the 10-foot by 10-foot plot and cover of organic (dead material), bare soil, and rocks/gravel. Daniel also took photos of each plot during each visit.

Don recorded the weather conditions for each treatment application and assessed the plots based on plant response to treatment (measured as percent control, defined within percentage categories to measure symptoms such as plant stunting, chlorosis, and necrosis).

**Data Analysis**

Dave Weixelman, a range ecologist with the US Forest Service who has significant experience with vegetation, restoration, and statistics, assisted with Phase 1 data
analysis and helped to guide development of the Phase 2 monitoring protocol. The graphs below show the results of each herbicide tested. Figure 1 shows percent control (i.e., plant response to the herbicides), and Figure 2 shows the changes in percentage of plant cover. In Figure 1, higher numbers on the Y-axis show a higher level of product efficacy, while in Figure 2, lower numbers show a higher level of efficacy (i.e., larger percentage of bare ground).

Although some products demonstrate higher potential than others, overall it is clear that in order to be effective the organic herbicides should be applied earlier in the season when the target vegetation is no taller than 4 inches.

The costs associated with the grazing and mowing have not yet been included in the analysis of Phase 1 outcomes. The team will calculate these costs for comparison once Phase 2 is complete.

Next Steps

Phase 1 has directly informed design of Phase 2, which the IVM team has initiated (described in the Phase 2 plan). Phase 1 data analysis results guided the determination of which products and approaches to test further. Phase 1 results will also be integrated into an overall analysis once Phase 2 is completed.
Figure 1

HERBICIDE RESULTS BY DATE

Y AXIS IS % CONTROL

- Adios
- Axxe
- Avenger
- Weed-a-way
- Weed Zap
- Finalsan
- Supress
- Opportune
- Marrone Microbial Extract
- Untreated Control

Figure 1
Figure 2

ANNUAL FORB

% COVER OF VEGETATION

ANNUAL GRASS

% COVER OF VEGETATION

PERENNIAL FORB

% COVER OF VEGETATION

PERENNIAL GRASS

% COVER OF VEGETATION