Assessing the most effective weed control re-treatment interval for Clidemia hirta-dominated areas at Oapaulea Lower Management Unit, Oahu

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INTRODUCTION

The goal of this study was to guide Oahu Army Natural Resources Program (OANRP) weed control planning for clearing of Oapaulea Lower Management Unit (OMU), where dense understory cover of this weed occurs (Fig. 1). This species is targeted due to its ecosystem altering characteristics and tendency to create thick monotypic stands. Several questions are addressed pertaining to the effect of weeding C. hirta-dominated areas. To what extent does C. hirta and other weed have rebound if an area is not re-seeded for 6, 12 or 18 months? In the course of weeding a small degree of understory native vegetation trampling occurs. Does re-seeding at 6 months cause further damage to native vegetation? How does species diversity change in response to weeding at different intervals and gaps in re-seeding? How long does it take for 10 cm tall C. hirta plants (typically not treated during weeding) to become reproductive? Does canopy cover change in response to understory weeding within 18 months?

METHODOLOGY

Field Methods: Plots (5 x 21 m) were monitored in May 2013 (month 0) and November 2014 (month 18) among 4 re-seeding treatments:

- Plot 1: control plot - not weeded
- Plot 2: weeded at 0 & 6 months
- Plot 3: weeded at 0 & 12 months
- Plot 4: weeded at 0 & 18 months

Undisturbed percent cover (using point intersect, n = 80 points), species richness (in 1 m² quadrats, n = 20), and canopy openness (using hemispheric photographs, n = 20) were monitored. To assess C. hirta maturation time, 50 individuals (10 cm tall) were tagged within a 5 x 5 m plot, and monitored every 6 months from May 2013 to November 2014. Weeding included all non-grass mature and immature plants and most seedlings.

Data Analysis: Analysis included chi-square and Fisher’s exact tests for change in understory cover within plots over time, and differences between plots at the end of the trial; t-tests for species richness change over time; and ANOVA with Tukey’s post-hoc comparisons for differences in species richness between plots at the end of the trial, and for canopy openness in hemispheric photographs derived using Gap Light Analyzer (GLA). Version 2.0 software (Frazer et al. 1999). Analysis of change in non-grass weeds and non-vegetated area was based on initial weed cover in Plot 1, as Plots 2, 3, and 4 were weeded prior to baseline monitoring. Anecdotal observations determined that weed cover was similar among all 4 plots at the start of the trial.

RESULTS

Non-native understory percent cover: There was a significant decrease in C. hirta (p < 0.001) and total weed cover (p < 0.001) at the end of the trial. However, a significant increase in total weed cover excluding C. hirta (p < 0.001), among all weeded plots (Figs. 2 and 3). The most commonly occurring grass, Paspalum conjugatum also increased significantly from very low (Plots 2 and 4) and low (Plot 3) to moderate low cover in all weeded plots. At the end of the trial, C. hirta cover differed significantly among all plots, ranging from very low to high in relation to the time elapsed since the last weeding effort (6, 12, and 18 months prior for Plots 3, 2, and 4, respectively, and Plot 1 never weeded). The total weed cover differed among plots (p < 0.001) except for Plots 2 and 3, ranging from moderate to very high, also in relation to time since weeding last occurred. Total weed cover excluding C. hirta differed among plots (p < 0.001) with the exception of Plots 3 and 4; ranging from moderately low (Plot 1) to moderate (Plot 2) to moderately high/moderate (Plots 3 and 4).

Native understory percent cover: There was a significant increase in native cover (from low to moderate) for Plots 2 and 3 (p < 0.001). Though initially absent, by the end of the trial, Acacia laue was present in all plots at very low cover, representing a significant small increase in Plots 2 and 4 (p = 0.034). Chloris chamissonii had a small significant increase in the control plot (p = 0.044), and a larger increase in Plots 2 and 3 (p = 0.001). Nephrolepis exaltata subsp. hawaiiensis had a significant increase (from very low to low cover) in Plot 2.

Non-vegetated percent cover: There was a very small significant increase in non-vegetated area in Plot 2 (p = 0.002) from very low to low percent cover.

Species richness: Non-native species richness increased significantly in Plots 1 (p = 0.001) and 4 (p = 0.001) (Fig. 4). At the end of the trial, there were significant differences in non-native species richness between plots (p = 0.001), with pairwise differences between Plot 1 and Plots 3 and 4 (Plot 1 vs. 3: p = 0.001; Plot 1 vs. 4: p = 0.049). There was a marginally significant increase in native richness in Plots 3 (p = 0.057).

SUMMARY AND RECOMMENDATIONS

Undisturbed cover: Weeding C. hirta-dominated understory at Lower Oapaulea produces reduced C. hirta cover paired with an increase in native cover after 18 months if initial weeding is followed by additional weeding 6 or 12 months later. However, substantial increased cover of non-native weeds other than C. hirta occurred, particularly the alien grass P. conjugatum. The plot weeded only once had very poor results after 18 months, with no change in native cover, and a resurgence of non-native cover to nearly as high as it was prior to weeding. Re-weeding (including grass control) should occur within 6 to 12 months, in order to allow native cover to expand and prevent weed cover from returning to near prior levels.

Species richness: Increased weed species richness resulted from a 12 to 18 month delay in re-weeding. Native species richness did not change substantially, the increase in native cover that occurred in the plots weeded twice was largely an expansion of species already present. Because C. hirta-dominated areas are partially replaced by other weed taxa, care should be taken to ensure that more problematic weeds do not become established.

Maturation time: Though the minimum time for C. hirta maturation from the small immature stage was 12 to 18 months in the weeding plot, the presence of mature plants in true-colour false photos, users manual and program documentation. Copyright © 1999 Simon Fraser University, Burnaby, British Columbia, and the Institute of Ecosystem Studies, Millbrook, New York.

REFERENCES


Canopy openness: Differences in understory change among plots may have been influenced by differences in light availability, as canopy openness differed among plots. Clearcutting non-native canopy in this area is not advised, unless there are resources to follow up and prevent C. hirta from becoming established.

Canopy openness: There was no significant change in canopy openness between the weeding efforts, there were significant differences among plots at the end of the trial (p = 0.001) (Fig. 5). Plot 2 was more open than all other plots, while Plot 4 was the least open.

Figure 4. Mean non-native and native species richness at the beginning and end of the trial. *Significant, **marginally significant, change within treatments denote significant difference between plots at the end of the trial.

Figure 3. Mean percent canopy openness at the beginning and end of the trial. Letters denote significant differences among plots at the end of the trial.