



Propane Flaming *Genista monspessulana* Resprouts

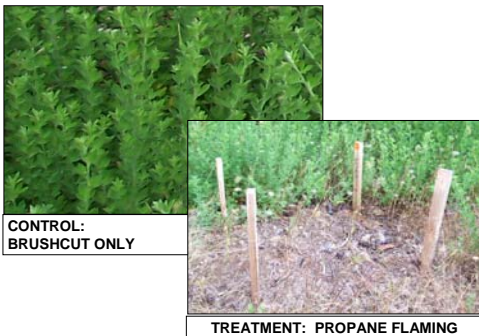


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Abstract: Propane flaming has been shown to be an effective tool in managing *Genista monspessulana* seedlings. The Marin Municipal Water District (MMWD), in conjunction with the Marin Conservation Corps (MCC) /Americorps Program, tested the efficacy of single-pass propane flaming on resprouting *G. monspessulana* plants that had been repeatedly mowed. We compared the mortality rates of single-pass flaming of resprouting *G. monspessulana* with that of a control treatment--brushcutting. We also examined the impact of stump size on survivorship. We found a statistically significant difference in the effects of propane flaming versus brushcutting, with propane flaming resulting in higher mortality rates and greater decreases in both percent cover and overall *G. monspessulana* growth post-treatment. Propane flaming resulted in a mortality rate of 80%, while the control treatment of brushcutting resulted in a 2% increase in the mean number of live stems per plot. Size had a statistically significant impact on survivorship (p-value < 0.01). Mean root crown diameter of surviving plants was 13.6 cm while the mean root crown diameter of killed plants was 7.8 cm. The largest individual to be killed by flaming had a root crown diameter of 31.5 centimeter. It should also be noted that the *G. monspessulana* mortality rate in the size effect trial was only 54%; we believe this is a direct result of our intentional selection of very large resprouts for inclusion in the trial.

Background: The Marin Municipal Water District owns and manages approximately 18,500 acres of watershed lands in the Mt. Tamalpais region of Marin County. While only 3% (700 acres) of district lands are infested with *G. monspessulana*, this invasive species poses a significant challenge. Because district policies prohibit the use of herbicide applications in close proximity to the reservoirs and upstream creeks, the District's approach to *G. monspessulana* management has been that of containment. Extensive stands of *G. monspessulana* are mowed annually to prevent seed production and reduce fuel loading. This method does not result in high levels of broom mortality and does not address the long-term maintenance costs or habitat degradation posed by *G. monspessulana* resprouts. Sites that have been previously treated by mowing are considered unsuitable for handpulling due to the high density of resprouting shrubs with extensive, hard-to-pull root masses. Handpulling, a lethal method that promotes the long-term recovery of invaded sites and over time reduces maintenance costs, is therefore restricted to unmowed sites.

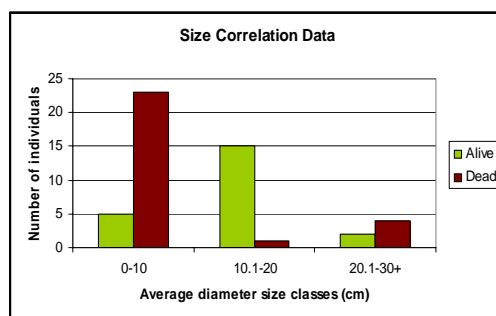
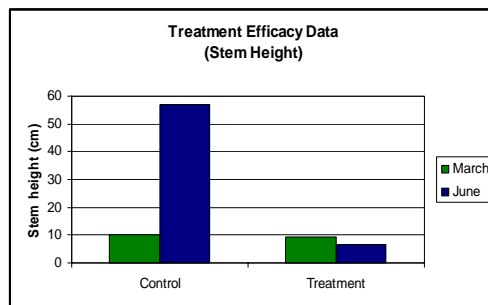
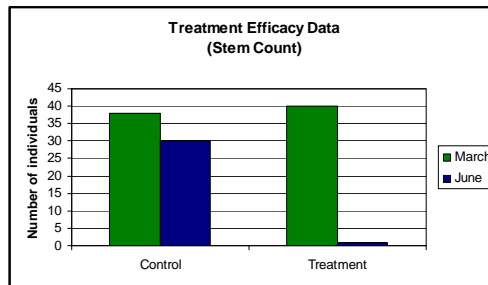
MMWD recently adopted the use of propane flaming to kill *G. monspessulana* seedlings that emerge after handpulling or broadcast burning. In this study, we examine the potential of propane flaming to treat previously mowed, resprouting *G. monspessulana*.



Methods: In March 2005, all *G. monspessulana* in the site received the annual treatment of brushcutting to a height of 10 cm. For the treatment efficacy experiment, eight plots were set up for control and received no additional management. Sixteen plots were set up for treatment and were flamed until individuals became charred using a liquid-withdrawal torch propane system (Red Dragon Liquid torch kit: liquid torch 750,000 BTU). Flaming time varied with the size of individual plants with flame applied for as long as was required for all above-ground parts of target plants to appear charred. Treatment and control plots were 1/2 m by 1/2 m separated by 1 m buffers. Plot location was randomized to prevent topographical biases. Data were collected on stem height, number of resprouts and seedlings and percent cover. Data were collected immediately before flaming and again in June, 2005. For the size correlation experiment, fifty plants (25 larger individuals and 25 smaller individuals) in close proximity to each other were tagged. The diameter of each plant was recorded in four cross sections, according to cardinal directions. The mean diameter size of treated *G. monspessulana* stumps was 10 cm (+/- 2). The individuals were flamed until they appeared charred. After three months, data was collected on the survivorship of the individuals. The data were analyzed using one-tailed t-tests.



Site description: The study site is located at Pine Point on the Bon Tempe Lake shoreline in the Mount Tamalpais Watershed in Marin County, California. The site was quarried during the construction of Bon Tempe Dam and is highly disturbed. Stem density in the area is approximately 71,000 stems per acre. *G. monspessulana* is well established on the remaining subsoil. For the past fifteen years, the site has been mowed at least annually. The site was burned in the summer of 2001 as part of a larger habitat restoration project. The study was conducted between March and June 2005. Unseasonably late rains occurred multiple times following the initial treatment.



Results:

Treatment Effects

The treatment of brushcutting previously mowed *G. monspessulana* followed by propane flaming resulted in statistically significant decreases in live *G. monspessulana* stems per plot (p < 0.001) while the control of brushcutting alone resulted in no statistically significant change in live *G. monspessulana* stems per plot (p = 0.44). Treatment plots also experienced a statistically significant decrease in percent cover of *G. monspessulana* (p < 0.002) with mean percent cover per plot dropping from 4.4% to 1.4%. Control plots experience a statistically significant increase in percent cover of *G. monspessulana* (p < 0.002) with a mean percent cover per plot increasing from 5% to 51.6%. Propane flaming decreased the mean stem height per plot from 9.4 cm to 6.8 cm, although this was not statistically significant (p < 0.15). In control plots, the increase in mean stem height from 10 cm to 56.7 cm was statistically significant (p < 0.001).

Size Effects

The size of *G. monspessulana* individuals subjected to propane flaming was correlated with survivorship. There was a statistically significant difference in the mean root crown diameter of individuals that survived 3 months following treatment (p < 0.005), with surviving individuals having a mean root crown diameter of 13.6 cm and dead individuals having a mean root crown diameter of 7.8 cm. Large individuals did succumb to treatment however; the largest plant to die following propane flaming was 31.5 centimeters in diameter.



Discussion and Conclusions:

Propane flaming is an effective method for killing previously brushcut *G. monspessulana*, although the size and age of the individual plants targeted for treatment impacts survivorship. We believe greater size results in greater survivorship because individual plants with larger root crown diameters have correspondingly higher nutrient reserves stored in their roots and are better able to recover from a flaming treatment. Propane flaming resulted in the death of some very large individuals, but we believe the torch operator applied flame to these individuals for longer periods of time than to smaller plants.

Our two trials, treatment effect and size effect, resulted in mortality rates of 80% and 54% respectively. We believe the difference in these mortality rates reflects the effect of size on survivorship. In choosing individuals for the size effect trial, we intentionally included individuals at the high end of the overall size distribution of *G. monspessulana* in the project area, thus selecting a disproportionate number of likely survivors.

Propane flaming appears to be a viable option for killing previously brushcut *G. monspessulana*. As expected, it is most efficient when used on younger, smaller *G. monspessulana* individuals. The method is slow and the equipment somewhat cumbersome, particularly on steep slopes. Its safe use is limited to the rainy season. Nonetheless, it offers a non-chemical alternative for effective *G. monspessulana* management.