

Research Progress Report

Proposal 05-R-02

Title: Mechanisms and Impacts of Integrated Pest Management for Sustainable Dalmatian Toadflax Control in the Western US

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Dalmatian toadflax is a highly invasive forb that threatens rangelands throughout the Western U.S.; this exotic forb is classified as a noxious weed in every Western state except Utah, Alaska, and Hawaii and impacts many different private and government land managers (Figure 1). Dalmatian toadflax is very difficult to control. Cultural control is largely ineffective and impractical on many invaded rangelands. Chemical control has shown promise, though herbicides can have detrimental effects on non-target plants. Biological control of Dalmatian toadflax with the weevil, *Mecinus janthinus*, has also shown promise but suppression is slow or insufficient under some conditions. Very little is known about IPM (integrated pest management) of Dalmatian toadflax, though this approach is clearly warranted. Our research seeks to evaluate IPM strategies for Dalmatian toadflax control using a combination of reduced-rate applications of one of two herbicides currently used for toadflax control (imazapic or picloram) and releases of the Dalmatian toadflax stem mining weevil (*Mecinus janthinus*). The overall objective of our approach is to minimize risk to non-target species, while achieving rapid, long-term and economical Dalmatian toadflax management.

This spring, we established three study sites for the project. The sites are located near Cheyenne, Wyoming, Centennial, Wyoming, and Lyon, Colorado. The three sites differ widely in their attributes including elevation, precipitation, and plant community composition. During the late spring and summer, we collected baseline data on plant community composition and cover, forage productivity, and Dalmatian toadflax density and cover from each plot (60 plots per site). In late May and June, we released the biological control agent *Mecinus janthinus* (30 insects per plot) into each plot receiving that treatment. We were successful in keeping the insects out of the untreated plots by applying a systemic insecticide. This fall we will monitor establishment of the insects and then apply certain herbicide treatments to the newly emerged toadflax stems. During the spring and summer of 2007, we will monitor the plots to determine the impact of integrating the biological control agents with different herbicides at commercial and reduced rates on the toadflax, non-target plants, and forage productivity.

To determine the mechanisms of impact, we are focusing on the root system of Dalmatian toadflax where clonal reproduction is initiated. We have established a greenhouse study using a minirhizotron approach to quantify the treatment effects on the root system of Dalmatian toadflax (Figure 2). Using this method, we are able to quantify root dynamics non-destructively in response to the bioagent and the herbicides. This part of the project will run through the fall of 2007.



Figure 1. Dalmatian toadflax invasion following a severe wildfire in Wyoming. While this is a common post-wildfire response, fire is not required for invasion.



Figure 2. The minirhizotron system. The camera is attached to an indexed handle and is inserted into a clear acrylic tube through the side of the container. Root images are captured and stored on a portable laptop computer for analysis with imaging software.