Western IPM Center

Project Report Form

How to submit: Please submit this completed form electronically, as an attached Microsoft Word file, to Jane Thomas at jmthomas@tricity.wsu.edu. If you have questions, contact Linda Herbst, (530) 752-7010. **Content:** Complete each section below, and include responses to as many of the questions listed in Attachment A as are relevant to your project. *These are guidelines.* Provide your readers with enough detail that someone who is not familiar with your project can understand what you were trying to achieve, how you went about it, and what you accomplished, but please keep it concise.

A. Report Data

Date: 3/24/2010
Reporting Period: 2009
Report Type (please check one):
☒ Progress Report ☐ Final Report

B. Grant Data

- Grant Agreement #: 07-001492-MON10
- Title: Integrating Biological Control and Targeted Sheep Grazing to Suppress Spotted Knapweed
- Grant Type: IPM Issues
- Lead investigator:
  - Name: Jeffrey C. Mosley
  - Title: Professor
  - Institution: Montana State University
  - Address: 119 Linfield Hall, Bozeman, MT 59717
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  - Email: jmosley@montana.edu
- Team members (name, title, institution): Rachel Frost, Research Scientist, Montana State University; Tracy (Brewer) Mosley, Park County Ag Agent, Montana State University
- State(s) involved: Montana

C. Nontechnical Summary. An overview of the project, briefly outlining the problem(s), how your project addresses them, and your results, *written to a lay audience.* (500 words)

Spotted knapweed (Centaurea stoebe L.) is an invasive, non-native weed that threatens the ecological sustainability of western rangelands and the economic sustainability of western ranches and rural communities. Spotted knapweed control has typically involved integrated management including herbicides, biological control, livestock grazing, or some combination of these. Limited research to date has evaluated the synergistic (or potential antagonistic) effects of combining targeted sheep grazing and biological control agents for spotted knapweed control. In some instances in the West, ranchers and land managers have been reluctant to implement targeted grazing where they have invested resources to establish biological control agents for fear that the sheep may adversely impact the efficacy of the insects and/or negatively impact insect populations directly. The goals of this project are to evaluate the effects of combining targeted sheep grazing and biological control to suppress spotted knapweed (Centaurea stoebe L.) and to determine the effects of targeted sheep grazing on biological control insect presence and activity. This research project will compare the effects of biological control only vs. biological control + sheep grazing on: 1) number of biological control insects present; 2) insect activity on buds and roots; and 3) number of viable spotted knapweed seeds per plant. Results from this research will help explain ecological relationships between biological control insects and sheep, and the ecological response of spotted knapweed to defoliation by the two control agents. All results will be extended to land managers and contract graziers through written publications, oral presentations, peer-reviewed journal articles and site tours.

D. Objectives and Progress. List your objectives and describe your progress for each objective.

Objective 1: Compare the effects of biological control vs. biological control + sheep grazing on the number of adult biological control insects present: 1) immediately following the sheep grazing period (July), and 2) at spotted knapweed senescence (September). A study site with an acceptable population of insect biological control agents was identified and fenced in June of 2009. Vegetation and insect sampling transects were established and pre-treatment vegetation measures (cover and number of flowers of spotted knapweed plants) were conducted. Biological control insect abundance was measured immediately prior to sheep grazing in July and immediately following sheep grazing. Final insect abundance measures were taken at knapweed senescence. Biological control agent populations decreased following sheep grazing. These numbers will be compared to pre-treatment populations in 2010 for a better understanding of the long-term impacts of sheep grazing on insect populations.

Objective 2: Compare the effects of biological control vs. biological control + sheep grazing on the occurrence of pupae and larvae in buds/flower heads and roots at spotted knapweed senescence.

All buds and flowers within 10 plots located along the transect were collected and returned to the lab for analysis. Flowers were dissected and examined for evidence of seedhead feeding weevil activity. The percent of buds damaged by weevils was determined for each treatment paddock. Activity of root boring weevils was not evident at senescence and will be determined prior to grazing in 2010.

Objective 3: Compare the effects of biological control vs. biological control + sheep grazing on the number of viable spotted knapweed seeds present per plant at spotted knapweed senescence. Seeds from the collected flowers and buds were counted and tested for viability in the laboratory by staining with a tetrazolium (TZ) solution. Three subsamples of twenty seeds or one-third of the total number of seeds from each plant were used in the viability tests. The percent viability for recovered seeds was determined for each treatment paddock.

Objective 4: Present research results to interested groups and individuals through national, regional, and local professional meetings; field days; and working group meetings. Initial results have been presented in an educational seminar on targeted grazing to BLM employees from all over the United States as part of an annual training program for certification in pesticide application. The project has also been introduced at local watershed meetings and weed summits in several counties in Montana. A producer tour of the study site is tentatively planned for the summer 2010 field season.

E. Outputs. List your project's outputs, which might include publications, information, data, meetings held, attendance at meetings held, etc.

Initial results have been presented in an educational seminar on targeted grazing to approximately 120 BLM employees from all over the United States as part of an annual training program for certification in pesticide application. The project has also been introduced at local watershed meetings and weed summits in several counties in Montana to approximately 112 attendees. A producer tour of the study site is tentatively planned for the summer 2010 field season.An annual project review meeting with cooperators is scheduled for April of 2010.

F. Impacts and Potential Impacts. The "impacts" and "potential impacts" sections of your report will help the Western IPM Center highlight the value of IPM research and education by detailing the real-world impacts of Center-funded projects. We will use the information in news articles, reports, and informational brochures to showcase the impacts of projects that our program supports. *See Attachment A at end of form for questions to assist you in describing the impacts of your project.*

1. Impacts. Describe any impacts of your work. ***Impacts*** are specific changes in condition for those affected by your work. Impacts include adoption of technology, creation of jobs, reduced cost to the consumer, less pesticide exposure to farmers, access to more nutritious food, and a cleaner environment and healthier communities.

2. Potential impacts. Describe your project's potential impacts. ***Potential impacts*** are the ways that your project's outputs could directly lead to changes in condition that will unfold in the future.

Outcomes

Results of this proposed research will reveal synergistic, neutral, or antagonistic relationships between the biological control agents and targeted sheep grazing. In any case, it is critical that the scientifically sound results be disseminated to those who have responsibility to manage spotted knapweed-infested rangelands, as well as to educators and interested parties.

If a synergistic relationship is discovered between insect biological control agents and targeted sheep grazing, all infestations of spotted knapweed currently controlled by biological control agents solely will become potential targets for integrating targeted sheep grazing with the biological control to enhance control of spotted knapweed. Similarly, in areas where biological control agents are currently absent and spotted knapweed is being controlled by targeted sheep grazing alone, introducing Urophora, Larinus or Cyphochleonus and implementing the proposed integrated approach would exacerbate the negative impacts imposed on spotted knapweed populations.

Antagonistic Relationship: If an antagonistic relationship is revealed between Urophora, Larinus and/or Cyphochleonus populations and targeted sheep grazing through this project, it will be critical to educate those involved in spotted knapweed control that the two methods are not compatible and should not be employed simultaneously on a site.

Neutral Relationship: If the two methods do not positively or negatively affect the other, it would make economical sense for that manager to focus resources on the one control method that fits the local situation and management goals the most closely.

Technology Transfer: It will be critical that all information gleaned from this study be disseminated to a wide variety of groups and individuals across the West. This information can be used by managers as they plan and implement spotted knapweed control in their area.

G. Leveraged Funds. List *additional funding* you have acquired because of the data and results yielded in this WIPMC-funded project.

Additional Funding Award #1:

Date of Award: 7-01-09	Name of Granting Entity: Western Region Sustainable Agriculture Research and Education (WSARE)
Dollar Amount: $49,865	Name of Grant Program: Research and Education Grants

Grant Period Duration: 3 years

Additional Funding Award #2:

Date of Award: Name of Granting Entity:
Dollar Amount: Name of Grant Program:
Grant Period Duration:

Additional Funding Award #3:

Date of Award: Name of Granting Entity:
Dollar Amount: Name of Grant Program:
Grant Period Duration:

H. Appendices

1. With your report, please attach ***at least two (2) photographs*** that illustrate your project. Please describe the photo and indicate the name and institution of the person who took the photo. (If you submit more than two photographs, please include those additional descriptions and photo credits under "I. Additional Information," below.)

Photo #1 description:

A spotted knapweed plant with all the buds and flowers removed by sheep grazing.

Photo #1 credit (photographer's name and institution):

Rachel Frost, Montana State University

Photo #2 description:

A newly emerged Cyphocleonus achates beetle perches on a spotted knapweed stem.

Photo #2 credit (photographer's name and institution):

Rachel Frost, Montana State University

2. Also attach any printed fact sheets or other publications resulting from your work that will enhance our understanding of your project and its impacts. Please provide a description of each attached publication below.

Document #1 description:

Document #2 description:

Document #3 description:

I. Additional Information

Credit: *Some of the language about impacts and potential impacts was adapted from a PowerPoint presentation by H. Michael Harrington, Executive Director, Western Association of Agricultural Experiment Station Directors, Colorado State University.*

Attachment A

Questions to Help in Reporting Impacts and Potential Impacts

Below are some questions that will guide you in assessing and then describing the impacts and potential impacts of your project. The relevance of each question may vary depending on whether yours is a research or extension project. Please answer as many as you can to the best of your ability, and feel free to describe any additional types of impacts not mentioned below. Remember to identify any potential impacts.

1. ***Innovations in IPM:***
   Are there new IPM practices that have been (impacts) or could be (potential impacts) adopted as a direct result of your project? What is the total number of acres (or homes, schools, greenhouses, nurseries) on which these practices could realistically be implemented?
2. ***Safeguarding human health and the environment:***
   a. Has the project reduced risk (or could it potentially do so) by changing the use of pesticides on farms, in homes, in schools, etc.? For example, could it result in fewer sprays per season or a switch to lower-risk pesticides? If possible, quantify the changes in condition. (Since there is no unanimous definition of *high* and *low risk,* investigators selecting this indicator are asked to categorize the pesticides they are reporting on as *high* or *low risk* according to the particular situation [e.g., lower risk to natural enemies]).
   b. Are there any other impacts or potential impacts on human health or the environment as a result of your project?
3. ***Economic benefits:***
   a. What is (or could be) the economic benefit (e.g., dollars saved) for clientele who adopt IPM strategies and systems you studied? Do you envision potential commercialization or mass production of these systems?
   b. How many clients are satisfied with IPM results (such as improved yield, improved quality of yield, reduced pest populations, more effective pest control, greater preservation of nonpest species)?
   c. Are there other financial benefits that might be realized (potential impact) as a result of your project?
4. ***Implementation of IPM:***
   a. How many IPM strategies and systems have been validated through this project (e.g., through on-farm trials, large plot tests, or other methods used to confirm efficacy)?
   b. How many educational materials were delivered? To whom? And what are the impacts or potential impacts?
   c. What is the number of growers/personnel trained? And what are the impacts or potential impacts?
   d. For a Web site, what volume of traffic and type of use has the site experienced? (For example, number of visitors per day or month; number of page views; number of unique user sessions; change in volume during growing season; average viewing time.) And what are the impacts or potential impacts?
   e. How many more people adopted IPM practices as a direct result of your project, or how many people adopted new IPM practices?
   f. Are there other ways in which your work will result in improved use or increased implementation of IPM strategies in your region or across the West?
5. Has your project or study increased collaboration among stakeholders interested in the development and implementation of improved IPM strategies and systems?