



TO BURN OR NOT TO BURN: WHAT IS THE QUESTION?

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INTRODUCTION

Conservation biology can be advanced through a greater understanding of locally relevant environmental issues and how science plays a role in these issues. By investing in education of the general public, it is possible to make a large difference in understanding critical conservation issues such as invasive species and biodiversity crises. To focus on the general public increased understanding, high school science classes are the perfect target for this type of education. As a demonstration project at a local high school, we conducted an experimental prescribed burn in a field dominated by invasive weeds. Our goal was to teach:

- Process of science using hands-on learning
- Field ecology as science
- Locally relevant ecological issues: disturbance & invasive weeds

METHODS

We developed this study with eight sophomore classes (~200 students); students were divided into groups of three, making ~ 8 groups/class. To ensure the students were able to fully participate in the experiment, the students needed to have knowledge of:

- experimental design
- population biology
- importance of good scientific questions

We implemented outdoor experiential learning activities throughout the year that addressed these issues (Figure 1). Each group developed questions and we selected and reframed the best eight questions (Figure 2) and assigned each group a question. We used a Before-After Control-Impact (BACI) design with three replicate a 20 x 20 m plots of three treatments:

- control
- fuel augmentation with weed-free straw and
- fuel augmentation with dried leaves (Figure 3).

Students collected pretreatment data, witnessed the burn, collected post treatment data and then interpreted the results.



OUTDOOR EXPERIENTIAL LEARNING ACTIVITIES

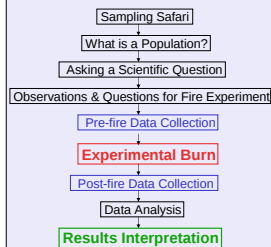


Figure 1. Hands-on activities implemented during school year. Each activity was implemented during a 1.5 hour class period.

QUESTIONS:

How will different levels of fuel augmentation followed by prescribed fire affect:

- 1) insect composition and density?
- 2) biotic soil factors (bacteria)?
- 3) abiotic soil factors (moisture, nutrients)?
- 4) cheatgrass and bunchgrass density?
- 5) plant growth rates (biomass)?
- 6) individual plant vigor and growth?
- 7) plant species composition?
- 8) moss density?

Figure 2. Questions developed by students for the prescribed fire experiment



Students collecting soil samples and counting moss in a Daubenmire frame

ABSTRACT

The ECOS Program is a partnership between the University of Montana's Division of Biological Sciences and College of Forestry and Conservation and Missoula County Schools Curriculum Consortium. The goal of ECOS is to contribute to an adaptable model of how locally based ecological research can be introduced to improve the teaching and learning of science in K-12 environments. A primary objective of ECOS is to develop science demonstration projects related to local ecology and conservation biology. As a demonstration project at a local high school, we conducted an experimental prescribed burn in a field dominated by invasive weeds. The project focused on two primary ecological themes: disturbance and invasive organisms, both of which are extremely relevant locally because residents often burn fields to reduce invasive weeds. This project successfully taught students about the scientific process and about ecology as science by having them develop and participate in a field experiment. We also designed and implemented other outdoor exercises throughout the school year to ensure the students fully participated in the experiment, including lessons on sampling, population biology and data collection. This demonstration project can be used as an international model for teaching science through hands-on schoolyard ecology.



Figure 3. Schematic of prescribed burn plots and photo of site.

EXAMPLE OF STUDENT QUESTION: EFFECTS ON MOSS DENSITY

Question 8: How will different levels of fuel augmentation followed by prescribed fire affect moss density?

Method: The students selected 20 random cells per plot and used a Daubenmire frame to visually estimate % cover of moss. The students places painted nails in the corners while collecting pre-treatment data to ensure measuring the same area post-treatment. Data was collected once pre-treatment and once post-treatment.

Result: Insert graphs

Interpretation: Students were given similar graphs and asked several questions to ascertain if they could interpret the data.

STUDENTS COMMENTS ABOUT THE PROGRAM

We gave an anonymous survey to all students at the end of the year and asked what they learned.

- "I learned how to ask a question & break it down to learn how to answer it"
- "ECOS taught me more about the scientific process than any one thing"
- "It gave me a better insight into ecology and how scientists draw their conclusions"
- "That ecology is in our everyday life"



CONCLUSIONS

Although this project required an extensive time commitment from both ecologists and teachers, all participants gained valuable skills and insights.

- Ecologists learned how to communicate to students from expert teachers.
- Teachers gained insight into how field experiments are conducted.
- Collaboration among university, public agency, and high school built community ties.
- Community willing to help education-related projects, we received donations of time and equipment from various individuals and organizations
- Experiment does not need to be as large-scale, most schools can find a small area outside to conduct an experiment.
- Students need to actively participate in process, not just observe. **Student participation is more important than data quality.**

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