**Using Citizen Science to Monitor Impacts of Climate Change on Forest Ecosystems**

Proposal to the Climate Change Studies Program, College of Forestry and Conservation

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## OVERVIEW

I am proposing to work with Drs. Cara Nelson (UM) and Travis Belote (The Wilderness Society) and the Monitoring Committee of the Southwest Crown of the Continent (SWCC) Collaborative Forest Landscape Restoration Program (CFLRP) to assess the efficacy of citizen scientists for monitoring forest ecosystem responses to disturbances. Understanding the extent to which citizens can be used to effectively monitor ecological change will be critical for developing programs to monitor ecosystem responses to climate change as well as interventions designed to mitigate climate change effects. The SWCC CFLRP Monitoring Committee has agreed to provide mentoring for this project, as well as supplies and travel for citizen-scientist events. Here, I am requesting money to support my work with this project this summer.

## PROBLEM STATEMENT AND BACKGROUND

Climate change is predicted to have far reaching impacts on ecosystems—from altering fire regimes (Westerling et al. 2006) to changing invasive weed distributions (Hellmann et al. 2008). With increasing concern and uncertainty about climate change, there is increasing need for monitoring programs that document both effects of climate change on ecosystems and the efficacy of mitigation and intervention activities. Recently, the popularity of using citizen scientists as multiparty monitors has increased. Although there are several high-profile examples of effective citizen science programs—including Project Budburst and Project Feeder Watch, which track phenological changes as a result of changing climate (Mayer, 2010)—the goal of citizen monitoring programs is largely considered to be solely educational, rather than to produce useable information (Moote et al. 2011). Managers and scientists often discount data collected by citizens because of concerns about data quality. However, the actual quality of citizen science efforts, and potential for contribution, has not been adequately assessed. The few investigations that have been done (Brandon et al. 2003, Fore et al. 2001, Galloway et al. 2006, Mumby et al. 1995, Nicholson et al. 2002) have focused primarily on aquatic ecosystems and have found that citizens can collect reliable data. To date, no one has evaluated the efficacy of using citizens to monitor invasive weeds or fuels, key variables for understanding change in forest ecosystems. Given the large amount of information needed on climate change impacts to forests, citizen-science programs could be very useful. But until citizen scientists have been proven to be reliable, data collected by them will be questioned. Thus, understanding the reliability of data collected by citizen scientists is a key need for developing climate change mitigation programs.

## OBJECTIVES

The objectives of the proposed research is to compare the reliability of data on invasive weeds and forest fuels collected by different types of citizen-science groups and trained professionals. This will help determine appropriate uses of volunteers for monitoring effects of climate change and other disturbances. Specific research questions that I will address include:

1) Does efficacy (determined as margin of error) of sampling for invasive plants and forest fuels vary with type of data collector (members of different citizen-science groups versus Forest Service employees)?

2) Does level of training (brief overview versus two-hour training session) affect efficacy of measurements.

## METHODS

This project will take place in the Southwestern Crown of The Continent (SWCC) region of western Montana, and specifically on the Lolo, Helena and Flathead National Forests. I propose to organize 12 volunteer days during the course of the summer, with four days each on each of the three National Forests. On each volunteer day on each Forest, I will have members of one of the following four types of groups collecting data: 1) grade-school-aged children, 2) college students, 3) community-group members, and 4) Forest Service fire fighters. I will aim to have at least ten individuals from a single group type participate at each volunteer event. At each event, all participants will collect fuels data along three Brown's transects and will measure cover of target invasive weeds along the three Daubenmire transects. Participants within each Forest will sample the exact same transects, so that measurements are directly comparable. All participants will receive brief instructions in the morning prior to sampling. In addition, half of the participants in each group will receive a two-hour training session mid-day; the other half will receive no additional training.

| Citizen Group | Potential Participants |
|---|---|
| Grade-school-aged children | Missoula Outdoor Learning Adventures, Missoula Natural History Center |
| College students | The Climate Change Studies field class 352, The Wilderness and Civilization Ecology class, Northwest Connection's Wildlife in the West program and Landscape and Livelihood program |
| Community groups | The Wilderness Institute, Wildland Restoration Volunteers |
| Professionals | Amber Kamps, District Ranger, Lincoln District, Helena National Forest, has agreed to allow fire fighters to assist with this study |

After data collection, I will conduct power analyses to determine the margin of error for each variable (abundance of fuels, cover of invasive plants) for each study group and training level on each Forest. Power analysis will also be used to determine the number of replicates necessary for each type of group. Results will be communicated to the SWCC CFLRP to assist with their design of long-term monitoring programs that include citizen scientists. Because there is so little information available on the efficacy of using citizens to monitor, I will work with Drs. Nelson and Belote to submit findings to a peer-reviewed journal.

## BENEFITS & CLIMATE CHANGE IMPLICATIONS

This project will produce data on the efficacy of citizen scientists that will be directly used by the SWCC CFLRP Monitoring Committee for designing their 10-year monitoring strategy. Thus it has the potential to make a substantive contribution to adaptive management efforts to mitigate potential climate change impacts on wildfire and invasive weeds. In addition, results will help scientists and managers outside of the region with the design of citizen-science efforts. Citizen science monitoring helps managers adapt their mitigation strategies of climate change impacts. Citizen science lies between ecological research and community based engagement. These are precisely the two areas that need to merge to effectively address climate change impacts. This project will help bridge that gap.This project will also give me an incredible opportunity to gain knowledge about experimental design and field data collection, while learning about community engagement.

## WORKS CITED

Brandon, A., Spyreas, G., Molano-Flores, B., Carroll, C. & Ellis, J. 2003. Can volunteers provide reliable data for forest vegetation surveys? *Natural Areas Journal,* 23**,** 254-261.

Fore, L. S., Paulson, K. & O'laughlin, K. 2001. Assessing the performance of volunteers in monitoring streams. *Freshwater Biology,* 46**,** 109-123.

Galloway, A. W. E., Tudor, M. T. & Vander Haegen, W. M. 2006. The reliability of citizen science: A case study of Oregon white oak stand surveys. *Wildlife Society Bulletin,* 34**,** 1425-1429.

Hellmann, J. J., Byers, J. E., Bierwagon, B. G. & DUKES, J. S. 2008. Five potential consequences of climate change for invasive species. *Conservation Biology,* 22**,** 534-543.

Mayer, A. 2010. Phenology and Citizen Science. *BioScience,* 60(3), 172-175.

Moote, A. 2011. Multiparty monitoring and stewardship contracting: a tool for adaptive management. *Sustainable Northwest*.

Mumpy, P. J., Harborne, A. R., Raines, P. S. & Ridley, J. M. 1995. A critical assessment of data derived from Coral Cay Conservation volunteers. *Bulletin of Marine Science,* 56**,** 737-751.

Nicholson, E., Ryan, J. & Hodgkins, D. 2002. Community data - where does the value lie? Assessing confidence limits of community collected water quality data. *Water Science and Technology,* 45**,** 193-200.

Westerling, A. L., Hidalgo, H. G., Cayan, D. R. & Swetnam, T. W. 2006. Warming and earlier spring increase western US forest wildfire activity. *Science,* 313**,** 940-943.

## TIMELINE AND BUDGET

**Timeline** = This project will be implemented over a 1-yr period, with a budget of $3,000.

| SEMESTER | ACTIVITY |
|---|---|
| Spring 2011 | Test volunteer day and sampling protocols; identify citizen groups |
| Summer 2011 | Conduct sampling and volunteer events |
| Fall 2011 | Analyze data, write report summarizing results |
| Spring 2012 | Technology transfer (article submitted to a peer-reviewed journal; presentation to CFLRP Committee, presentation to Climate Change Symposium |

**Budget –** I have already secured support for this project from the SWCC CFLRP for travel and supply costs for citizen scientist events. Here, I am requesting funds to cover my salary during the summer,

| EXPENSE | DESCRIPTION | $ REQUESTED |
|---|---|---|
| Transportation, Event Food, Materials[1] | | $ 0 |
| Student Stipend | 300 hours @ $10/hour | $3,000 |
| Total | | $3,000 |

[1] Contributed by SWCC CLFPR Monitoring Committee