

Catherine Kleier

Research Interests

I consider myself an applied ecologist, conservation biologist, restoration ecologist and environmental scientist. This means that my research interests may fall into any number of overarching disciplines in order to answer management questions. I am primarily concerned with gathering appropriate information to make data-driven management decisions, and I see my role as a facilitator in answering such questions.

Environmental assessment of human dominated alpine and subalpine ecosystems

Since 2006, I have been collaborating with Dr. Christy Carello from Metropolitan State College of Denver on an environmental monitoring project providing environmental data to the Town of Breckenridge, CO. This area of land, called Cucumber Gulch, is a 77 acre wildlife preserve that is located between the main area of town and the base of the Breckenridge ski resort. The gulch acts as a corridor for both wildlife and recreationists and also as a major recreation site. In 2008, the Town of Breckenridge approved the construction of a new gondola over this site, and much of our research was vital in determining the least destructive route over the wetlands. The City is using our data to understand the environmental impact of this development. In addition, we are keeping long-term weed management records to investigate the effectiveness of various weed management techniques. Aside from collecting long term environmental management data, I have also designed several research projects in the preserve. During the winter, the Town of Breckenridge clips 2 meter wide belts of willow shrubs to maintain several miles of cross-country ski paths, which presented an opportunity to study how this clipping might change reproductive output. From our study, we determined that clipping willow shrubs drastically reduces the reproductive output (catkin number). Although many willows reproduce locally via vegetative means, the decrease of sexual reproduction means significantly altering the variation within the population. Such limitations to variation could have negative impacts on the ability of willow to maintain itself as a dominant species within subalpine meadows. From our work, the Town of Breckenridge moved the cross-country ski trails into the forest and not over with willow shrubs.

Forest management impacts on Abert's Squirrel (*Sciurus aberti*)

This two-year project began as a small grant for Boulder County Parks and Open Space (BCPOS). Land managers wanted to know what effect different forest thinning practices had on Abert's squirrel populations. I collaborated with Dr. Kelly Worden at Red Rocks Community College to answer this question. We monitored Abert's squirrel (*Sciurus aberti*) populations in thinned and unthinned stands of ponderosa pine (*Pinus ponderosa*) in Heil Valley Ranch, which is an old ranch area that was bought by BCPOS for recreation and wildlife management. In 2008 and 2009, we sampled twenty-seven 4-hectare (200m x 200m) monitoring plots for incidence of Abert's squirrel over-wintering feeding activity and general vegetation characteristics important to their populations. We used a recognized feeding sign index regression model to estimate Abert's squirrel population size. Interestingly, we found no relation of canopy cover to squirrel density in 2008. However, in 2009 BCPOS started a chipping operation, which is where trees are cut and mulched, and the mulch is blown on the ground. This process requires heavy machinery in the forest and makes a lot of noise. In 2009, we found far fewer squirrels than in 2008, and we suspected that the chipping operation may have been the cause, although we didn't test that hypothesis directly. Because of our work, BCPOS decided to start a yearly census study to gain long-term data sets on Abert's squirrels.

Ecology and conservation biology of *Azorella compacta*

My dissertation work included research on *Azorella compacta*, a giant (> 2 m diameter) woody cushion plant in the Andes Mountains. *Azorella* is a remarkable plant considering that very small rosettes (< 1 cm) cover a plant that can amass a surface area of almost 10 meters. This plant grows above treeline in the altiplano where Peru, Chile, and Bolivia meet and has been overharvested in the past because it served as the only source of biofuel in this region when the railroad was built from La Paz to Arica, Chile to provide port access for Bolivia. Thus, my past work has demonstrated growth rate, demography, and physiology of this plant in order to determine the present age and recovery of the population. In future trips, I will evaluate experiments I set up to determine germination rates and microhabitat requirements for germination. These experiments will provide valuable information for the conservation of this unique species.

Ecology of *Chrysothamnus viscidiflorus* in the White Mountains, CA

Another part of my dissertation work included demography and range descriptions of curly-leaved rabbitbrush (*Chrysothamnus viscidiflorus*) at the White Mountain Research Station (WMRS) in the White Mountains of Eastern California. This ecosystem is very unique in being high in elevation and also extremely dry. Through my work, I've been able to document the upward expansion of this shrub, and I would like to continue this long-term monitoring as well as develop other questions about the flora of this area, such as facilitation questions involving the Bristlcone pine (*Pinus longaeva*). The projects at WMRS are also good for undergraduate and graduate student projects because of the facilities located there.

Restoration and conservation of urban and alpine ecosystems and

Recently, we developed a community garden on our campus from an urban weed lot. I am also exploring the most cost effective and low maintenance approaches to restoring urban weed lots. Another research interest involves the impacts of dogs on wildlife and flora. This impact is easily quantified via observational studies on the flora and fauna of regional parks and open space that allow dogs versus those that do not allow dogs. I am developing some contacts to develop a research program in alpine restoration of trails and mine sites.

Student-generated projects

Lastly, I have undertaken several studies investigating the reduction of plant growth and fecundity due to the road salt magnesium chloride. This work has been entirely in the laboratory to date. Recently, students have also developed the herbarium at Regis, investigated quantitative reasoning in introductory environmental science texts, and surveyed students about the environmental studies capstone course in environmental assessment. Currently, students are working on burned soil and grass germination and projects for making Regis a more sustainable campus.