

## ALDO LEOPOLD WILDERNESS RESEARCH INSTITUTE

<http://leopold.wilderness.net/>

### MANAGING RECREATIONAL IMPACTS TO MOUNTAIN VEGETATION: PLANT RESPONSE TO TRAMPLING

**Keywords:** campsites, ecological impact, recreation ecology, resistance, vegetation impact

**Background & Management Issues:** The impacts of camping and hiking on high-elevation plant communities are a concern to many wilderness managers. A common management strategy is to encourage wilderness visitors to concentrate their impacts by using trails and established campsites, thus minimizing the spatial extent of recreational impacts. Where use levels are low, however, impacts can be largely eliminated if hikers spread out and use previously undisturbed sites. The keys to this strategy are (1) to only disperse use where use levels are low and (2) to help visitors choose hiking routes and campsites that are resistant and/or resilient.

The studies described here provide information on the response of different plant communities to differing levels of use, and the ability of different vegetation types to recover after impact. These results may be used by managers to judge where on the landscape use should be concentrated – or dispersed – to minimize impacts of camping and trampling. The results should also be useful to hikers who travel off-trail and want to minimize their impact.



Popo Agie Wilderness, Wind River Range.  
Photo: Craig Allin, NWPS database: <[www.wilderness.net](http://www.wilderness.net)>

#### **Project Objectives**

- ❖ To assess how rapidly impact occurs when different vegetation types are subjected to varied intensities of trampling and camping, as well as how long it takes for recovery to occur.
- ❖ To predict the resistance and resilience of different vegetation types based on readily observable plant characteristics.

#### **Project Description:**

Experiments were conducted at five sites in the Wind River Range, Wyoming. Two sites were located within sub-alpine coniferous forests, one with a ground cover of erect forbs, and one dominated by the low shrub, *Vaccinium scoparium* (grouse whortleberry), the most widespread subalpine vegetation type in the Rocky Mountains. The other three sites were non-forested. They were (1) a seasonally wet subalpine meadow of dense, graminoids and forbs, dominated by the grass *Deschampsia caespitosa* (tufted hair grass); (2) a dense, drier alpine turf comprised mainly of graminoids; and (3) a plant community dominated by matted forbs that was transitional between alpine turf and fell-field. Trampling experiments were applied in all five plant communities. Treatments to the lanes varied in trampling intensity, and the number of years that trampling occurred. Some lanes were trampled one year and allowed to recover over the subsequent three years. Other lanes were trampled for each of three consecutive years, with recovery followed for one year. Measurements of vegetation cover, vegetation height, and species composition were taken over a three year period, pre- and post-trampling. Two of the plant communities used for the trampling experiment (the forested *Vaccinium scoparium* site and the *Deschampsia caespitosa* meadow) were used in the camping experiment. Previously undisturbed sites were camped on at intensities of either one or four nights/year, for either one (acute disturbance) or three consecutive years (Chronic disturbance). Camping treatments were applied by groups of four backpackers who were enrolled in National Outdoor Leadership School (NOLS) courses, and were well-versed in Leave No Trace techniques. Within each of the sites, changes in bare ground and vegetation height were measured over four years.

## ALDO LEOPOLD WILDERNESS RESEARCH INSTITUTE

### **Results:**

Detailed results can be obtained from the publications listed below. Some of the major findings are as follows.

**Trampling.** Low levels of trampling caused substantial reductions in cover and height, but subsequent rates of change decreased as trampling intensity increased. Changes in species composition also occurred but they were more modest. Plant communities varied greatly in both resistance (their ability to avoid being damaged) and resilience (their ability to recover from damage). Differences in resistance and resilience that were greater than an order of magnitude were observed in different plant communities growing immediately adjacent to each other. Plant communities dominated by low, woody shrubs or by erect forbs were less resistant than those dominated by groundcovers of turf-forming or clumped graminoids or by matted, creeping or low-growing forbs.

Response to chronic trampling (repeated for three years) was generally similar to response to acute (one year) trampling, although the differences between vegetation types were less when trampling disturbance was chronic.

**Camping.** Low levels of camping, even by campers trained in Leave No Trace techniques caused rapid and substantial impact. Near-maximum levels of impact occurred after the first year of camping in the forest and after the second year of camping in the meadow. Differences in impacts between the two plant communities were marked. The magnitude of vegetation loss on meadow sites, after four nights/year of camping for three years, was less than half that caused by one night of camping on the forest sites. Forest sites, even those camped on for just one night, did not recover completely within three years, while meadow sites recovered within one year, at the camping intensities employed in the experiment. These experiments also assessed the spatial pattern of impact on campsites.

### **Management Implications:**

- ❖ Extremely low levels of trampling and camping can cause significant impacts to vegetation, despite the practice of Leave No Trace techniques. Campsites can become substantially impacted after just a single night of use.
- ❖ The ability to tolerate impact varies greatly between plant communities that are growing in close proximity to each other. Consequently, impacts can be reduced if recreationists can be taught to recognize and avoid plant communities that are intolerant of trampling.
- ❖ On sites with vegetation dominated by low woody plants, such as grouse whortleberry (*Vaccinium scoparium*) or other plants with low resistance or resilience, impacts are most effectively limited by concentrating use on a few sites, as well as on a small portion of any campsite. However, more resistant vegetation types, such as those with dense or clumped graminoids and low-growing forbs, such as the tufted hairgrass (*Deschampsia caespitosa*) meadow, may endure low levels of dispersed use with little or no impact.
- ❖ The lack of resistance to recreational use exhibited by grouse whortleberry (*Vaccinium scoparium*) is of particular concern because this is the most common and widespread subalpine vegetation type in the Rocky Mountains.
- ❖ These results are most applicable to managing lightly used and off-trail areas.

### **Publications / Products:**

- ❖ Cole, David N.; Monz, Christopher A. 2002. Trampling disturbance of high-elevation vegetation, Wind River Mountains, Wyoming, U.S.A. *Arctic, Antarctic, and Alpine Research*. 34(4): 365-376.

#### **Leopold Publication Number 461**

- ❖ Cole, David N.; Monz, Christopher A. 2003. Impacts of camping on vegetation: response and recovery following acute and chronic disturbance. *Environmental Management*. 32(6): 693-705.

#### **Leopold Publication Number 505**

- ❖ Cole, David N.; Monz, Christopher A. 2004. Spatial patterns of recreation impact on experimental campsites. *Journal of Environmental Management*. 70: 73-84.

#### **Leopold Publication Number 498**

*For additional information...*

**David Cole, Leopold Institute Investigator**

phone: 406-542-4199

email: [dcole@fs.fed.us](mailto:dcole@fs.fed.us)

**Christopher Monz, St. Lawrence University**

phone: 315-229-5890

email: [cmonz@stlawu.edu](mailto:cmonz@stlawu.edu)