RMRScience
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Help with Restoring Wilderness Campsites

Scientists at the Rocky Mountain Research Station are in the midst of a study that is offering help for wilderness managers faced with the daunting task of trying to revegetate and restore overused campsites.

Their research takes root in the Wilderness Act of 1964 that dictates an often difficult and challenging mandate for managers – "wilderness areas are to be kept in a wild and natural state, relatively free of human influence and human control." Despite this emphasis on protection and preservation, wilderness areas are typically open to recreation use, and resultant impacts can be severe, particularly on campsites. Recreation use, often heavy and highly concentrated, has turned many sites into compacted, erosion-prone places, stripped of vegetation and topsoil.

Because little is known about factors that limit the rate of natural recovery or about the effectiveness of techniques designed to accelerate recovery of highly-impacted wilderness campsites, Station scientists designed a study to assess the effectiveness of several common restoration treatments on closed campsites in high subalpine forests. The study is taking place in the Eagle Cap Wilderness in northeastern Oregon – a site typical of many wilderness areas throughout the western United States. Research Biologist David Cole, with the Aldo Leopold Wilderness Research Institute in Missoula, Montana, says the study has three main objectives: to study the influence of 1) amending soils with organic matter, composted sewage sludge and a native soil inoculum; 2) transplanting and seeding with local, native species; and 3) applying a surface mulch on the establishment, survival and growth of vegetation.

A well-impacted campsite prior to restoration, illustrating loss of vegetation and compaction of exposed mineral soil.

The Study Site

Six campsites were selected for restoration in 1995. All had been heavily used, had virtually no groundcover vegetation, and had not been revegetated in the past. The sites exhibited high levels of impact (soil compaction, lack of vegetation and minimal soil organic matter) for at least 50 years.

Treatment Methods

Each campsite was divided into two plots, one with and one without a surface mulch application. Each plot was subdivided into six sections which received combinations of soil amendments and planting. All were scarified utilizing shovels, picks, pitchforks, hoes and hand kneading to break up compaction and clods to a depth of 15cm. Treatments that received an organics/inoculum treatment were covered with a mix of peat moss and well-decomposed, locally collected organic matter to a depth of about 2.5cm. The material was mixed with mineral soil to a depth of 7.5cm. Inoculum came from the rooting zone of local transplants that were being transplanted onto the site.

Experimental plots immediately after planting, showing mulch, transplanting and organic amendments.

Compost treatments had organic matter and inoculum added in an identical manner. In addition, scientists added 2.5 cm of composted sewage sludge, lightly watered and raked into the top 10cm of organic and mineral soil.

Half of the plots were seeded and transplanted. Seeding involved: 1) collecting seed locally from several species with mature seed; 2) dividing available seed into equal quantities for each seeded plot; 3) pinch-broadcasting seed over the plot; and 4) raking seed into the upper 2.5cm of soil.

Transplanting involved: 1) digging up enough transplants in the vicinity to plant equal numbers of each species in each plot; 2) digging a hole and placing transplants in the hole, along with Vita-start (vitamin B-1) to reduce transplant shock; and 3) giving each transplant 0.6 liters of water.

After planting, mulch mat is visible on the right.

Half of the plots were covered with a biodegradable erosion control blanket made of straw interwoven with cotton string and jute. Each campsite was closed to use by blocking main access points with string and an obvious sign. No evidence of camping use has been observed since campsites were closed to use. In 1996, when it appeared that soils were extremely dry, plots were watered several times with an equal amount of water. No supplemental watering was done in later years.

Results

Seedling establishment was assessed beginning in early July 1996. "Overall, the restoration techniques were highly effective," says Cole. "Virtually all of the transplants survived. Most were growing vigorously and many were flowering three years after planting," he said.

Cole and his counterpart in the study, Biologist David Spildie, believe soil amendments (organic matter, soil inoculum and composted sewage sludge) contributed greatly to the vigor of transplant growth. They note that surface mulch had no clear effect, either positive or negative.

Although seedling density varied greatly between campsites, the mean seedling density of perennial species on seeded plots was 267 seedlings/m^2 three years after seeding. Mean seedling biomass increased more than ten fold during the second growing season, and mean seedling height increased 68 percent during the third growing season. Scarification, seeding and the organic and compost soil amendment were all effective in increasing seedling density. Scarification and seeding had more effect on seedling establishment, while the soil amendment had more effect on seedling survival during the hot, dry summers. The organics and compost treatment was most effective in enhancing seedling growth, while the surface mulch and organics treatment had less effect.

The third growing season was hot and dry, and seedling survival declined dramatically. "This suggests that supplemental watering may be critical to effective restoration during years with hot, dry summer weather," says Cole and Spildie. "In fact, supplemental watering may be needed for several years, particularly where soils have not been amended with organic matter. It is quite possible that much of our success with seeding was the result of the supplemental watering done when seedlings were germinating during the initial growing season following seeding," they said.

Transplant coverage being recorded, using a meter square grid.

Results show that projected recovery rates vary greatly between treatments. Mean vegetation cover on undisturbed stands close to campsites was about 55 percent. Plots with the organic and compost amendment that were scarified, planted and mulched had a mean cover of 35 percent in 1998. This amounts to more than 60 percent recovery in just three years. "Projecting past recovery rates into the future, plots receiving this most beneficial treatment would experience complete recovery of cover in about five years," said Cole. "On planted plots without soil amendments, recovery would require about 10 years. On plots that are scarified but neither amended nor planted, recovery would require more than 100 years. Without scarification, recovery would take even longer," explained Cole.

Although more than 60 percent recovery of plant cover in three years seems successful, composition has not recovered as rapidly as cover. "Compositional recovery," says Cole, "will require many decades unless transplanting, particularly of shrubs, is done at densities that mimic undisturbed conditions."

Cole and Spildie recommend that closed sites remain signed and roped off at least until vegetation cover on restored sites approximates pre-disturbance conditions. They note that even with effective restoration techniques, it will likely require hundreds of years, after impacts are confined to the levels and places deemed acceptable, to restore all the places where impact is undesirable and unnecessary. "This suggests the importance of avoiding damage in the first place, by implementing effective management programs wherever regular recreation use occurs," say the scientists.

The effect of compost on plant vigor is apparent in the relative height of grasses to the right of the stake that marks the corner of the plot.

Further Reading

Additional details on this study are available in *Wilderness Science in a Time of Change Conference, Volume 5: Wilderness Ecosystems, Threats, and Management*, Proceedings RMRS-P-15-Vol-5, available in hardcopy from the Rocky Mountain Research Station at **http://www.fs.fed.us/rm/main/pubs/newpubs/np00_3js.html.**

Four other proceedings from the Wilderness Science in a Time of Change Conference have also been published by the Rocky Mountain Research Station. They include: *Changing Perspectives and Future Directions* (Proceedings P-15-VOL-1); *Wilderness Within the Context of Larger Systems* (Proceedings P-15-VOL-2); *Wilderness as a Place for Scientific Inquiry* (Proceedings P-15-VOL-3); and *Wilderness Visitors, Experiences, and Visitor Management* (Proceedings P-15-VOL-4). All are available on the above website, or by writing to the Rocky Mountain Research Station.

Aldo Leopold Wilderness Research Institute

The Aldo Leopold Wilderness Research Institute (ALWRI), located in Missoula, Montana, provides coordination and direction to ecological and human dimensions research relevant to the understanding and management of wilderness and other protected areas. It is the only research group in the Nation dedicated to developing the knowledge needed to improve management of wilderness and other natural areas. Administered by the Rocky Mountain Research Station, ALWRI operates under an interagency agreement among the Forest Service, National Park Service, Bureau of Land Management, US Fish and Wildlife Service and the Biological Resources Division of the US Geological Survey. Managers and scientists from all five agencies play an active role in developing programs and priorities aimed at a better understanding of: the character of wilderness ecosystems; the biological and social impacts of human activities on wilderness ecosystems; the role of wilderness in larger social systems; and the impact of different policy and management alternatives. For more information on ALWRI, and how science can help managers accommodate the wise use of wilderness, visit its website at **http://www.wilderness.net/leopold/intro.html**.

Publication Reviews

Wilderness Recreation Use Estimation: A Handbook of Methods and Systems

(General Technical Report RMRS-GTR-56)

Documented evidence shows that managers of units within the U.S. National Wilderness Preservation System are making decisions without reliable information on the amount, types and distribution of recreation use occurring at these areas. There are clear legislative mandates and agency policies that direct managers to monitor trends in use and conditions in wilderness. This report is specifically designed as a convenient resource for wilderness managers and others who have the responsibility of monitoring and describing visitor use in wilderness. It is a comprehensive manual on estimation techniques and procedures that are essential to appropriately and accurately measure visitor use-related characteristics and conditions. Guidelines enable the manager to evaluate options and decide on a use estimation system that meets the needs of a specific area and set of circumstances. This handbook provides, in a single source, all relevant information on setting objectives, making decisions about what to monitor, developing a sampling plan, collecting the needed information, and computing basic statistics to provide input into management decisions. The user should have mathematical abilities at least through algebra; knowledge of statistics and calculus would be helpful. You can order this publication by visiting **http://www.fs.fed.us/rm/pubs/newpubs/np00_3js.html**, or by writing the Rocky Mountain Research Station.

Monitoring Wilderness Stream Ecosystems

(General Technical Report RMRS-GTR-70)

This new report presents a protocol and methods for monitoring the major physical, chemical and biological components of stream ecosystems. The monitoring protocol is organized into four stages. At Stage 1, information is obtained on a basic set of parameters that describes stream ecosystems. Each following stage builds upon Stage 1 by increasing the number of parameters and the detail and frequency of the measurements. Stage 4 supplements analyses of stream biotic structure with measurements of stream function: carbon and nutrient processes. Standard methods are presented that were selected or modified through extensive field application for use in remote settings. *Monitoring Wilderness Stream Ecosystems*, General Technical Report RMRS-70, can be ordered by visiting **http://www.fs.fed.us/rm/main/pubs/newpubs/np00_4od.html**, or by writing the Rocky Mountain Research Station.

RMRScience is a quarterly report from the USDA Forest Service's Rocky Mountain Research Station. Each issue highlights on-going or recently completed research, and features findings useful to land managers and other natural resource specialists...a tool for getting research results into the hands of users. To be added to the mailing list, free-of-charge, write RMRScience, Rocky Mountain Research Station, 2150 Centre Ave., Bldg. A, Fort Collins, CO 80526; or e-mail cfletcher@fs.fed.us; or fax (970) 295-5927. Comments and suggestions are always welcome.

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USDA Forest Service
Rocky Mountain Research Station
2150 Centre Ave., Bldg. A
Fort Collins, CO 80526

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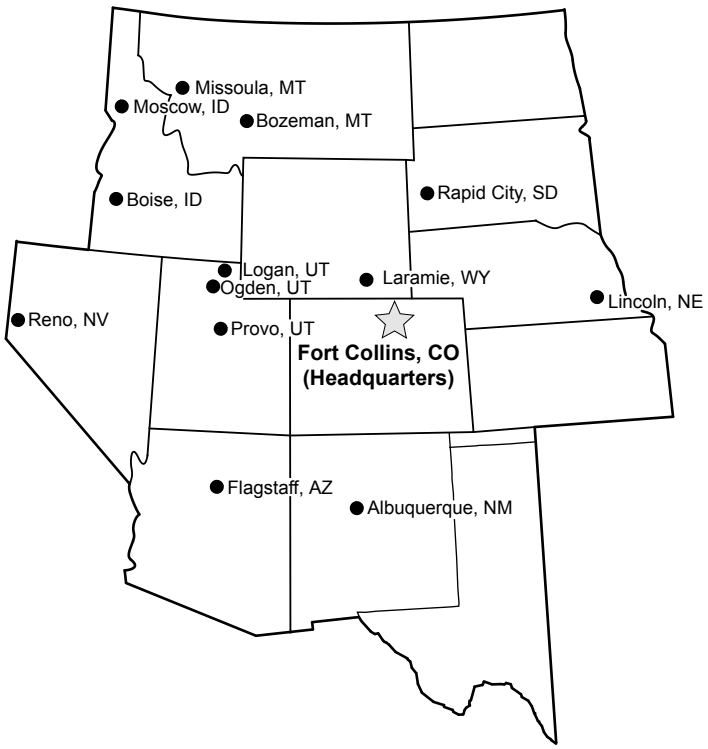

The USDA Forest Service's Rocky Mountain Research Station is one of seven units nationwide that make up the most extensive natural resource research organization in the world. Headquartered at the foot of the Rockies in Fort Collins, CO, the Station maintains 14 field laboratories within a 14 state territory (see map). Scientists conduct studies nationwide, with emphasis on the Rocky Mountains, Great Basin, Great Plains, and Southwest. Research serves the Forest Service, as well as other federal agencies, international organizations, private groups, and individuals. For more information, visit our website at http://

http://www.fs.fed.us/rm