Restoration and Reclamation Review
Student On-Line Journal
Vol.3, No.1, Spring 1998
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Reversing Degradation in the Mission Mountains Wilderness of the Rocky Mountain West

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Area Description

The US Forest Service manages approximately 35 million of the total 106 million acres of wilderness in the United States as part of the National Wilderness Preservation System. The Mission Mountains Wilderness (MMW) is on the Swan Lake Ranger District of the Flathead National Forest in northwestern Montana. Officially classified as wilderness on January 4, 1975, the 73, 877 acre MMW is managed in accordance with the Wilderness Act of 1964. The primary direction for managing wilderness comes from the Wilderness Act, which focuses on preserving the "natural condition" in wilderness and keeping the resource "unimpaired for future use and enjoyment". The following excerpts from the Wilderness Act clarify the justification for restoration actions as a management strategy used to address impacts. The Act states that:

A wilderness, in contrast with those areas where man and his own works dominate the landscapes, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural condition and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable (Wilderness Act 1964).

History of Restoration in the MMW

In the MMW during the 1960's, roughly 100 miles of trails were used primarily by horsepacking groups (Tassinari 1978). Currently, 44 miles of trails are maintained. Eighty-five percent of the visitors are backpackers, and approximately 200 campsites have been located and inventoried in the MMW (Flood & Gunderson 1985). The foundation of the 1978 Mission Mountains Wilderness Management Plan was based on data gathered which measured locations, amount and types of recreational use (Code-A-Site, 1978). According to Tassinari (1978) it has been difficult to establish visitor carrying capacity standards consistent with maintaining outstanding opportunities for solitude, and protecting soil, water and vegetation. The carrying capacity on some sites has already been exceeded, resulting in unacceptable resource damage. Concentrated recreational activity and improper use of the land pose the most significant threat to the wilderness resource. Several areas are deteriorating due to excessive use and negligence by people. The biggest impacts to the wilderness generally occurred during fall hunting trips when the area was very wet. Often, the horses and mules were tied directly to trees for long periods.

The two most popular lakes, Cold and Glacier received the most use and resource damage. The high number of people using the area has resulted in lakeshore erosion and removal of on-site vegetation at campsites due to human trampling. As a result of the impacts, Cold and Glacier

Lakes have been closed to overnight camping since May 1, 1980. Contributing factors include easy access, short trail distances, good fishing, and outstanding scenery. Closures were part of the draft management plan for the MMW. The public was provided an opportunity to comment on the draft. There was not a lot of resistance to the proposed closures to overnight camping, since both areas were already used primarily as day use areas and many of the long-term users strongly supported the Forest Service in their restoration efforts (Tassinari 1983). One seasonal ranger was hired in 1978 to provide information and educate wilderness users about the closures and to enforce camping restrictions.

In 1981 and 1982 campsite restoration efforts began at Cold and Glacier Lakes. Area managers and seasonal rangers scarified the compacted soils, transplanted vegetation (taken from areas adjacent to the campsites), irrigated plants, and educated wilderness users throughout the summer months (most areas were not roped off). In 1983, there was no money to fund a seasonal ranger. Early restoration efforts were only marginally successful due to the lack of physical barriers to keep visitors off the site (Flood 1985).

Since 1984, wilderness ranger and restoration services have been performed by private contractors, Joseph P. Flood and Kari Gunderson of Gunderson/Flood Wilderness Managers (GFWM). In 1984, a campsite inventory was implemented throughout the MMW to measure the changes in vegetative cover, soil composition, and secondary trail development as a result of recreational impacts in the MMW (Stankey et al. 1985). The inventory was completed in 1985 (Gunderson & Flood 1985). Inventory results identified some sites in the MMW that were heavily impacted and acceptable standards had been exceeded.

The biophysical indicators for measuring campsite conditions are vegetation and soil. Selecting biological indicators that can be used across a large landscape is important. For example, the loss of vegetation from trampling and soil erosion at a site can be measured (% vegetation loss and % mineral soil exposure) and compared to a natural control site to establish the degree of change which has occurred. Standards are set for each area and a specific level of impacts is allowed within a range of acceptability. For example, popular trail access points may allow a greater degree of change in biophysical conditions than an area deep in the wilderness, where allowable standards for human caused biophysical changes are little to none. When impact standards at a particular location are exceeded, a management strategy or a combination of strategies is implemented to bring the impacted site back within an acceptable standard. When restoration is selected as the preferred management tool to restore on-site conditions, it is usually implemented with visitor use restrictions and education efforts (Flood & Gunderson 1986). For example, a combination of strategies used at Cold and Glacier Lakes closed the area to overnight camping to control impacts and a ranger visits the area each weekend providing visitor information and education about minimum impact practices and why restoration has been implemented in these areas.

Principle Factors Influencing Amount of Impact

Primary use occurs within the MMW between the months of July and September. These easily accessed areas have attracted summer camping, fishing, hunting, and outfitting for many years

(Flood 1995). Fish stocking has occurred in most lakes over the past 40 years; fishing has been identified by users as a primary form of recreation. As a result of extensive recreation use and subsequent impacts, scars from both past and present stock use and hiker use, impacts continue to erode fragile soils and have potential to damage fragile aquatic ecosystems. Generally the amount and frequency of use, type and behavior of users, season and time of use, and environmental conditions where recreation occurs are all principle factors which influence the amount of impact. The number of visitors and how often they visit a particular area influences the level of impact. Day-use visitors generally spend four hours/day in an area, and have less impacts than overnight visitors who spend twenty-four hours/day. The types of users and their behaviors can be important determinants of potential on-site impacts. A group of horse riders may have a greater impact on vegetation and soils than a group of backpackers. Some users have large fires in the wilderness, while others choose to apply low-impact camping practices during their visits. During the spring and early winter periods the soils in many areas are saturated with moisture and very susceptible to impacts by recreational visitors. When selecting a campsite, visitors can significantly reduce impacts during the spring and late fall period by camping on areas with gravel surfaces and on flat rock outcrops. In contrast, wet meadow areas are very vulnerable to impacts and may take a long time to recover once impacted (Cole, et al. 1987).

MMW Restoration Program

Vegetation within the MMW ranges from *Arctostaphylos uva-ursi* (Kinnikinnick), *Pinus ponderosa* (Ponderosa Pine), in lower elevations to fragile *Cassiope mertensiana var.* (White Mountain Heath), *Xerophyllum tenax* (Beargrass), *A. lasiocarpa* (Subalpine Fir), and *P. albicaulis* (Whitebark Pine) in higher elevations. Mountainous areas provide plant-growing challenges that accelerate with increases in elevation and exposure. Water, temperature, and radiation stress are factors in plant survival during both winter and summer. Non-native species are considered inappropriate in federally designated wilderness areas, due to the strict adherence to genetic integrity (USDA Forest Service 1993).

Restoration in the MMW is a comprehensive program designed to restore wilderness conditions in a heavily used subalpine area and to encourage change in people's camping behavior through education efforts and special regulations. There are currently five campsite areas being restored using specific treatment strategies, management actions, and education techniques. A three hundred meter section of trail is currently being restored at Mollman Meadows near the headwaters of North Elk Creek. The initial impacts to this area were a result of extensive horse-use during the 1960's (Tassinari 1983).

As a result of many years of use, the trail had deep gullies (two to three meters deep and up to eight meters wide), and heavy erosion was washing silt into a stream below. In an effort to stabilize the site, water bars were installed in the upper portions of the trail to divert water off the trail. In the gullied areas, check dams were installed using ten meter sections of *Picea engelmannii* (Englemann Spruce blow downs from a wind storm) logs one meter in diameter. Once the logs were installed, soils from the remaining exposed root wads were hauled to the trail. Once the trail was returned to grade, on-site native seed (twenty species) collected from the previous year was planted. Also, small seedlings salvaged from the project were planted throughout the site. The stability of the soil and vegetative growth are monitored at the site each year. After two years, the planted vegetation has had a 70% survival rate and the check dams have stabilized on-site conditions (Flood 1995).

Site Planning and Design

This section describes the combination of the most effective methods and techniques used to reduce, contain, and restore campsites and trail systems in the MMW (Flood 1989). Restoration planning within the MMW includes a variety of site design strategies. Specific site design planning demands a clear understanding of the desired future condition of the site. Prior to beginning the project, it is essential to determine the current and future use of the site and what the site will look like at the completion of the restoration. To establish an effective site design, inventory an adjacent non-impacted site (control site) with comparable landscape components, and begin rebuilding the missing pieces. Site design strategies often start by incorporating native site barriers such as large herbaceous plant material, large boulders, and planted trees to block unwanted access to a particular site or trail. The local plant community determines what native materials are available and most effectively utilized as site barriers. When native materials are used as barriers, the primary goal is to duplicate non-impacted off-site conditions. The type of barrier selected is most commonly determined by the terrain, soil conditions, budget, and availability of other similar nearby campsites. When initial restoration is implemented, the most proven and effective temporary site barriers have been a combination of rope and lath.

Over the years, GFWM have learned a lot about which restoration techniques work best. They've seen better results from micro-siting (shelter planting near large rocks or logs) versus planting in open areas. Micro-siting reduces environmental stressors by reducing the plants' exposure to wind, excessive solar radiation, human trampling and provide pockets for collecting additional moisture, seeds, and soil nutrients. Using plant material to physically block access to social trails has proven very effective. Best success has come when using *Cyperaceae hepburnii* (Elk sedge), *Filipendula occidentalis* (Spiraea) and *Pinaceae engelmannii* (Engelmann spruce). Restorationists have successfully used check-dams, 2 to 3 meters in length to stabilize and establish plantings in rehabilitating trails (Walker, 1995; Flood, 1996).

It is imperative but problematic to provide users with other campsite selections, or to implement management strategies that reduce the type of use, or restrict camping in specific areas. By closing one site, use shifts to other sites causing new impact problems to other more pristine areas. Specific on-site conditions, elevation, types of methods used, and how often visitors walk or camp on the closed site all influence the time period needed to restore a site. The control site is used throughout the restoration process for monitoring purposes. The site can be used to compare soil composition, species spaciation, species diversity, site design characteristics and hydrological function. This allows for effective evaluation of restoration efforts (Flood 1996).

Effective Methods and Techniques Used in Wilderness Restoration

Soils and soil salvage are recognized as key elements in the success or failure of a restoration project. Plant establishment and maintenance is directly dependent on the capacity of soil (physical, chemical and biological properties) to support plant growth. Trampling by visitors increases soil erosion potential and results in modified soil density, acidity, microbiology and resistance to erosion. In the MMW the microbiology of an area is rehabilitated through plant installation, inoculation, mulching and importation of similar soils from an appropriate collection area. Soil salvage is an effective way to use soils normally discarded from nearby trail reconstruction sites. Planning and coordination for this operation is an important part of the restoration plan. By coordinating projects with the lead trail person, the restoration project schedules can coincide with soil and vegetation salvage efforts.

On-site seeding regimes have been commonly practiced since the very beginning of restoration efforts in the MMW. Typically, sites are mildly tilled or scarified and locally gathered seed is distributed. Success is often limited by untimely seed collection, lack of proper conditions for seed germination, and poor maintenance of the site after seeding. Due to the amount of time each year needed to collect seed, volunteers provide the necessary human power to collect seed from approximately twenty-five native species. Strict standards ensure that a high level of genetic integrity is maintained. Seed is taken from the same drainage within a three hundred meter range of elevation, and is placed in soils with similar composition, horizon structures, and with the same vegetation and aspects.

Plants used in restoration come from plant salvage opportunities, or propagule cuttings are grown in a greenhouse, and returned to the site. Plant recovery or salvage is the act of collecting plants from nearby trail reconstruction sites and transplanting them in the restoration site. The advantages of this process include use of otherwise discarded plants, introduction of more mature plants into the landscape, use of environmentally adapted plants, and the exploitation of available indigenous plants that may be difficult or expensive to propagate in a nursery setting.

The advantages of transplanting over seeding include the potential for a high survival rate, more rapid establishment of ground cover and seed or rhizome source, and the opportunity to utilize companion plantings. Field transplanted plants carry with them established root systems, soil microbes, plant biomass and potential on-site seed sources. When using on-site plant materials ensure collection areas are not compromised. When removing a transplant, naturalize the site to camouflage any sign of disturbance

Root division is a simple technique for vegetatively reproducing herbaceous plants and grasses when there is a limited supply of parent plants. It has the advantage of immediate duplication of transplantable smaller plants that are genetically identical to plants indigenous to the area. It can be used with both greenhouse-propagated plants and field collected stock. Multiple stemmed perennials, grasses/sedges or plants that produce off-sets or runners are the best candidates for this procedure.

One of the most challenging aspects of site restoration is the acquisition of mature plant material to use in combination with early successional species plantings or seeding. As critical components of the site design, larger plants provide visual relief, shading, seed sources, and micro-niches for smaller plant growth (Flood & Gunderson 1987). Often *Hedysarum* species (Sweetvetch) are planted as nitrogen fixers. These pioneering grass species are used to stabilize on-site conditions and establish a healthy growing regime).

Root pruning has been used in the MMW to confine the root wad of a tree or shrub within the dripline or outer edges of the plant. This procedure, commonly done in the nursery industry, not only encourages the proliferation of roots hairs within the root system, but also enhances the easy transport of the plant at the appropriate time to the restoration site. Since root pruning is a multi-year process, the use of flagging makes it easy to the relocate the plant (Hanbey 1992).

Layering is generally used to reproduce, onsite, a limited number of shrub or woody plant propagules that are genetically identical to parent plants. The goal of layering is the formation of roots on a stem while it is still attached to a plant. This technique is used to introduce a larger variety of plant material to the restoration site without dependance on an off-site nursery propagation program. The developing plant uses the nutrients and water from the parent plant while it is growing. Once rooted, the new plants can be severed from the parent plant and transplanted into the restoration site. If left connected, the new plant can be trained to grow into a campsite or trail corridor to inhibit movement or "contain" the size of a site (Flood 1989).

Live staking, cuttings and layering are bioengineering methods designed to fill-in or stabilize eroding or erosion prone sites with materials taken from adjacent live plants. The most successful plants used n the MMW include many from the *Populus nigra* (black cottonwood), *Salix monticola* (willow), and some from the *Cornaceae* (e.g.*Cornus stoloniferia* , red osier), and Rosaceae (e.g. *Rubus Amelanchier* , serviceberry). These plants have tremendous ability to promote root and leaf development under stressful growing conditions.

The introduction of native mulches is used in he MMW to enhance the cultural growing conditions of a site and inhibit erosion. When available, mulch material from nearby trail projects works well and often contains native seed. Properly applied mulches not only help stabilize a site, but retain moisture, protect plants and seeds from wind, sun and trampling, ameliorate surface temperatures, reduce frost action, and provide organic matter for soil buildup (Hanbey 1992). Using J-Tack (a sticky seaweed derivative) to adhere the straw mulch to the site surface has been a very successful strategy (Flood 1989). For larger sites, synthetic mulching blankets are more commonly used, but often take many years to break down. When mulch is applied too thick at high elevations, a cold micro climate can be created and ultimately reduce plant growth and survival (Rochfort 1990; Flood & Gunderson 1987).

Watering becomes an immediate factor in almost all restorative situations involving plantings and seed bed development. Authors Rochfort (1990) and Flood (1989) suggest the best strategy is to plant vegetation during the fall just as the rainy season begins in northwestern Montana. Plants can generally self-maintain, while slowly rooting into dormancy. A second approach is to establish a watering schedule if the plantings are done during the dry season. This can only work if there is adjacent water and labor available on a frequent schedule. With few exceptions, this has proven problematic, especially in remote areas where adequate labor is not available. (Hanbey 1992).

Monitoring Restoration Success and Failures

Monitoring what has worked is a critical aspect of restoration. Also, being able to state why something didn't work is equally important to the future of advancing restoration knowledge. Sites need to be visited on a regular schedule to adjust the mulch cover, landscape features, erosion control systems, check for plant survival rates and those naturalizing on the site, and record these changes. Establishing an on-going site evaluation program provides an important feedback loop in the monitoring process. On-site inventory forms are used to evaluate vegetative survival rates and species diversity in the site (Appendix).

A wilderness site restoration worksheet is used as a monitoring instrument and is completed for each restoration site in the MMW. The worksheet provides an on-going history of management actions and implications; presenting problems; resource information; restoration activities; restoration problems; recommended strategies; and, vegetation composite (Appendix). Site management plans must include procedures to prevent the continuation of impacts that created the original need for restoration. Maintaining good site barriers and signage to keep visitors off the site is critical to successful restoration.

GFWM have developed their restoration knowledge from trial and error experiments, restoration training, greenhouse specialists, and restoration literature. Their success has been limited by the lack of soil at impacted campsites, visitors trampling vegetation in restoration sites, and underestimating how long it takes for plants to grow in subalpine conditions.

The results of restoration efforts in the MMW are still pending. Plan implementation has resulted in fewer degraded campsites and reduced impacts throughout the wilderness area. GFWM are monitoring progress by measuring changes in impact levels and comparing pre-restoration baseline data taken from each campsite during initial campsite inventories and subsequent monitoring efforts. The key predictors for restoration success have been presence of soil micro-fauna, soil composition and depth, aspect, elevation, and most importantly adequate funding to plan, implement and monitor the restoration program. Site design characteristics are also critical, since restoration goals are to restore a specific site to a pre-impact condition.

Management and Education Strategies

In the MMW, closing entire lake areas to overnight camping has been the most effective strategy to restore impacted campsites, but also the most restrictive. Containing stock 200 feet from lakeshores and implementing effective education strategies has been very successful in reducing stock impacts (USDA Forest Service 1995). The primary education strategy is through information provided by Forest Service district personnel (off site), signage at trailheads, visitor contacts with wilderness rangers (along trails and on-site), and on-site signing. On a national scale, wilderness education efforts target sixth graders across the country, providing them with information on how to visit a wilderness and leave-no-trace of their visit. Information about restoration efforts are part of that national wilderness education effort. Stock use in wilderness can cause impacts that eventually have to be restored. Efforts are currently being implemented to work with a national stock riding group to provide information about reducing impacts while identifying the best places to keep stock while visiting the MMW. Collaboration is critical to solving resource problems and developing restoration solutions (Flood 1997). Many of these same groups volunteer to pack in materials used in our restoration programs.

Rangers provide information and education to the visitors about the restoration program, new regulations, monitor compliance, and demonstrate low impact techniques using highlines, and leave-no-trace practices. Locating sites in the backcountry at least one hundred meters from water and fastening two straps around trees with a rope in between them (highlines) has been an effective strategy to reduce stock impacts along lakeshore areas and at campsites (Figure). On-site education and maintenance of sites are an essential part of an effective program, and most sites are visited on a weekly basis to ensure compliance and vandalism is kept to a minimum. Ranger visits are an important part of a successful restoration program.

Overall visitor compliance has been good. Only a few users have reacted negatively to restoration programs. Generally wilderness visitors are pleased to see management strategies implemented to restore impacted areas. GFWM spent a lot of time focusing on educating the user about recreational-caused impacts and the restoration program. Despite a flood of "Leave-No-Trace" messages over the years, many people have not changed their camping practices. Many people who consider themselves careful and thoughtful users of wilderness, haven't done a good job at minimizing their trace. Managers may have to consider limiting the number of users in the future along with increased educational efforts by rangers (Flood 1997).

In Summary

For the past seventeen years Gunderson/Flood Wilderness Managers have developed and implemented an effective restoration program. With assistance from volunteers, they have relocated lakeside trails, closed sites, rehabilitated trails, and restored campsites. Comprehensive planning, public support, and partnerships with local user groups have resulted in a very productive restoration program. Inconsistent funding for on-going restoration and monitoring efforts is an overall weakness of the MMW restoration program.

The future of wilderness rests in the hands of today's managers and the American public. If funding is available at a national level, restoration can be used as a management strategy to preserve a wilderness experience for future generations of visitors. To many people wilderness represents the watershed of life. If we reflect back to the Wilderness Act, it clearly states, "Wilderness is managed as to preserve its natural conditions and which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable" (Wilderness Act 1964). From this mandate, managers should be able to answer the question, is this mandate being accomplished in wilderness? If not, what measures need to be taken to ensure success? In order to accomplish this mandate, managers need to make a commitment that allows restoration to be an effective tool to preserve the wilderness idea. Aldo Leopold stated, "The richest values of wilderness lie not in the days of Daniel Boone, nor even in the present, but rather in the future" (Leopold 1949).

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Appendix: MMW SITE RESTORATION WORKSHEET

<u>*Brief history of site & management implications</u>

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<u>*Summary of presenting problem(s)</u>

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<u>*Resource Information</u>

-Soil type & description

-Soil pH, aspect & gradient

-Vegetation type & condition

-Distance to water

<u>*Recommended restoration activities</u>

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<u>*History of restoration problems</u>

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<u>*Recommended management strategies</u>

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<u>*Vegetation composite</u>

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<u>*Weeds present</u>

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ONSITE RESTORATION INFORMATION

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Restoration site____Date_______

Approximate plot size____Ranger_________________

1. Method used for site preparation____

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2. Type of reveg material a) #plugs____

b) seed____

c) nursery stock____

d) transplants____

3. Species____

____

____

4. Onsite materials used a) boulders____

b) logs____

c) stumps flush cut______________________________________

5. Evaluation of vegetation growth and vigor____

a) _____ good - vegetation flourishing and spreading to adjacent areas

b) _____ fair - vegetation flourishing but little or no spreading

c) _____ poor - vegetation stunted or dead with o spreading

6. Sketch restoration site (include size, location, trails, natural features & photo points).