Report for 2002MT1B: The effectiveness of burn-area emergency rehabilitation (BAER) techniques in reducing post-fire soil erosion on the Sula state forest in western Montana.

There are no reported publications resulting from this project.

Report Follows:

MONTANA WATER CENTER FY2002 PROGRESS REPORT

Research Synopsis

This study is determining the effectiveness of several techniques that are presently used to reduce soil erosion after forest fires in the western United States. The specific study objectives are to: 1) determine the effectivness of straw wattles, mulching and aerial seeding for reducing hillslope-scale erosion rates, and 2) determine the effectiveness of aerial seeding and mulching for reducing plot-scale erosion rates. Study sites have been identified in two areas of Montana that were affected by forest fires in 2001 and 2002, respectively. The 70,000 acre Moose Fire burned parts of the Flathead National Forest and the Coal Creek State Forest in July and August 2001. The 6,000 acre Redfox Fire burned in an area on the Blackfeet Indian Reservation in July 2002. The study comprises two experimental studies and one observational study.

Our first experiment is assessing the effectiveness of straw wattle installation and straw mulching in reducing post-fire erosion rates from hillslope-scale plots in response to natural rainfall. We are using silt fences to compare the erosion rates from replicated hillslope-scale plots that have been treated with straw wattles or mulching to an untreated control plot. Study plots are located in areas of the Flathead National Forest and the Coal Creek State Forest that burned during the Moose Fire in 2001. Each replicate comprises three adjacent plots (two treatments and a control) that have similar slope and vegetation characteristics. Each plot is approximately 20-50 meters in length, with a 10 meter wide silt fence at the toe of the slope. The plots were installed in August 2002, and the silt fences below each plot were emptied for the first time in early June 2003. Preliminary analysis of these data indicate that there was minimal soil erosion (<1 kg/ha) from any of the plots between August 2002 and June 2003. However we anticipate greater amounts of soil movement in response to rainstorms during the summer of 2003. Silt fences will therefore be emptied, and the accumulated sediment mass measured on a monthly basis in the summer of 2003.

Our second experiment is assessing the effectiveness of aerial seeding and mulching in reducing post-fire erosion rates from small (0.5 m^2) plots in response to simulated rainfall events. The plots for this study are located to the east of St. Mary's Lake, Montana in an area burned

during the 2002 Redfox fire. Each replicate comprises three adjacent plots; the first plot in each replicate was treated by aerial (helicopter) seeding with grasses in spring 2003. The second plot was treated by hand distribution of straw mulch, and the third plot is an untreated control. Both the mulched plots and the control plots were sheltered from the aerial grass seeding by covering the areas with tarpaulin sheets during the seeding operation. In the summer of 2003 we will conduct rainfall simulations over each of these plots to determine the infiltration and runoff rates and the amount of potential soil erosion. The first round of simulations will be conducted in late June 2003, and the second round in late July or early August. Each rainfall simulation will last 1 hour, and the rainfall will be applied at a rate of approximately 80 mm/hr. This rate is much higher than most rainfall events in the study area. However the applied rainfall rate must exceed the soil infiltration rate in order to determine the infiltration capacity of the soil in each plot. Water and sediment produced from each plot will be collected at approximately one minute intervals throughout the simulation. The total amount of runoff from the plot will be determined by summing the volume of water collected at each minute interval. The water samples will be filtered through a 0.45 μm filter paper to collect the sediment. The total amount of sediment eroded from the plot will be obtained by summing the accumulated sediment on each filter paper. We anticipate that erosion rates in the plots treated with straw mulch will be less than those in either the grass seeded plots or the control plots, but that the effectiveness of the grass seeding in reducing soil erosion will increase as the grasses become more established.

The goal of our observational study is to determine the effectiveness of aerial seeding for reducing erosion rates on hillslope scale plots in response to natural rainfall. The study area is the same as that used for our second experiment, to the east of St. Mary's Lake on the Blackfeet Indian Reservation. In August 2002 we installed nine silt fences below hillslopes in the area where aerial seeding was planned. Since the seeding was intended to cover an area of over 400 acres it was not possible to use adjacent untreated hillslopes as a control. Thus in this study we are comparing the measured erosion rates to data on the physical characteristics of each plot. Specifically we are planning to measure the ability of site variables such as slope angle, soil texture, and percent cover to predict variability in erosion rates. Most of the burned areas was left devoid of any ground cover after the fire, so much of the first year regrowth in the study plots will likely be due to the germination of the seeded grasses. Thus by comparing the significance of ground cover for predicting erosion rates to other site factors we can assess how effective the

aerial seeding has been in reducing erosion rates. We anticipate that there will be an inverse relationship between percentage ground cover and erosion rates from the plots. However, previous research suggests that there may be a threshold level of ground vegetation coverage below which the grass seeding has little effect.

Focus Categories

1. GEOMOR
2. HYDROL
3. NPP

Descriptors

Forest fire; Wildfire; Soil erosion; Erosion control; Burn Area Emergency Rehabilitation; Water quality; western Montana.