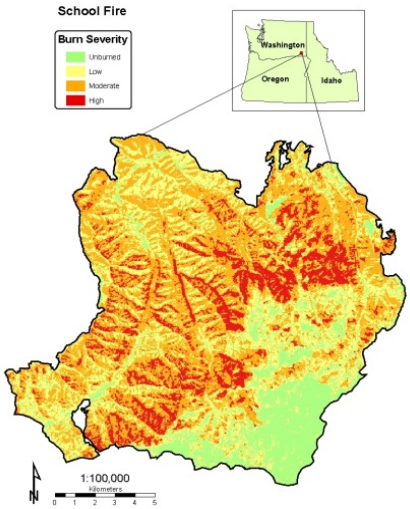
Assessing soil and vegetation recovery following the 2005 School Fire, Umatilla National Forest

SCHOOL FIRE

10-year update

Introduction and research questions



Following the 2005 School Fire which burned ~ 50,000 acres across forest and grasslands, managers were particularly concerned with treating severely burned areas to mitigate weed spread and to limit soil erosion. Various mulching treatments (wheat straw, wood strand, and hydromulch) were implemented to control erosion on steep slopes above the Tucannon River Canyon. Locally-collected native grasses were seeded successfully, which at the time was the largest such post-fire treatment nationwide, providing a unique opportunity to monitor the effects on native plant recovery, weeds and erosion control. Some sites were salvaged logged. We monitored the effects of these treatments on field sites from 2005 to 2011.

Our research, funded by the Joint Fire Science Program and the Umatilla National Forest, addressed these questions:

- ✓ How does vegetation respond to varying degrees of burn severity? To post-fire erosion control treatments? To native grass seeding? To salvage logging?
- ✓ How do post-fire treatments affect soil biology such as microbial activity?
- ✓ How effective are post-fire treatments at reducing erosion?

Vegetation response affected by burn severity, post-fire native grass seeding and salvage logging

Vegetation responded rapidly across the burned area throughout the study period – by 2011, total understory vegetation cover averaged 50-70% across all burn severities and treatments.

- Sites burned at low and moderate severity had greater canopy cover and greater species richness and diversity than sites burned at high severity; the site treated with hydromulch + grass seed had greater species richness and diversity than the other mulch treatments.
- Weeds were found mainly in areas where they existed prior to the fire; very few nonnative species were found on our plots, regardless of burn severity, seeding or salvage logging.
- Seeded areas had high native grass cover (30% in 2011) which appeared to preclude weed invasion; however, forb (15%) and shrub (1%) growth was also hindered on these plots. We found lower ponderosa pine seedling density on seeded sites.
- Wood and wheat straw mulch persisted, augmenting total ground cover (>70% since the first post-fire year). Wheat straw decomposed more quickly than wood straw; six years post-burn both were far more persistent than hydromulch.
- Wheat straw and wood strand mulch treatments had low grass cover (1-3%) during the study period, and forb cover was low on the wood strand site.
- Mulch application after wildfire may enhance nitrogen (N) availability: ~ 40% higher total soil N was found on mulched plots compared to unmulched plots. Mulch application also increased local soil moisture and microbial respiration.
- Salvage logging delayed vegetation response – we found a 1-2 year lag in vegetation cover when comparing plots burned at the same severity. Initial differences were pronounced and declined with time.
- Plots that were salvage logged produced less canopy cover of shrubs and forbs, but more canopy cover of graminoids, especially on the high and moderate burn severity plots. High severity plots that were salvage logged and seeded with native grasses had the lowest species richness, diversity, and cover of all treatments.
- Post-fire tree seedling densities were high but variable in low and moderate severity burns; fewer ponderosa pine, Douglas-fir and grand fir seedlings were found in areas burned with high severity due, in part to distance to seed source.
- Tree seedling density was more variable where salvage logging occurred, but we did not find significant differences in tree seedling densities or heights due to salvage logging as others have found.

Post-fire mulch treatments and grass seeding reduced erosion, but little erosion occurred

The same low-intensity rainfall events following the fire that aided vegetation recovery resulted in lower than expected sediment production as measured by our sediment fences on the severely burned steep slopes above the Tucannon River.

- By 2011, erosion rates were negligible on all monitored hillslopes, regardless of treatment.
- Total vegetative ground cover was high on all sites, independent of treatment. The minimal amount of exposed mineral soil (~10%) likely contributed to low rates of erosion.
- Six years after fire, we were able to conclude that wheat and wood straw mulch were most effective at reducing erosion in the first year after the fire; native seeding reduced erosion similar to the mulch treatments in the third year after the fire after the grass was well established.
- Relatively low erosion rates and high ground cover suggest that these treatments were effective in reducing the immediate vulnerability of these sites. This outcome may have been different if we had had intense rainstorms in the first post-fire growing season when there was little ground cover except mulch.

We concluded that the vegetation and soils on this site were resilient to the combined effects of wildfire and multiple strata of post-fire management.

Our publications provide more detail

Berryman, E.M., Morgan, P., Robichaud, P.R., Page-Dumroese, D. 2014 Post-fire erosion control mulches alter belowground processes and nitrate reductase activity of a perennial forb, heartleaf arnica (*Arnica cordifolia*). Res. Note RMRS-RN-69. Fort Collins, CO: U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Research Station. 10 p.

Lewis, S.A., Robichaud, P.R., Hudak, A.T., Austin, B., Liberman, R.J. 2012. Utility of remotely sensed imagery for assessing the impact of salvage logging after forest fires. *Remote Sensing* 4: 2112-2132.

Morgan, P., Moy, M., Droske, C.A., Lentile, L.B., Lewis, S.A., Robichaud, P.R., Hudak, A.T. 2014. Vegetation response after post-fire mulching and native grass seeding. *Fire Ecology* 10(3): 49-62.

Morgan, P., Moy, M., Droske, C.A., Lewis, S.A., Lentile, L.B., Robichaud, P.R., Hudak, A.T., Williams, C.J. 2015. Vegetation response to burn severity, native grass seeding and salvage logging. *Fire Ecology*, in review.

Morgan, P., Droske, C.A., Lentile, L.B., Lewis, S.A., Robichaud, P.R., Hudak, A.T., Davis, A.S., Williams, C.J. 2015. Conifer seedling density and growth six years post-fire influenced by salvage logging and grass seeding. *Canadian Journal of Forest Research*, in review.

Robichaud, P.R., Lewis, S.A., Wagenbrenner, J.W., Ashmun, L.E., Brown, R.E. 2013. Post-fire mulching for runoff and erosion mitigation. Part I: effectiveness at reducing hillslope erosion rates. *Catena* 105: 75-92.

For more information

Project information on FRAMES: http://www.frames.gov/partner-sites/assessing-burn-severity/project -home/

RMRS Moscow website (full-text publications): http://forest.moscowfsl.wsu.edu/library/

Who we are

We are Forest Service Rocky Mountain Research Station and University of Idaho researchers working in cooperation with managers of the Umatilla National Forest and the Washington State Department of Natural Resources.

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