

Summary Report - West Fork Fire Complex Experimental Soil Stabilization Plots

Compiled by Emma Reesor and Peter Wise, RGHRP
December 15th, 2017

Background:

In the summer of 2013, the West Fork Fire Complex burned over 100,000 acres of forest in the upper Rio Grande watershed. The complex of three fires were ignited naturally by lightning strikes and spread easily due to dry and windy conditions. The West Fork Fire Complex denuded hill slopes of vegetation and changed soil properties that affect watershed hydrology and sediment-transport processes, thus increasing the probability and magnitude of flood and debris flows. In order to investigate different methods to provide ground cover to increase soil water holding capacity in order to improve vegetative cover and reduce hill slope erosion, the Rio Grande Headwaters Restoration Project (RGHRP) and the Rio Grande Watershed Emergency Action Coordination Team (RWEACT) partnered to install and monitor 10 experimental soil stabilization test plots in the West Fork Fire Complex burn area. These plots were located at two different locations marked on the map below.



Methods:

Test plots were installed at two sites in the West Fork Fire Complex burn area. Site 1 has a slope of 42%, is located on private land and is not grazed by livestock. Site 2 has a moderate slope, is on US Forest Service Land, and is grazed by cattle. Each site contains 5 test plots with each plot receiving a different soil stabilization treatment. These treatments are summarized in the table below.

SUMMARY OF TREATMENTS FOR THE WEST FORK FIRE COMPLEX SOIL STABILIZATION PLOTS					
Site 1 (42% slope, no grazing)					
	Control	Seeding and Felling	Wood Straw Mulch	Mulch Pellets	Hydro Mulching
Dimensions	200x50	200x50	200x50	200x50	200x50
Seed Rate	No Seed	20 lbs. per acre	20 lbs. per acre	20 lbs. per acre	20 lbs. per acre
Seed Method	No Seed	Broadcast and Raked	Broadcast and Raked	Broadcast and Raked	Broadcast and Raked
Mulch Type	No Mulch	No Mulch	Mountain Pine Manufacturing, Wood Straw	Terra Novo EarthGuard Edge	Terra Novo EarthGuard Fiber Matrix, sprayed by
Mulch Rate	No Mulch	No Mulch	Applied at a rate of 216 bales per acre with a goal of 60% ground	5000 lb./acre	2000 lb./acre
Site 2 (moderate slope, cattle grazing)					
	Control	Hydro Ax	Wood Straw Mulch	Mulch Pellets	Hydro Mulching
Dimensions	200x50	200x50	200x50	200x50	200x50
Seed Rate	No Seed	20 lbs. per acre	20 lbs. per acre	20 lbs. per acre	20 lbs. per acre
Seed Method*	No Seed	Broadcast	Broadcast	Broadcast	Broadcast
Mulch Type	No Mulch	Rue Logging Hydro Ax	Mountain Pine Manufacturing, Wood Straw	Terra Novo EarthGuard Edge	Terra Novo EarthGuard Fiber Matrix, sprayed by
Mulch Rate	No Mulch	N/A	Applied at a rate of 80 bales per acre with a goal of 40% ground	4000 lb./acre	2000 lb./acre
*Seeding at Road Canyon: decided not to rake because the site was very wet and we felt it was unnecessary.					

Ground cover for each test plot was measured using the line-transect method, which involves stretching a line across the test site and recording what material intersects the line at specified points. For this study, a 100 ft tape measure was stretched lengthwise along the plot and ground material (bare ground, litter, rock, mulch, and plant type) was recorded at each foot marker. To avoid error, measurements were read from the same side of the tape each time.

For the initial sampling in October 2013, one line-transect was ran through the middle of each test plot. However, to increase the statistical power and validity of this study, we modified the protocol for the May 2014 sampling and future sampling to include three, evenly distributed line-transects throughout each plot. The transects were taken from varying starting points for each sample and each date. The data collected from these three transects were averaged to get a more accurate sample of the ground cover in each plot.

Results:

Mulch cover in all test plots has decreased over time. This decrease is most significant in the HydroMulch plots with mulch cover disappearing almost entirely by the sampling in September 2015. Mulch cover has lingered the longest in the Wood Straw plots and HydroAx plots. While the Wood Straw mulch is the only remaining mulch on Site 1 in September, 2017, HydroAx is the only mulch remaining on the more moderately sloped Site 2. (Note that HydroAx was not applied on Site 1.) The table below shows the results of the most recent sampling.

Vegetation has increased over time in all test plots. Except for the Control and Seeding on Site 1, all plots began with 1% or less vegetative cover. In 2017, around 60% of the ground on Site 1 had vegetation except for the Site 1 control plot, which had 27% vegetative cover. The Site 1 Mulch Pellets plot had the most vegetative cover at 72%. Site 2 shows strikingly

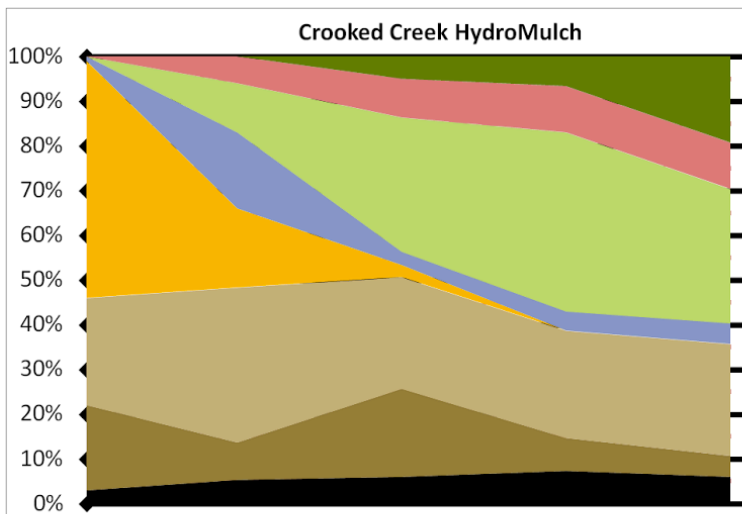
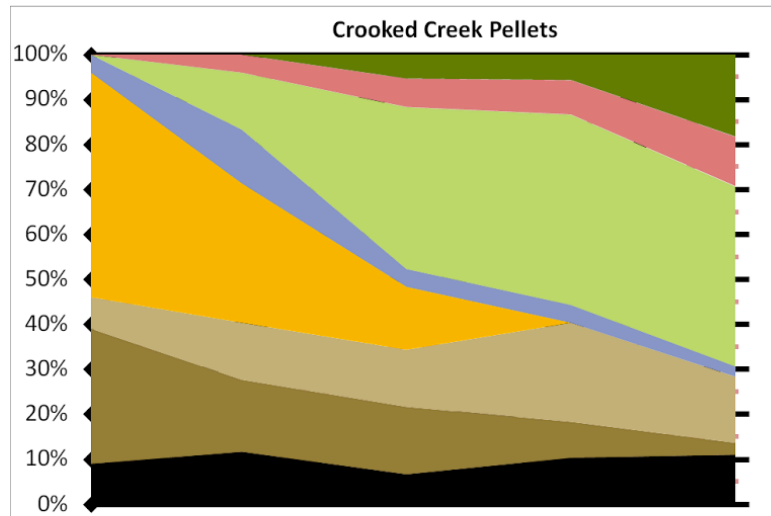
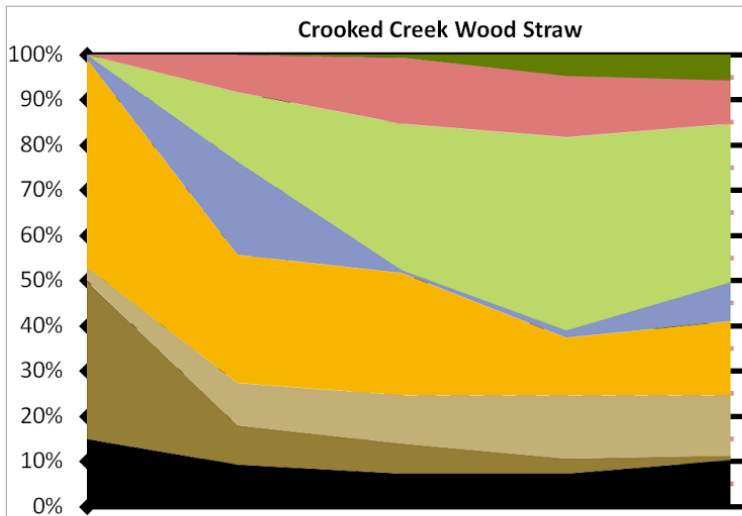
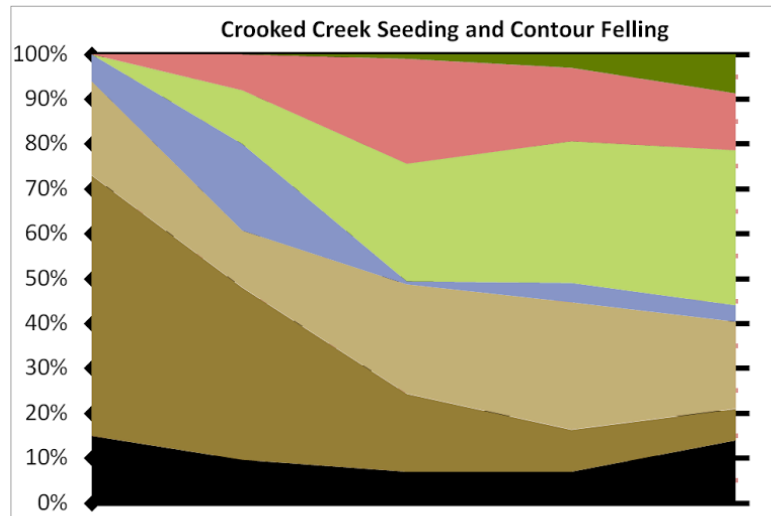
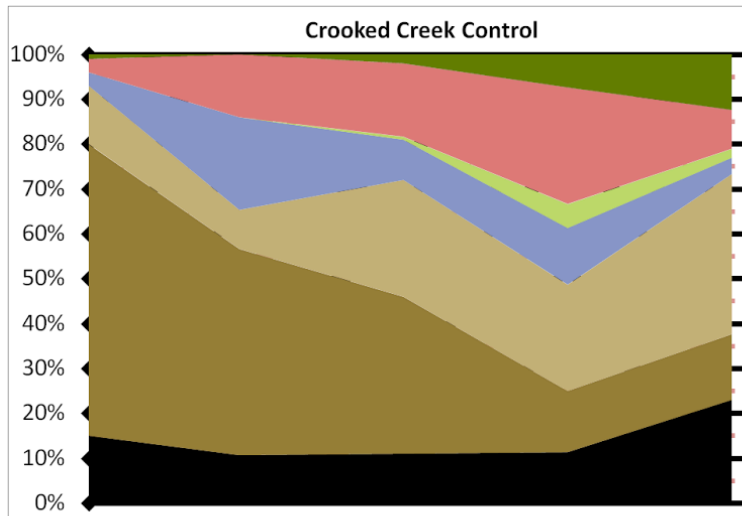
similar performance of Site 2 plots having vegetative cover on 50-56% of the ground, with the Control having the most cover. In both Control plots, grass cover is significantly lower than in plots that received seeding. On the Site 2 Control plot, forb cover is higher compared to the seeded plots. In the first 3 years, both sites' control plots saw a higher percentage of tree, shrub, and forb cover than did the seeded plots.

Results of test plot sampling collected September 26th, 2017					
Cover at Site 1 (42% slope, no grazing)					
	Control	Seeding	Wood Straw	Mulch Pellets	HydroMulch
rocks	23.00%	14.00%	10.33%	11.00%	6.00%
bare ground	14.67%	7.00%	1.00%	2.67%	4.67%
litter	35.67%	19.33%	13.33%	14.67%	25.00%
mulch	0.00%	0.00%	16.33%	0.00%	0.00%
forbs	3.67%	3.67%	8.67%	2.33%	4.67%
grasses	2.00%	34.67%	35.00%	40.00%	30.00%
trees and shrubs	8.67%	12.67%	9.67%	11.00%	10.33%
moss	12.33%	8.67%	5.67%	18.33%	19.33%
Total	100.00%	100.00%	100.00%	100.00%	100.00%
Cover at Site 2 (moderate slope, cattle grazing)					
	Control	HydroAx	Wood Straw	Mulch Pellets	HydroMulch
rocks	3.00%	0.00%	0.00%	0.67%	0.33%
bare ground	13.67%	14.33%	14.33%	23.33%	17.33%
litter	28.00%	19.67%	33.67%	23.00%	32.00%
mulch	0.00%	13.00%	0.00%	0.00%	0.00%
forbs	24.67%	17.33%	11.67%	6.00%	6.67%
grasses	20.00%	35.00%	34.00%	28.00%	37.00%
trees and shrubs	5.67%	0.33%	2.67%	8.33%	2.67%
moss	5.00%	0.33%	3.67%	10.67%	4.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

While looking at vegetation can help discern how well a slope is being stabilized, comparing bare ground can help portray how well mulch and litter are keeping soil from being exposed. In September, 2017 on Site 1, Wood Straw, Mulch Pellets, and HydroMulch kept bare ground to less than 5%. However, Wood Straw on Site 1 outperformed the rest with 1% exposed soil in 2017 and less exposed soil in previous 4 years of the experiment than the other trial covers and control. At Site 2, more bare ground was left exposed than at Site 1. The Site 2 Control left the least ground exposed at 13.67% in September, 2017. However, both the HydroAx and Wood Straw plots of Site 2 exposed 14.33%, less than a percent more bare ground than the Control. While the Site 2 Control has the least bare ground, it had the most bare ground exposed until the fall of 2016. Both the HydroAx and Wood Straw mulches reduced bare ground the fastest.

Included below are visual representations of cover type over time to get a better grasp of the results of the test plots. The graphs are trimmed for visual comparison purposes, but larger and complete versions of these graphs can be found in Appendix A. The graphs below plot ground cover vs time, each point being the year's fall sample. In addition to the enlarged graphs, photographs of the plots over time can be found in Appendix A.

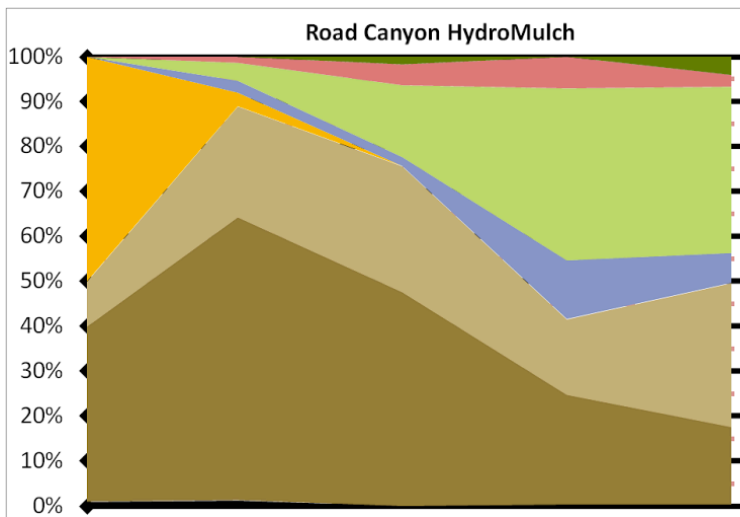
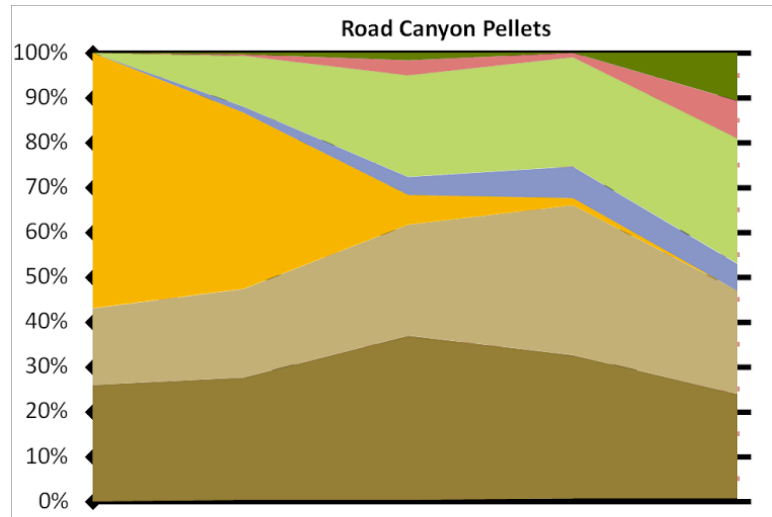
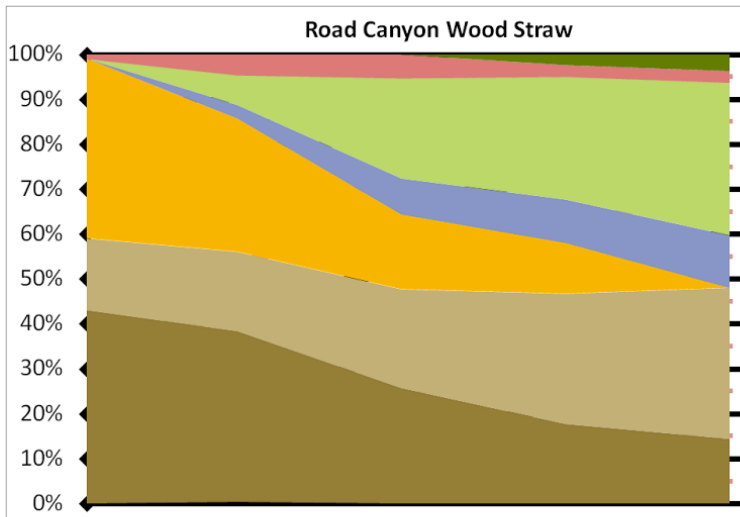
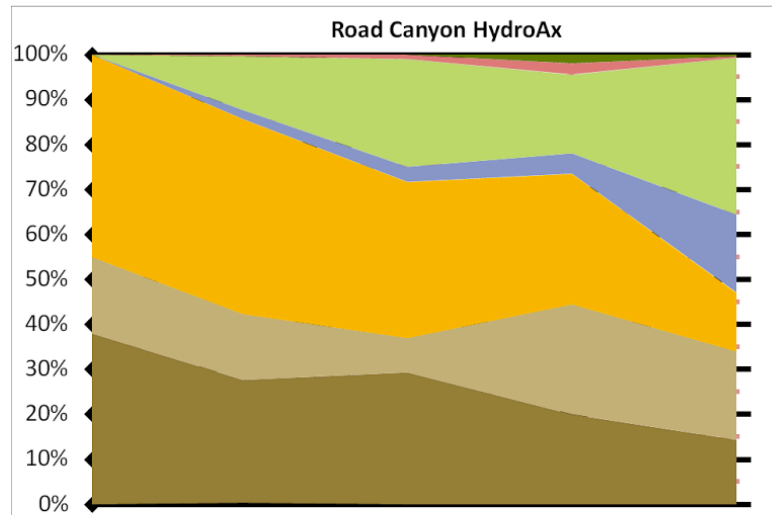
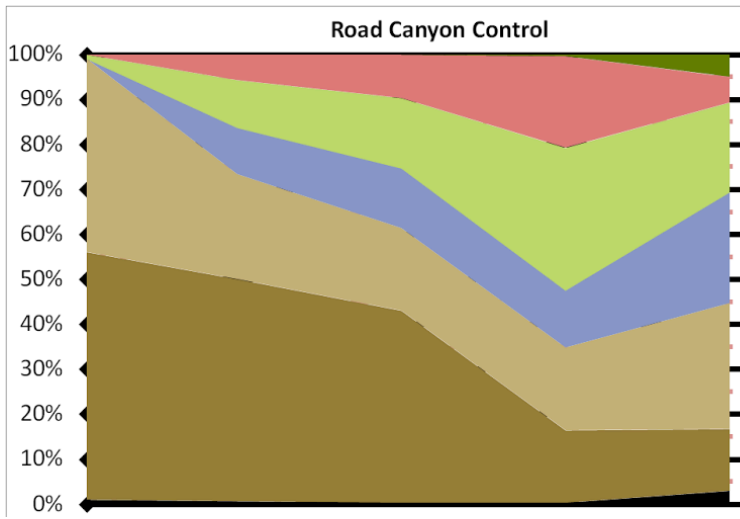
Site 1 Test Plots



Legend:

Moss
Trees and Shrubs
Grasses
Forbs
Mulch
Litter
Bare Ground
Rock

Site 2 Test Plots



Legend:

Moss
Trees and Shrubs
Grasses
Forbs
Mulch
Litter
Bare Ground
Rock