Pacific Southwest Research Station

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Riverside Fire Laboratory

Testing Innovative Mulch Treatments on The 2002 Indian Fire: First Year Results

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Following the Indian Fire on the Prescott National Forest in May 2002, we tested the erosion control effectiveness of two innovative mulch treatments against a standard method – straw mulch at 2 tons acre^{-1} (4.5 Mg ha^{-1}) – and an untreated control, each in a separate watershed. The first new treatment is clearing all trees with a feller-buncher, followed by chipping all logs and limbs up to 14 in (35 cm) with a mobile chipper. For the second innovative treatment compressed, tackified straw pellets were hand spread to give 50 percent cover before wetting. These pellets expand 4-fold upon wetting, and release a proprietary polyacrylamide-family soil flocculant.

Photo 1. View up the straw catchment just after straw spread in August 2002.

Photo 2. Sediment and fence after 10 September storm.

Two silt fences were placed at the mouth of each catchment so that any overflow from the upstream fence was captured in the second fence. Fences are 33 to 49 ft (10 to 15 m) long and about 4.25 ft (1.3 m) tall.

Fences were installed as near as possible to the time the treatments were installed:

- Wood chips and straw pellets in mid July
- Straw the week of 5 August

In only one case (the straw pellets) did an erosional event occur after a treatment was applied but before we installed the silt fence – the 24 July storm.

Following major storm events, we measured the accumulation of sediment behind each silt fence. Subsamples of the wet sediment were collected and returned to the lab for measurement of moisture content, and an appropriate wet to dry correction factor was calculated for the sediment. All sediment behind each fence was removed and its wet weight measured. After moisture contents were obtained from the subsamples wet weights were converted to dry weights.

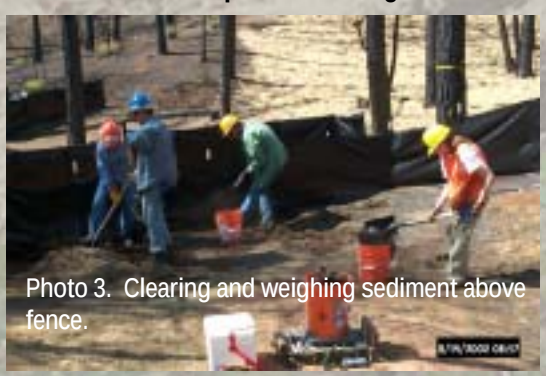


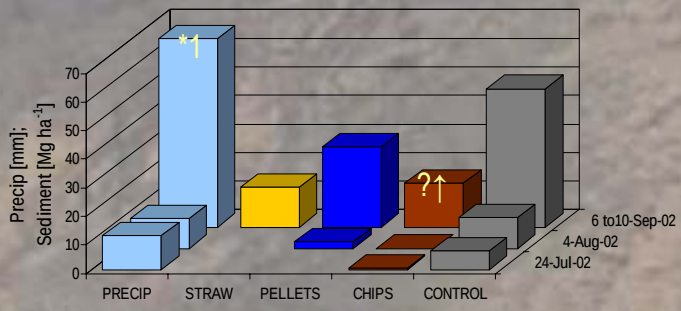
Photo 3. Clearing and weighing sediment above fence.

Results

Preliminary results — based on less than one full season's data and not statistically replicated — indicate that all mulch treatments, including the innovative treatments, consistently and substantially reduced sediment yield relative to the untreated control. Storm total precipitation and intensities are shown in Table 1; sediment yields in Chart 1.

Table 1. Rainfall intensities for each erosion-causing event

			max rain intensities [in hr^{-1}]		
date	total min	total in	10 min	30 min	60 min
24-Jul-02	201	0.37	0.90	0.48	0.27
04-Aug-02	58	0.37	1.50	0.68	0.37
06-Sep-02	615	0.82	2.82	1.22	0.65
07-Sep-02	722	0.48	1.50	0.56	0.29
08-Sep-02	310	0.05	0.12	0.06	0.04
09-Sep-02	159	0.16	0.36	0.16	0.11
10-Sep-02	28	0.92	4.62	1.82	0.91



*1 38 mm over 3 days, followed by 23 mm in 28 minutes.
? ↑ Understimate of total due to partial fence failure.

Chart 1. Precipitation and sediment yield by treatment and storm.

Three significant erosional events occurred after the first treatments were applied: thunderstorms on 24 July and 4 August and a multiday rain event from 6 to 9 September followed by an intense thunderstorm on 10 September (Table 1).

In the first storm, the wood chip treatment reduced sediment yield by 93 percent, relative to the control catchment. The pellet treatment was not measured during the first storm because the fence had not been installed, but the pellets were inspected and observed to have expanded greatly and released the flocculant.

In the second storm the wood chips had no sediment yield and the pellets reduced sediment yield by 80 percent.

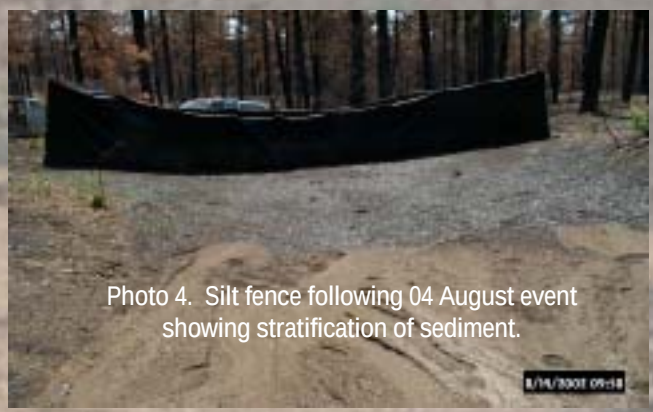


Photo 4. Silt fence following 04 August event showing stratification of sediment.

The third rain event was the first precipitation since the straw had been applied. We noted at the visit in August that the pellets had fully dispersed to a fine chaff and that the flocculant which was previously obvious on the surface was no longer visible, but had presumably been incorporated into the soil.

In the thunderstorm of 10 September, the combination of accumulated sediment and flowing water tore the upstream fence on the wood chip catchment and partially collapsed the backup fence, so we lost sediment and were unable to measure total yield from the chip treatment for this storm.

The 1.5 in (38 mm) of rain which fell from 6 to 9 September is assumed to have thoroughly wetted the surface soil, enhancing antecedent soil moisture and setting the stage for a significant erosional event. The storm on 10 September was a very intense rain event, with a maximum 10-minute intensity of 4.62 in hr^{-1} (117 mm hr^{-1}, Table 1), and yielded a storm total of nearly 22 t ac^{-1} (50 Mg ha^{-1}) of sediment from the control catchment. The pellet treatment reduced this sediment yield by 42 percent, presumably because the soil flocculant was effective in binding (flocculating) the soil particles. The straw treatment was also effective, reducing sediment yield 71 percent. However, direct comparisons among the treatments cannot be made because this was the first rain event for the straw – it may have been more or less effective had it experienced the previous storms.

Photo 5. Straw catchment after rains of 6 to 9 September, before major storm of 10 September

Vegetation plots were established and measured on each catchment. As of August 2002, vegetation cover, excluding oak resprouts, was trivial on the plots – a maximum of 1 to 2 percent.

The vegetation plots were remeasured in October and some had substantially increased in vegetative cover. Variability was high and differences were not significant -- mean cover of grass and forbs ranged from 2.3 percent (straw) to 12.1 percent cover (pellets).

In conclusion, all the mulch treatments were very effective in reducing sediment yield from the watersheds during the summer of 2002. Measurements will continue in 2003.