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Hydroseeding Test Plots

Paul Sturm, Ridge to Reefs

Roberto Viqueira and Louis Meyer, Protectores de Cuencas

Lisa Vandiver, NOAA Restoration Center

Jeiger Medina, UPR Rio Piedras, USFWS, Intern

Edwin Mas, NRCS

RIDGE TO REEFS

PHONE 410.227.7689

paul@ridgetoreefs.org

As a continuation of our efforts to define, test and implement soil stabilization efforts in high mountain areas of the Guánica watershed in Puerto Rico, we performed stabilization techniques using number of different formulations to determine best practices. The formulations were based on the results of a Exposed Soil Roundtable held earlier this year in the upper watershed with representatives from plants, soils, restoration, agronomy and erosion and sediment control experts from NRCS, FWS, NOAA RC and NC State University. Our first test plots were chosen on one large and varied site associated with the re-routing and reconstruction of part of a road on PR-355 above the town of Yauco was chosen due to the large area of exposed soils as well as the varied slopes and aspects that were exposed. The area was also a priority based on rainfall, slope and exposed soils; it scored as a high priority site in our prioritization analysis. In this update, we discuss and show photos of the plots pre-stabilization, during stabilization and post-stabilization (after 3-4 weeks post-stabilization) and provide initial lessons learned and measures of effectiveness -- though ultimately the effectiveness will be gauged over a longer duration.

Soil Stabilization Test Plots

10 plots were established to test various hydroseeding mixtures in an effort to determine their effectiveness and cost effectiveness -- the initial plots were tested at both a 70-75% slope with unconsolidated soil and an 85-90% slope with a mix of consolidated (more rock and compacted soil) and unconsolidated (less compacted soil). Together these represent some of the more extreme conditions encountered in the high mountain areas and if effective stabilization can occur on these plots -- similar methods should be able to be applied to less severe slopes. The goals of the test plots were:

- to determine appropriate mixtures for steep slopes
- to determine rates of application of various constituent parts of the mixtures including seeding rate, fertilizer, polyacrylimides (PAMs)
- to determine cost effective mixtures for high mountain areas in Puerto Rico
- to test pergamino (coffee skins) to determine if they are an effective mixture for soil stabilization
- to compare wood mulches with bonded fiber matrices (BFM)
- to develop a comfort level with the machinery for hydromulching
- to test the use and incorporation of fern spores from several species in the area to determine the efficacy of propagation

The sites are summarized in Table 1.

TABLE 1. SOIL STABILIZATION PLOTS								
PLOT	MATERIAL	SLOPE	APPLICA-TION RATE	FERTILIZER 13-25-12	TACKI-FIER #3 W/ PAM	SEED BERMUDA /RYE 30%/ 70%	PERCENT COVER AFTER 3 WEEKS	NOTES
1	Wood Mulch	85%	4000lbs/ac	6lbs	3lbs	10lbs	80%	
2	Flexterra Bonded Fi-ber Matrix (BFM)	85%	3500lbs/ac	6lbs		10lbs	80%	
3	Flexterra	70%	2500lbs/ac	6lbs		10lbs	65%	Rock
4	Wood Mulch	70%	4000lbs/ac	6lbs	3lbs	10lbs	85%	Fiber loc
5	Flexterra	40% -70%	3500lbs/ac	6lbs		10lbs	80%	Fern spores
6	Flexterra	70%	3500lbs/ac	6lbs		10lbs	80%	
7	Wood Mulch	70%	4000lbs/ac	6lbs	3lbs	10lbs	90%	Shade
8	Wood Mulch	85%	4000lbs/ac	6lbs	3lbs	10lbs	60%	12oz Icky-Sticky, Fiber loc
9	Wood Mulch	85%	4000lbs/ac	3lbs	3lbs	10lbs	65%	12oz Icky-Sticky, Fiber loc
10	Wood Mulch	85%	4000lbs/ac	6lbs	3lbs	10lbs	70%	6oz Icky-Sticky, Fiber loc
* Note Flexterra contains both PAM and tackifier								

Photos Pre-Stabilization

Figure 1. Laying out test plots on a 70-75% slope

Figure 2. Breaking the slope to reduce concentrated runoff on the hillslope

Plots during application

Figure 3. Flexterra application in the foreground and thick application of wood hydromulch in the distant plot (note red flags that delineate plots)

Figure 4. Hydromulching complete on the 70% slope plots

Figure 5. Applying hydromulch to the 85% slope in Plot #2

Plots post-application

The vegetative plots helped us refine our preferred hydromulching mixes based on the resultant grass cover and stabilization that occurred after 3-4 weeks of post application time and after a 2.5 inch rain event. These photos were taken on July 23, 2012.

Figure 6. 7-23-12 Note Plot 3 with 50% vegetative cover and less vigorous grass growth was a thinner application of Flexterra (BFM) but also in an area with full sun and and high proportion of rock/consolidated material

Figure 7. Closeup of Plot 3 -- Thinner application of Flexterra BFM. Note good germination but less vigorous grass growth and the presence of rock

Figure 8. More vigorous plant growth in higher shade areas where Wood Fiber Mulch mixes were used

Figure 9. Grass coverage on Plot #2 using Flexterra BFM

Observations and Findings

- Shade improved the overall vigor of the vegetative cover -- likely a combination of reducing the impact of the raindrops as well as decreased heat and solar impact which can affect soil moisture
- in areas dominated by rock/consolidated material hydromulching efforts had less success in establishing vegetation
- wood mulch with tackifier and PAMs worked equally well or better than more expensive BFM mixes
- initial efforts to use coffee pergamino were unsuccessful because coffee beans were left in the skins which was a concern because we did not want to damage the pump -- pergamino will be tested in the fall when cleaner sources of pergamino can be gained during the coffee harvest season when better processing occurs
- the use of a product to reduce nozzle clogging and to add additional PAMs resulted in the loss of higher amounts of mulch
- volunteer native or native adapted vegetation readily colonized the sites though efforts to incorporate fern spores have not resulted in noticeable germination after three weeks
- applying Flexterra (BFM) at lower application rates was not as successful at stabilization plots as thicker mixtures and those using wood fiber mulch

Figure 10. Volunteer species establishing themselves on the plots