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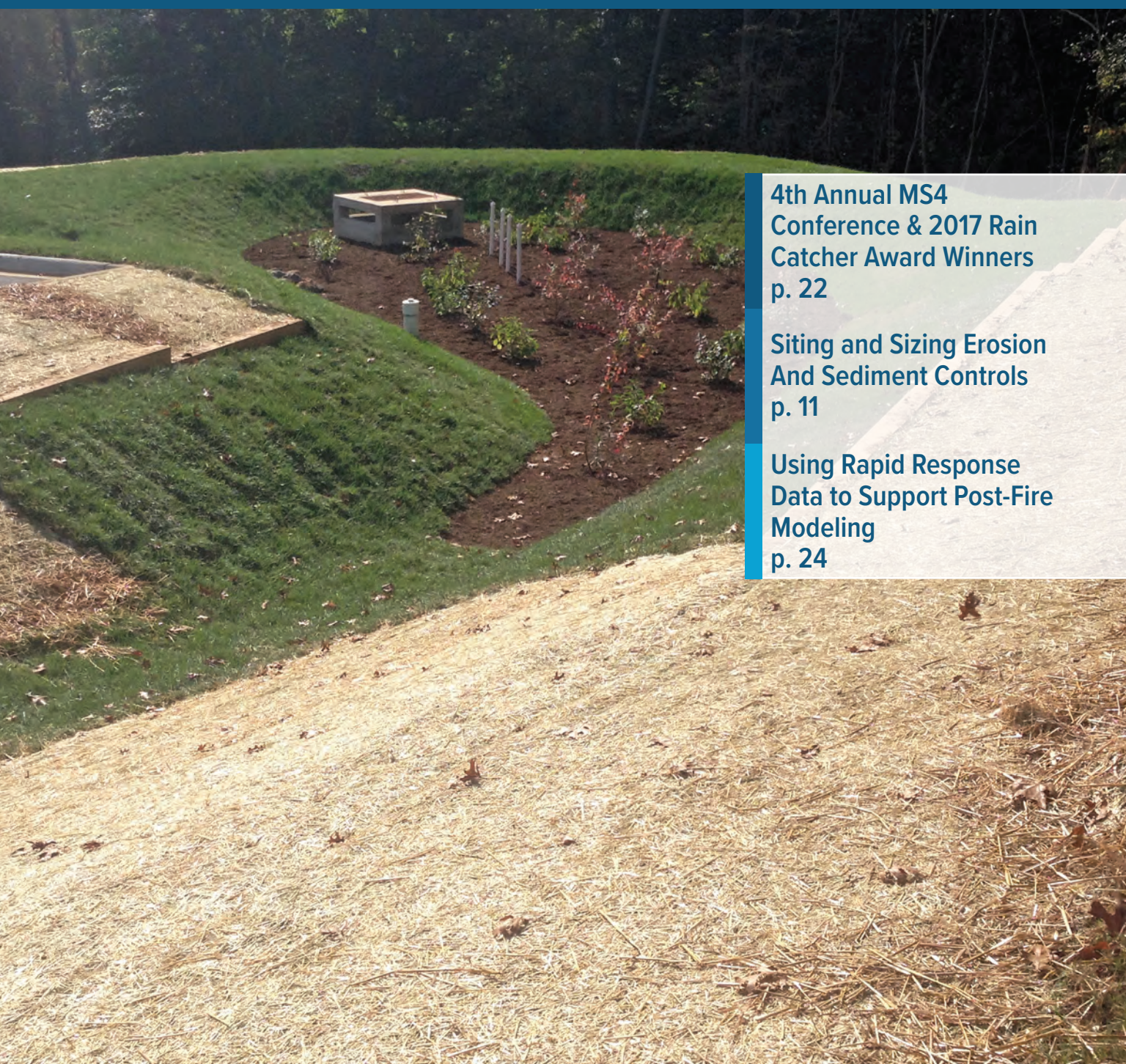
JULY/AUGUST 2017 | VOLUME 12, ISSUE 3 | IECA.ORG

ENVIRONMENTAL connection

THE OFFICIAL PUBLICATION OF THE INTERNATIONAL EROSION CONTROL ASSOCIATION



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ON THE COVER
This bioretention area is part of the Rain Catcher Award-winning South Park Watershed Enhancement Project. See p. 22 for more.

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Bullish for Wool: Using Wool in Erosion Control Blankets Shows Promising Results in a Montana Field Study

By Rob Ament, Monica Pokorny and Stuart Jennings

Wool, a historic fiber used by humans since time immemorial, could be a new miracle fiber that helps to establish vegetation and control surface runoff and erosion. A new study sponsored by the Montana Department of Transportation (MDT) and also funded by the Center for Environmentally Sustainable Transportation in Cold Climates has researchers at the Western Transportation Institute (WTI) exploring the use of wool in erosion control blanket (ECBs). More specifically, the project targets the use of waste wool or other harvested fiber that is substandard or unmarketable, which offers both environmental and economic benefits.

The attributes of wool are legion: After it has been scoured (cleaned of oils and dirt), it consists of 17 percent nitrogen, is weed-free, hypoallergenic, nearly fireproof, and absorbs 400 percent of its weight in water. As a result of these excellent properties, other countries around the world have been using wool to develop weed suppressant mats, fertilizer pellets (often mixed with sheep dung), matrices for sod roofs and other novel items.

Experimental plots using a random block design along U.S. Highway 287 near Three Forks, Mont.

The two-year research project at WTI started by reviewing existing wool products that might be readily adapted for roadside reclamation uses; however, none of these produced promising results. In the next stage, the research team developed its own roadside reclamation products: 1) ECB; 2) silt fencing; and 3) used cut wool pieces as an additive to wood-based mulch. Of these, the ECBs were by far the most successful. Therefore, this article will focus on the development of the ECBs and the field study to evaluate their effectiveness.

Wool Product Development

Typically, erosion control blankets for roadside reclamation are fabricated from straw and coir (coconut fiber). For this project, the research team worked with several wool mills and an ECB manufacturer to develop and construct ECBs of varying weights, densities, and composition. Following preliminary laboratory testing, six ECBs were selected for field evaluation:

- Two carded (processed to align fibers) pure wool blankets (two different weights)
- Two felted (processed to lock fibers together) pure wool blankets (two different densities)
- One rolled ECB composed of 100 percent wool
- One rolled ECB composed of 50 percent wool and 50 percent straw

Field Study Approach and Methods

The goal of the field study was to conduct a side-by-side comparison of the performance of the wool products with the

Treatment	Description	Mean Percent Canopy Cover (%)		
		Seeded Native Grass	Desired Non-Seeded Species	Weed Species
1	Carded Wool Blanket (73 g/m^2; 2 oz/yd^2)	8.6	3.2	17.8
2	Carded Wool Blanket (44 g/m^2; 1 oz/yd^2)	9.7	4.5	21.5
3	Needle punched (one pass) felted wool blanket[2]	15.1	3.2	20.4
4	Needle punched (four pass) felted wool blanket	2.9	2.0	24.3
5	Compost with cut wool; 40:1	10.2	1.7	39.1
6	Control: standard 70% straw / 30% coconut ECb	4.7	5.0	17.7
7	Control: Compost	6.4	1.3	35.4
8	Control: Broadcast seed only	0.9	2.9	47.1
9	Control: no seed or treatment	0.9	3.5	49.8
10	100% wool ECB	20.9	1.4	10.8
11	50% wool / 50% straw ECB	24.6	2.1	13.6

Mean percent canopy cover of plant groups by treatments at the U.S. Highway 287 test site.

performance of more commonly used roadside reclamation products (straw/coir ECBs and wood fiber compost). Working with MDT, the research team selected a study location along U.S. Highway 287 near Three Forks, Montana. MDT had previously drill seeded the site after highway reconstruction but it failed to sufficiently revegetate, demonstrating that a difficult site to revegetate was selected for the field tests.

The field study began in 2014. Working along a west-facing roadside cut slope, the research team established a randomized block design of one meter^2 experimental plots. The design included seven types of treatment plots: the six different ECBs selected for evaluation, plus a wood fiber compost with a wool additive. It also included four types of control plots: unseeded, seeded, seeded and covered with a standard 70 percent straw/30 percent coir ECB, and seeded and covered with a wood fiber compost. Each type had eleven replicated plots within the overall test site.

To establish vegetation, the research team broadcast seeded all of the plots (except the unseeded control plot) with a native perennial grass seed mix. The seed mix was comprised of four perennial grass species (fescue, wheatgrass, bluegrass and wild rye), which are commonly used by MDT for revegetation projects. The designated ECB or compost was then placed over each plot and covered with a piece of plastic mesh to protect it from strong storm events and the wind.

After the first and second growing season, the research team evaluated the performance of the woolen and standard products by measuring the percentage of canopy cover of each plant species present in each plot. “Canopy cover” measures the percentage of ground that is covered by a vertical projection of a plant’s foliage. To conduct the comparative analysis, researchers calculated an average species canopy cover percentage for each functional group: seeded grass species, species remaining from a 2003 drill seeding, desired but unseeded volunteer species, and weeds.

Year 2 Results and Significance

The woolen reclamation products developed for this project demonstrated notable results: all six types of wool erosion control blankets outperformed the control products by having higher mean canopy cover of broadcast seeded native grasses. In particular, the two types of rolled woolen ECBs had significantly higher performance results. The ECB composed of 100 percent wool produced a mean canopy cover of broadcast seeded native perennial grasses of nearly 21 percent, and the ECB composed of 50 percent wool and 50 percent straw produced a mean canopy cover of nearly 25 percent, compared to less than 5 percent for the standard straw/coir ECB. All of these differences between each wool product and the standard coir-straw ECB were statistically significant using independent T-tests. In addition,

the same two types of wool/straw ECBs had less mean canopy cover of weedy species, approximately 11 percent and 14 percent, respectively, than the standard straw/coir ECB, which had nearly 18 percent canopy cover for weeds. However, the independent T-tests indicated they were not statistically significant.

Also of note, standard wood fiber compost mixed with wool had higher mean canopy cover (10.2 percent) of seeded native perennial grasses than wood fiber compost alone (6.3 percent). This suggests that wool has potential applications in composts as well as in ECBs, although the differences were not statistically significant.

The research team is currently conducting analysis on results from a second test site in another area of Montana, with the final project report due in late 2017. Based on these preliminary findings, they are enthusiastic about continued development of wool reclamation products.

"We are creating a new use for underutilized wool, and the rolled wool ECBs are so far producing great results," said principal investigator Rob Ament of WTI. "It's exciting and gratifying to work on something that is potentially beneficial to the U.S. transportation, agricultural and environmental communities."

The project's final task reports can be found on MDT's website at: http://www.mdt.mt.gov/research/projects/env/wool_test.shtml

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