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## A Few Good Sprouts

The Science of Seed Selection

# The **Science** of **Seeds**

Experimentation produces the right combinations of soil amendments and seed mixes.

BY BARBARA HESSELGRAVE

**R**emember how 10 blindfolded people in a room each describe the elephant from their own perspective? The same might be said of soil—the stuff we interchangeably refer to as ground, dirt, or surface covering. Eric C. Brevik, a professor of soil science at Dickinson State University in North Dakota, illustrates how soil by any other name is not just dirt.

In a chapter of the book *Land Use, Land Cover and Soil Sciences*, he says a geologist would define soil as a medium to grow plants; an engineer might say it is “all unconsolidated materials above bedrock;” and a soil scientist would call it “living matter to support plant life that arises from biogeochemical and physical weathering.” And yet, for those who manage erosion, soil is more often than not a really big headache—both to get it where it needs to be, and to move it away from where it causes problems.

While current management practices are helped by the latest science and technology, much of what we do today is not new. Fertilizers, seed treatment, and soil amendments

are all erosion management practices built on centuries of previous experiments by civilizations that precede us, some by thousands of years.

Manuscripts from as early as 800 B.C. show that the Phoenicians constructed bench terraces on steep slopes and practiced a cultivated, irrigated agriculture on these terraces. The early Britons and the Chinese also practiced terracing by the 7th century A.D. Early farmers knew that crop rotation, planting of legumes, and spreading green and composted manure increased soil productivity.

Although the basics of managing erosion by restoring plants to the soil have not changed—soil is prepared, seeds are planted and covered with protective materials—our latest techniques are nevertheless pretty remarkable.

## **Prioritizing the Damage**

“It was sloughing at such a rate we were losing property,” says Molly Trujillo, capital improvements projects manager with the Southeast Metro Stormwater Authority (SEMSWA), describing the Piney Creek stream restoration in Centennial,

CO, within the Denver metropolitan region.

Trujillo says her organization collaborated with the Urban Drainage and Flood Control District (UDFCD) to facilitate a drainage master plan that would restore Piney Creek. The creek is 12 miles long and drains a watershed of 22 square miles.

“Since Piney Creek is such an alluvial channel, we’ve been experiencing accelerated erosion and sedimentation issues, so we prioritized this project as it was literally falling apart and was highly unstable.”

She describes how the project is being done in phases. “The first one included establishing a stabilized bankfull channel section with geomorphic design principles, along with revegetation work, which was performed to stabilize and secure the channel and reduce the chance of any future erosion.”

Trujillo explains that the mission of SEMSWA in the southeast Denver metro area is one of both solving and preventing drainage and flood control challenges, embarking on projects “that are needed to protect the environment, people, and property.”

Rich Borchardt of UDFCD explains how these efforts fit into the larger geographical picture. “SEMSWA is the local arm of government that handles drainage for the city of Centennial and portions of unincorporated Arapahoe County, whereas we cover the broader Denver metro area.”

He says the Piney Creek stream restoration started when residents first noticed a problem that they brought to local

officials, who then contacted SEMSWA, which performed a master plan study with UDFCD’s assistance.

“They [SEMSWA] are a fee-based stormwater utility, and an additional funding partner is the Cherry Creek Basin Water Quality Authority, who are funded by a fee from state parks,” he notes.

Borchardt adds that his organization provides drainage improvements and uses natural solutions rather than hard armoring whenever possible; vegetation plays a huge role in this effort.

“We need to take extra effort in vegetation to preserve and protect the stream itself. It’s a vital part of the whole system, and the Piney Creek project was designed to achieve both of those goals. It’s a great example of how things can be done.”

Borchardt says the groups partnered with Denver-based THK Landscape Architects for design and revegetation specifications. The project was so successful it was awarded an American Society of Landscape Architects (ASLA) Merit Award for revegetation and stabilization efforts. Components of the effort included amending the top 6 inches of land surface, native seeding, wetland sod, and native shrubs and trees.

Jenna Bockey, landscape designer with THK, says, “We’ve done a lot of river restorations and they trust our recommendations. We came up with species for successful plantings and everything is establishing really well.”

She adds that restoring wetland habitat to the creekbed was an important aspect of the work. “Some 18,000 feet of



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wetland was installed with wetland sod, and a wide variety of shrubs that are native to the area were planted to create an underbrush area.”

Bockey says 200 cottonwood poles “rather than ball and burlap” were sunk 10 feet along the banks. The species, she notes, is “native to our foothills and streambeds here.”

### Getting a Good Connection

Drew Bartok of CDI Environmental Contractor, the contractor charged with implementing the project, says, “The work needed to be in four phases. We had to prioritize early on because the area was so unstable. We finished phase one in May of 2016 and the next segments are now in the process of restoration, or in planning stages.”

He adds that Piney Creek was “one of the better jobs we’ve ever done, primarily because all of the parties involved partnered so well together, and our efficiency of effort was streamlined toward progress.”

He says crews installed 10,000 yards of coir blankets; 20,000 square feet

of wetland sod produced by North Fork Native Plants, a supplier in Idaho; about 10 acres of seeding with product from Granite Seed, using the species specified by THK; and 1,000 upland shrubs.

“What we had to do was get good contact with the existing soil to ensure root establishment. Since most of the topsoil was gone, we had to create an environment conducive to revegetation, so we used biotic earth growing medium under the 20,000 square feet of wetland sod. This was the first step to stabilize the banks.”

Bartok says the entire project used organic amendments supplied by Bowman Construction Supply including Biosol fertilizer and MycoApply mycorrhizal fungi. “These are great products that help establish healthy root systems and foster seed growth. Plus, since they are organic, the soil and aquifers are

PHOTOS: CDI



totally protected.”

He adds, “A challenging aspect of the project was that we had to drill down 10 feet to install 18-foot-long cottonwood poles.” These dormant log cuttings will establish a root system to add to the bank stabilization efforts.

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Piney Creek in Centennial, CO

**“On many sites, waterfowl key in on newly installed wetland plants and can pull them out of the ground.”**

**Seeds and Sod Ready To Go**

Tim Watters, one of two owners of North Fork Native Plants in Rexburg, ID, describes the wetland sod mats that were used to help stabilize the stream-bank on the Piney Creek project.

“We produce a unique product used specifically for restoration and reclamation projects,” he explains. “Our pre-vegetated coir mats are used extensively throughout the Intermountain West.”

For Piney Creek, North Fork supplied CDI with nearly 29,000 square feet of 16- by 3-foot wetland sod mats, which Watters says are grown hydroponically with native sedges, rushes, and bulrushes. “We have nearly 8 acres of production ponds with a capacity of over 4,000 of these mats”

Each mat is plugged with more than 100 small wetland plants; it takes time to allow the plants to integrate into the coir mat and expand to reach a minimum specification of 50% root mass coverage and 50% top growth coverage.

At Piney Creek, the mats were

installed at the toe of the newly constructed channel. They provided temporary erosion control until the wetland plants in the mats rooted in and became established. Two rows of mats were installed with a “drier” species of plants used on the up-slope zone.

Because the plants have reached a stage of relative maturity by the time they are delivered, the coir mats provide an immediate aesthetic value and accelerate establishment onsite. Moreover, they can offer protection from sudden weather events and avert potential damage from erosion. And while wildlife can threaten young plants, these mats can withstand the enthusiasm of waterfowl finding a new supply of food.

“On many sites, waterfowl key in on newly installed wetland plants and can pull them out of the ground as they feed on top growth. Since the roots in our mats are integrated into the coir matting, top growth can be grazed but the roots stay intact, allowing for regrowth,” says Watters.

Tren Hagman, from Denver-based Granite Seed, is a specialist in seed and erosion control. He describes Granite’s role in the Piney Creek effort, “When CDI called and they had won the project, we talked about what they needed for that specific site. We grow a lot of it here on our farms in Washington and Montana—grasses and forbs—but we also go out and collect what we need if it’s a particular species request, typically forbs and shrubs.”

Hagman says this project used a riparian mix of nuttall sunflowers, yarrow, and blue verbena, “which is a lower-growing plant that spreads.” He says, “We mixed soil inoculant with the seed as well. For Piney Creek we mixed 15 pounds of seed with 20 pounds of inoculant, and this takes care of close to 3 acres.”

“Altogether, the revegetation efforts are a terrific success because of design, the amendments, and the quality of sod and seeds we used,” affirms Bartok.

**Growing as Nature Intended**

After struggling with the cost and pitfalls of chemical fertilizers, Sue Wisbey of Alpha Nursery and Garden Center in Cascade, ID, is enthusiastically beating the drum over the benefits

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of Biosol, MycoApply, and Menefee humate. “I started testing these with my projects in 2008, and the results were so stupendous I converted 100% to organic. It works for lawns, planting trees, shrubs, everything.” Now, she holds forums for homeowners, gardeners, and landscapers—anyone who wants to get better results and get off the chemical amendment bandwagon.

But there’s fascinating science behind these products, as Wisbey explains. When you fertilize with organics she says, they stay “in stasis” in the soil. In other words, “Once they go in, they stay there, whereas chemical fertilizers vaporize at a rate of about 30%. This vapor combined with air is converted to nitrous oxide, which is 330 times more damaging to the environment than carbon monoxide.” She adds, “Another 30% of chemical fertilizers gets washed out of the soil into our water systems aquifers and streams, creating high levels of nitrates in the water systems.”

A product Wisbey uses with great success is Menifee humate, which creates humic acids in the soil and this breaks down organic materials. In her business, this eliminates the need for the tedious process to collect grass clippings.

Wisbey describes the mycorrhizae in MycoApply as “a spore that a plant root recognizes as a friend, so the root system opens up and allows the spore to become part of the plant.

“This is a naturally occurring fungus that is so beneficial to plants. When the symbiotic relationship forms and the plant produces sugars, it sends signals to the fungus, saying, ‘I need more nitrogen,’ so the spore creates filaments that



The restoration included coir blankets, seed, wetland sod, upland shrubs, and cottonwood poles.

will stretch out in the soil, find the nutrient, and deliver it to the plant.”

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house for analyzing information and maximizing metabolic efficiencies, creating higher levels of humic acid, and stabilizing pH—a feature Wisbey is particularly impressed with.

She says optimum pH for her projects is essential because if soils are too acidic, “it locks up nutrients and plants can’t get to them. When you keep adding acids or alkalines to balance your soil, these are good for maybe one year, but then they wash away. What you need to do is correct the soil permanently, and these products do that. In our 9-acre test development site we are getting to a balance of pH, and once we’re there the plants will have ready access to every nutrient they need,” says Wisbey.

Finally, she says, if we grow the way nature intended, “you don’t have to worry about aeration, adding chemicals to correct everything each year. When people come to me and are educated to these benefits and finally get the big picture and understand the differences between chemical and organic soil management, I get a 95% conversion rate.”

She adds that the upfront expense may seem high, but the investment pays back with huge production increases, stability, and lower maintenance.

“Plus, you have reassurance that the environment—plants, wildlife, air, and water—is well protected in the bargain. And another great benefit, we don’t know why, but for some reason it repels voles!”

### Reclaiming Soils

Tom Bowman, division president of Rocky Mountain Bio products, a division of Bowman Construction Supply, says, “We’re also known as We Fix Dirt, because it was easier to get the message across.”

Bowman says adding micro- and macronutrients during revegetation and reclamation projects is a great insurance policy investment for those projects. “This really is a case of ‘do it right the first time,’” he says. Bowman’s company is the North American supplier of Austrian-manufactured Biosol.

He describes one amendment’s origin as a penicillin

**Adding micro- and macronutrients during revegetation and reclamation projects is a great insurance policy.**

byproduct. “After you grow penicillin, what’s left is mycelium, and this fungus is a high-quality, bound nitrogen source that has been fermented, so it is very stable. This is the vegetative source for mycorrhizae in our MycoApply to thrive in.

“While it’s primarily used for agriculture in Europe, here we see it is used for reclamation and for soils that are very poor, highly disturbed, or on difficult sites. But because of its absolutely benign affect on the environment, some places like the Lake Tahoe water basin, for example, rarely specify anything else.”

And after 180 days, “We’re still releasing nutrients as the plant needs them,” he says. “Because of the beneficial fungal biomass of this product, there are a lot of great qualities such as holding onto water and disease suppression, with the results of healthier and better seed germination, and the benefit of erosion control. There are organics, and then there’s *this* product—they are not the same as composts or animal byproducts. The fermentation and specific organic binding of the high-quality nutrients are incredible, and the results in just the first year at Piney Creek, a very alluvial and threatened stream, are clear evidence that it works.”

The first stage of work for Piney Creek stream is well on its way. Borchardt affirms that the success has residents, project sponsors, SEMSWA, UDFCD, and suppliers thrilled at the regrowth and wetland restoration achieved so far. All stakeholders anticipate a high level of preservation and future protection for the stream as they continue onto the next project segments.

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## A Federal Case of Success

When Richmond, VA-based firm Timmons Group tackled the revegetation of the Social Security Administration's new National Support Center in western Maryland, the landscape architects were faced with multiple challenges.

Designed to be a mission-critical data center that will achieve LEED Gold certification, the project boasts a magnificent setting worthy of any five-star hotel resort, with breathtaking 360-degree vistas of the Blue Ridge Mountains and pastoral landscape.

But this enormous \$500+ million structure of 300,000 square feet—nearly 7 acres—created a huge site that needed healing. Timmons Landscape Architecture senior project manager and horticultural specialist, Neal Beasley says the company faced a multifaceted project of nearly 64 acres.

"We not only had to replicate the native grasses, shrubs, and woodlands, but these plantings also had multiple functions—performing as both an aesthetic to mask the nearby com-



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merce center and highway, as well as to function as shade for parking areas, enhance the geometry of the building, and act as green spaces to reduce heat island effect."

Beasley says the project had a challenging hillside slope of two to one leading to a creek, and this required numerous bioengineering efforts, including micro-bioretenment, bioswales, and grassed swales.

Managing stormwater and roof runoff involved collecting and storing water in an underground cistern. The water was then reused to supplement water for the cooling towers. Runoff from other portions of the building is collected and used for irrigation of the large property, Beasley explains.

But one problem surpassed all the others in the big headache department.

"There was an explosive weed population. As soon as plants started coming up across the landscape, there were weeds everywhere, so we called

our partner suppliers at Ernst Seeds, who sent out specialists to evaluate the problem and devise a strategy."

## Scalping Plants and Sinking Soils

Greg Kedzierski, the plant materials specialist from Meadville, PA-based Ernst Conservation Seeds, describes what he found when he arrived onsite at the Maryland project.

"I knew right away it must have been a farm; there were typical fallow-field weed species everywhere—thistle, velvet leaf, and many others."

The site had a complex landscape plan with species that were to reach various low, medium, and higher growth heights. However, Kedzierski explains, there is a big difference between revegetation and landscaping.

"In landscaping, you're trying to pull off a certain aesthetic—a meadow blowing in the wind, colorful panels of wildflowers—and you want to copy that and recreate nature in a manageable situation, because you don't want it to look weedy. But in a restoration, that is simply revegetation, and you don't

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Near Piney Creek

really care if some weeds eventually move into the site because no one sees it. But on a created landscape, it's high visibility and this *is* noticeable."

A landscape this large, compared to a simple restoration project, requires constant maintenance and specific care, whereas with restoration, "we put plants in, and after they get going we pretty much leave them alone," explains Kiedzierski.

But the maintenance went overboard at the site, he says, as crews had been mowing it constantly and too low, like a lawn. "You can't scalp-mow with these species, so we had to find a lawn maintenance contractor who had the capability to mow at 6 inches and higher."

In one area that had a permeable geotextile installed close to the building, he discovered that maintenance people had been driving over it, causing a compaction problem.

The landscaping problem was also compounded by weed-seed-contaminated

**"In a restoration, you don't really care if some weeds eventually move into the site because no one sees it."**

stockpiled topsoil that had been sitting a long time with growth all over it, "so when it was spread out it was already full of undesirable seeds and weeds."

He says Ernst worked with Timmons to figure out how to selectively kill the weeds with herbicide in each section. Once the weeds were under control, "We put in low-growing clover mix next to the building and wildflower mix farther out. Our team created a site plan that indicated what was where and how it should be maintained. The Timmons plan was excellent, but the site owners were unaware of the specific required maintenance," says Kiedzierski.

An important side note, he adds, is the project "was all about pollinators."

"I think this is the first federal facility to have a pollinator-friendly landscape, and the specs for native clovers and wildflowers were very specific, which is great since this is the Ernst Seed specialty."

Ernst spokesperson Randy Ferguson explains that the company has been helping customers with sensitive and challenging problems like this one for

more than 50 years. "With about 10,000 acres in propagation, we grow a few hundred species of seeds," he says. "We are very proud of our high-quality seed product; we have these tested by what we think is the best lab in the country to ensure a high-germ seed product. Native seeds have been our primary focus for the last 25 years, and we are one of the largest and most respected native seed suppliers in the US."

Native seed was just what the Timmons project needed, and Beasley and his colleagues were exceptionally pleased with the Ernst level of commitment, customer service, and high-quality product to get the huge project turned around and under control.

"Their experts worked with us onsite for several meetings with the owner and maintenance contractor, and they were essential in helping educate everyone on the project maintenance and establishing a perpetual and good-looking 45-acre meadowscape," he says. **EC**

*Barbara Hesselgrave is a writer specializing in environmental topics.*

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