

EROSION CONTROL

FEATURE



Photo: BASF

Practitioners protect native species, rebuild damaged soil, and save money.

By Mary Ellen Hare

An increasing number of national and state highways are looking dressed up: no longer parched stretches of dull green or faded brown spikes but instead a fantasy of brightly colored flowers. A driver is tempted to stop and pick a few for the dinner table.

The late Lady Bird Johnson, largely responsible for the Highway Beautification Act of 1965, often said, "Where flowers bloom, so does hope."

Former President Lyndon Johnson's wife can take credit for as many as 38 state programs currently in place to preserve and restore vegetation.

Roadside wildflowers are not simply a feast for the eyes, however. States have discovered a major reduction in maintenance costs as a result of less mowing. Other benefits include increased wildlife habitat and biodiversity, improved erosion control, and weed suppression.

In any case, whatever the state or national commitment to the environment or to aesthetics, the main goal of a roadside crew is safety. Drivers first must be able to see where they are going without distractions that arise when roadsides are not properly maintained. This often requires a combination of techniques and practices.

Getting the Right Grass to Grow

Mike Maurer, a 33-year industry veteran, oversees the vegetation management programs for the Pennsylvania rights of way (ROWs) in the Pennsylvania Department of Transportation's Engineering District 12. In a state with the fifth-largest number of road miles in the country, Maurer takes a big-picture approach when it comes to managing ROWs. "I see everything as part of a greater management system and try not to focus on one particular species without first assessing how each part fits into one of my main goals: maintaining clean, competitive turf along roadside

corridors; clearing brush from rights of way; and managing bare ground areas underneath guardrails.”

Maurer generally aims to have cool-season fescue grasses lining the roadsides. While mowing works in some areas, a program of using plant growth regulator (PGR) also suppresses seed heads and grass growth that create visibility hazards in tough-to-reach areas like steep ditch banks or high-traffic areas. By treating these areas with herbicide in late April to early May, fescue can be maintained at a desirable height. In addition, other common ROW weeds like foxtail can be kept at bay. Foxtail grows tall, and when it infests roadsides, it causes additional sight line problems for drivers.

Although District 12 had used PGR technology since 1996, the team turned in 2005 to two newer products, Plateau herbicide and Overdrive herbicide from BASF Professional Vegetation Management (ProVM). The district had particularly good results using these herbicides in the tank mix to control late-season foxtail and to suppress grass heights.

Partnership with Pennsylvania State University and several private-sector representatives has helped Maurer develop a recipe for success throughout his career. “We’ll keep researching the latest and greatest products out there,” he says. “By doing that in the past, we’ve managed to take care of problematic vegetation and save budget dollars.”

Spraying and Cutting in One Fell Swoop

One of the problems in applying any herbicide is wind drift, according to John Davis, maintenance supervisor for the Washington Department of Transportation in Pierce and Thurston counties.

For the past seven or eight years, transportation workers in those counties have been using the Brown Brush Monitor in areas that require both cutting and herbicide to remove invasive vegetation such as blackberries and scotch broom.

Previously, according to Davis, workers would first spray, then mow, and then go in with weed whackers. Now, with the Monitor, “You’re only out one time.”



Photo: BASF

Calhoun County Highway Department crews complete brush control rounds using boom mowers.

The machine has two specialized chambers to handle the tasks of mowing and applying herbicides. In the first chamber (the mower deck), the brush encounters a set of 6-inch blades that can cut stems 2 to 3 inches in diameter.

The mowed debris is removed from the mowing chamber through a side discharge, which does not allow the cut biomass to pass through the herbicide application chamber. Behind the mowing chamber is an enclosed herbicide chamber where the cut stubble

encounters two treatment phases; a row of nozzles sprays herbicide directly onto and through the stubble rather than onto the ground. Then, any herbicide that passes by the stubble is caught by an applicator made up of a series of scrapers, brushes, and chains, which wipes herbicide onto the stubble in the second application stage.

“The Brown Brush Monitor has two saddle tanks with 50 gallons of chemical,” Davis explains. “You can apply it to the exact location. The beauty is, instead of herbicide drift, the Monitor puts it down on the vegetation at a low level; it’s almost contained. Basically, it’s only 6 to 8 inches off the ground. It’s really one of the better tools we have.”

The Monitor is not useful for steep-sided hills like the slopes at interchanges, according to Davis. “It all depends on the grades; it’s really a judgment call.”

When slope becomes a problem, the Doyle family of Diamond Mowers Inc. has a solution. The company has been selling hydraulically driven roadside mowers since 1969. Roadside vegetation management is its proclaimed specialty, and one of its newest products is the Wet Blade, which has been on the market out for seven or eight years, according to Danny East of Sioux Falls, SD. “We use it to control erosion and to release native species, particularly in wetlands. It puts no herbicide into the air. It’s been used to treat thistle,

wormwood, just about anything.”

Using centrifugal force, the Wet Blade runs the chemical underneath the cutting blade as it spins, keeping the chemical on the bottom of the blade until it touches the top of the stubble and then brushing on the herbicide with a wiping motion. The plant sucks the chemicals into the root and dies.

For the past two years, maintenance crews in Lucas County, IA, have been using a Wet Blade boom mower to control brush in the ditches along rolling, hilly gravel roads. “On our 75 miles of paved county highways, we use a regular 15-foot brush mower,” says Clayton Smith, superintendent of Lucas County’s maintenance crew. “But the ditches on our gravel roads are deeper and steeper. We were having to go back and hire someone to cut the brush out. Now we can do a more thorough application.”

Smith explains that the boom mower reaches 24 feet from the tractor on the road, allowing crews to mow a ditch from the fence line in a 4.5-foot swath. “When the Wet Blade hits the ends of trees or brush, it creates a shock that releases the chemical. It gets rid of the brush but doesn’t touch the grass [underneath] at all.”

When steep grades make it difficult or impossible to mow, specialists in some areas use a PGR

program.

Tom Bowman, division president of Bowman Construction Supply in Denver, CO, has worked in partnership with Mycorrhizal Applications for the past five years. His company supplies Biosol, an organic fertilizer that is a byproduct from the manufacture of penicillin, which in combination with a tackifier, wood fiber mulch, and native grass seed, is sprayed on a given area to induce vegetation in areas depleted by erosion. Bowman describes a roadside project in Agness, OR, where the roadside was “close to a one-to-one slope,” or a 45-degree angle. “Previous attempts to vegetate that area had failed repeatedly,” Bowman says. “I knew just enough about mycorrhizae to be dangerous, but that project showed me that it really does work.” The area was fully vegetated in eight months and has remained so ever since.

The Guest Grass Becomes the Enemy of the Host

Sometimes, spraying for one kind of grass can lead to the proliferation of new species and accompanying new problems.

In Calhoun County, AL, which features the nation’s densest concentration of federally protected natural areas, the public roadsides present a special challenge. Brian Conary, a lifetime resident of the county, is project manager and 12-year veteran of the Calhoun County Highway Department (CCHD)

vegetation management program. Responsible for protecting the roadside environment as a natural area, he must also keep it safe for drivers while dealing with a limited budget.

When invasive grasses became a problem in his territory, Conary and his team tried mowing in combination with herbicides to manage weed height. Aiming for an ideal stand of Bermuda grass, the county used a mowing program to keep out Johnson grass, the primary competitor. Mowing proved to be costly and hazardous to drivers, and it did little to protect native species of grass and wildlife.

“We were mowing two complete rounds on our roadways every year,” Conary recalls. “We decided that a combination mowing and herbicide spray program might provide a safer and more cost-effective solution.”

He explains, “We thought that controlling Johnson grass would solve all our weed problems. Instead, it almost seemed as though we accidentally started a foxtail and mare’s tail release program, which were also weeds we didn’t want on our roadsides.”

Both yellow and giant foxtail also out-compete Bermuda grass. As annual grasses, they thrive in disturbed areas such as roadsides. While foxtail grows to approximately 3 feet, mare’s tail can grow to heights of 10 feet—even taller than Johnson

grass. Each plant can produce 150,000 to 200,000 light seeds that blow on the slightest breeze.

Mare's tail is a very difficult weed to pull by hand, and glyphosate-resistant mare's tail is beginning to show up around the country.

Conary turned to BASF ProVM and made a first application of 6 ounces per acre of Plateau and 32 or 64 ounces per acre of MSMA (monosodium methanearsonate) herbicide to the roadsides.

Because Plateau can be used in natural areas where it is important to maintain native grasses, wildflowers, and wildlife habitat, Conary was able to protect the roadside environment as a natural area, an important community requirement, while controlling the weeds.

“We now mow only once, with minor touch-ups and spot work when needed,” he says. “Although herbicides are an upfront cost, they actually save money over the course of a season.”



Photo: BASF

Penn State researchers work with the PennDOT program.

The CCHD uses the NorthStar injection spray system, which involves 30-gallon tanks mounted on trucks. Accurate herbicide rates are programmed into a computer, and the herbicides are automatically pumped into a water-carrier pump at a regulated rate. The spray pattern and stream can be adjusted from the cab of the truck via the computer.

This system takes much of the calibration work and mixing time out of the equation, further reducing overall spraying costs.

Staff from other counties and from the Alabama Department of Transportation and the Agriculture Department visited Conary's roadside demonstration plots in the summer of 2005. "These folks wanted to see where we've been and where we're going," Conary says. "They could see parallels to their own situations."

Plants Save the Day When Riverbank Erodes

Erosion is a concern along any roadway, and sometimes transportation departments can learn from private enterprise how to use vegetation to combat erosion.

Gerber Legendary Blades, now a division of Fiskars, is a manufacturer of jackknives, with headquarters near Portland, OR. In 2006, following large storms in the Pacific Northwest, flashy streamflows eroded the banks of a nearby stream and undermined the company's parking lot foundation, its asphalt surface, and a 40-foot corporate sign. All efforts to repair the site failed until the installation of Agrecol's Envirolok vegetated retaining wall system, distributed and installed by Sunmark Environmental Services of Troutdale, OR.

"It was a pretty big mess," says Robin Cook, general manager of Sunmark. "The remnants of a monsoon in the Philippines hit Washington and Oregon in November 2006 and dumped 6 inches of rain in two days.

"Interstate 5 is right next to Gerber, and six storm drains piped water into Ball Creek. Its bank is normally 4 to 5 feet high, and the water went right over it and flooded the parking lot. When the water receded, it took the bank with it.

"The site [Gerber's] was already eroding under the asphalt, and we were worried about even driving vehicles over it. Using the Envirolok system, we were able to encase the bank with a sandy loam compost soil blend."

The vegetated retaining wall system combines interlocked soil bags and native plants to stabilize

slopes and control erosion. Soil bags encapsulate the soil and are woven into a wall unit. After construction, the faces of the bags are planted with native plants, sod, and seed, which develop extensive root systems that hold the structure in place. According to Agrecol, when fully vegetated, bags can retain their integrity for as long as 200 years, depending on conditions.

Agrecol, which was founded in 1991 as an agricultural research and development firm, started in 1995 to focus its attention and resources on the production of native plant species grown from remnant foundation collections gathered primarily in southeastern Wisconsin. Agrecol's services and products include native seed and plants; design, installation, and maintenance; erosion control; and stormwater management.

“Our main goal for the project was to get the right balance for vegetation,” Cook says. “That’s the key to the whole system: getting it vegetated. After we built the wall, we used all native plants: grasses such as Roemer’s fescue, wetland plants like slough sedge, native woody plants—for example Nootka rose—and wildflowers such as river lupine.”

Cook says the project was completed on May 14, 2007. “By July 31, 2007, you could no longer see the streambanks, and the stream itself had changed. There used to be big erosive cuts in the banks, and we don’t have those anymore.”

The habitat also improved, according to Cook. Getting the vegetation established improved the water quality and allowed small schools of fish to congregate and thrive. “Before, it was a muddy-brown, soil-filled stream. As the plants grow taller, they will shade the stream, lowering the water temperature and providing a habitat for wildlife.”



Photo: Sunmark Environmental

Erosion was undermining this parking lot in Portland, OR.

Maintenance is surprisingly not an issue. Cook says the vegetation was established so quickly that the weeds didn't stand a chance. “The combination of soil blend and compost is just an excellent growing system.

You see weeds on the other side of the bank but not on this side.”

The Oregon Department of Transportation has applied for permission to apply the Envirolok system on the other bank, according to Cook, who says Sunmark has turned over its plans to the state for such a project.

Prairie Grass Cuts Cost While Staying Green

Fred Circle, president and owner of FDC Enterprises in Columbus, OH, says he has spent the last five years transforming what used to be largely a roadside spraying business into the business of creating prairies. Last year, the

company transformed 18,000 acres of land, with average-size plots of 20 acres. Workers even invented a specialized piece of planting equipment to accomplish the task. "It's a hybrid, somewhere between a corn/bean planter and a wheat planter. Instead of jamming a wad of seed down the hole and hoping one of the seeds grows, this machine separates the plants and drops the seeds down one at a time."

A recent project involved lakeside property in Marshall, MI. The city was renting the land for \$25 an acre to farmers and asked John Anderson, Michigan representative for FDC Enterprises, what it would cost to transform the land into a native prairie grassland area. After receiving partial funding from the Fish and Wildlife Service and the Calhoun County Quality Deer Management Association, the city was able to transform 80 acres of farmland into native prairie grassland with such native plants as big and little bluestem, Indian grass, and switchgrass.

"Once the area was transformed, the city was able to enter a conservation program with the federal government, who will pay them \$76 an acre each year for the next 15 years. In addition, the transformation will contain soil erosion, stop pesticides from migrating into the lake, and make the area attractive for hunting, walking, and fishing," says Circle.

Yet even a prairie must be sprayed in the period before new vegetation can establish itself against competitors. Circle says the company has relied on Jim Brayton of Townsend Chemical in Selma, IN, for both products and information. “It’s truly a partnership, an informal one. They are terrific to work with and not afraid to tackle a new challenge. They’ve given us a lot of good information (for soil and weed types) so that we didn’t have to use trial and error.”

Starting From Scratch

When an area is badly disturbed, as in mine reclamation or, in this case, a road being straightened, sometimes the only solution is to start over.

David Steinfeld is a revegetation specialist for the US Department of Agriculture (USDA) Forest Service Pacific Northwest Region 6. His office is in West Bend, OR, but he spends most of his time out in the field working in partnership with the Federal Highway Administration (FHA) to revegetate roadside areas in national forests.

Steinfeld describes two recent projects, one on the 12-mile road running from Sunriver to Bachelor, OR, and one on the Sunriver Interchange. The road was straightened, leaving cuts, fills, and areas of abandoned roadway. “These are highly disturbed sites, almost like mine reclamation, except you don’t have the toxic substances.



Photo: Sunmark Environmental

A wall of interlocked soil bags stabilized the bank.

“We have to start from scratch,” Steinfeld says of the restoration work.

“There is little or no topsoil, and what is left is sand base. It’s sterile. We can try to use what little soil is left, but there’s not

enough to go around.”

Revegetating such areas is far from a quick, simple task, according to Steinfeld. “The area goes through three ecosystems, with a bottom of 4,000 feet and a top at 5,000 feet. You can’t apply the same strategies to all areas.”

Becoming familiar with a particular project site is all-important, Steinfeld says. “You have to understand the soils, the climate, and the vegetation before you can begin to have a successful project.”

As long as four years before any road construction work takes place, Steinfeld and his team assess the site. “We spend a week in the field, doing soil work, assessing botany, and establishing reference sites.”

He explains that identifying an area where some vegetation has been naturally reestablished allows the team to determine what might best grow in the area. “We are copying nature.”

Once they establish a revegetation plan, the team members collect native seeds and send them to farmers to propagate, which requires two years. “We’re ready when they start building roads,” Steinfeld says.

Once construction is under way, the work starts again. “We’re out there on the ground, overseeing seeding and planting and making sure our plan gets implemented. We can adjust if necessary as we go along.”

Steinfeld’s involvement is more than supervisory. “I’m out on the hydroseeding machine, on the ground with them, for days. While I’m waiting for a machine to arrive, I can hand-seed an acre in an hour.”

From beginning to end, a project can last as long as 10 years. “Once a project is completed, we do statistical monitoring at one, three, and five years.” The results are not immediate. “I tell the engineers not to expect a blanket of green the first year. The important thing is to cover and protect the soil we have and think long-range. If we build the soil, the plants will come.”

Asked about the revegetation products used on various sites, Steinfeld says, “All products have a place. You have to think about where you’re going to put them.” One of his tools is mycorrhizae, the soil fungi that form a beneficial relationship with the

roots of plants. The tiny mycorrhizal fungal filaments reach and draw nutrients from a greater volume of soil than do the plant roots alone. “[Mycorrhizae] have some advantages because they propagate through plants. A mycorrhiza infects a root of grass, which explodes and carries spores. It’s a one-shot way to get plants colonized.”

Asked about taking advantage of the mycorrhizae available in nature, Steinfeld says that waiting for nature to take over is too slow. “That takes years, and we just have one shot; we can’t wait around for nature.”

Steinfeld is not a fan of fertilizing during the first year. “Many of the weeds are annuals, and they love fertilizer. They take advantage of it faster than the perennial native grasses we plant.”

The FHA in Oregon seems to be ahead of its time in revegetation management. “They’re pioneers,” Steinfeld says, adding that in a national forest area, the emphasis is always on preserving the natural habitat.



Photo: Sunmark Environmental

Preserving aquatic habitat is important when solving streambank erosion problems.

Using Fungi to Speed Growth

Mycorrhizal Applications Inc. of Grants Pass, OR,

researches, produces, and sells mycorrhizal fungi that greatly accelerate plant growth. The fungi excrete chemicals that dissolve mineral nutrients, absorb water, retard soil pathogens, and glue soil particles together into a porous structure. In return, the mycorrhizal fungi receive sugars and other compounds from the plant for their own nutrition.

Mike Amaranthus, Ph.D., is an associate adjunct professor at Oregon State University and president of Mycorrhizal Applications. Dr. Mike, as he is called in the industry, has been working with mycorrhizae for 30 years.

He claims nursery and landscape professionals are gaining increased appreciation of the living soil and more frequently incorporating soil biology and mycorrhizal products into their practices. Native plants that have been established for a long time are especially dependent on mycorrhizae, according to Dr. Mike. “They [mycorrhizae] increase the surface absorption 100 up to 1,000 times. There is a mile of mycorrhizal threads in a thimbleful of soil.”

Because the mycorrhizae require energy from the roots of plants, they are lost when the soil is disturbed, for instance by tilling or erosion. “They don’t like what happens when you prep a site,” Amaranthus says. “They can’t survive without a living host. Sure, you can override biology by applying fertilizer, but a year later it’ll probably look

like hell. The plants are only above the ground; they lack the underground resources needed to thrive. Mycorrhizae have doubled the survival of native plants.”

Tim Meikle, principal of Great Bear Restoration in Hamilton, MT, has worked with mycorrhizae for years. He previously received a USDA grant to produce mycorrhizal plants in a greenhouse environment and has since formed his own company, which incorporates mycorrhizal inoculations to grow native trees and shrubs in greenhouses for restoration and reclamation.

A recent project at Montana State University’s Agricultural Research Center involved field studies in the fall of 2006, followed by planting the dormant stock of five different species: common chokecherry, common shrubby cinquefoil, silver sage, skunk bush sumac, and Wood’s rose. Meikle says his team has observed substantial increased growth in chokecherry, sumac, and rose. He and his team currently are harvesting all the plants and evaluating them for biomass, caliper, and colonization to provide hard evidence for the difference in performance between stock inoculated with mycorrhizae and non-inoculated nursery stock.

“When I look at mine sites or highly disturbed areas, I see that moisture and nutrients are greatly limited for outplanted seedlings,” he says. “The

mycorrhizal plants have a mechanism in place to acquire moisture and nutrients at much lower levels. Seed production under old practices suffered deficiencies. Plants that have not been inoculated are basically starving to death. If you look at disturbed sites, plants inoculated in the greenhouse go through transplant shock much better than those receiving standard greenhouse practices.”

Meikle says it costs no more to grow plants inoculated with mycorrhizae and a modified fertilizer regime. “Essentially, there is no difference in the cost to the end user, but the performance is substantially higher.”

Vegetation control clearly begins in the backyard. It is all a matter of planting, growing, cutting, and weeding. Sounds simple. Until you think about it.

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