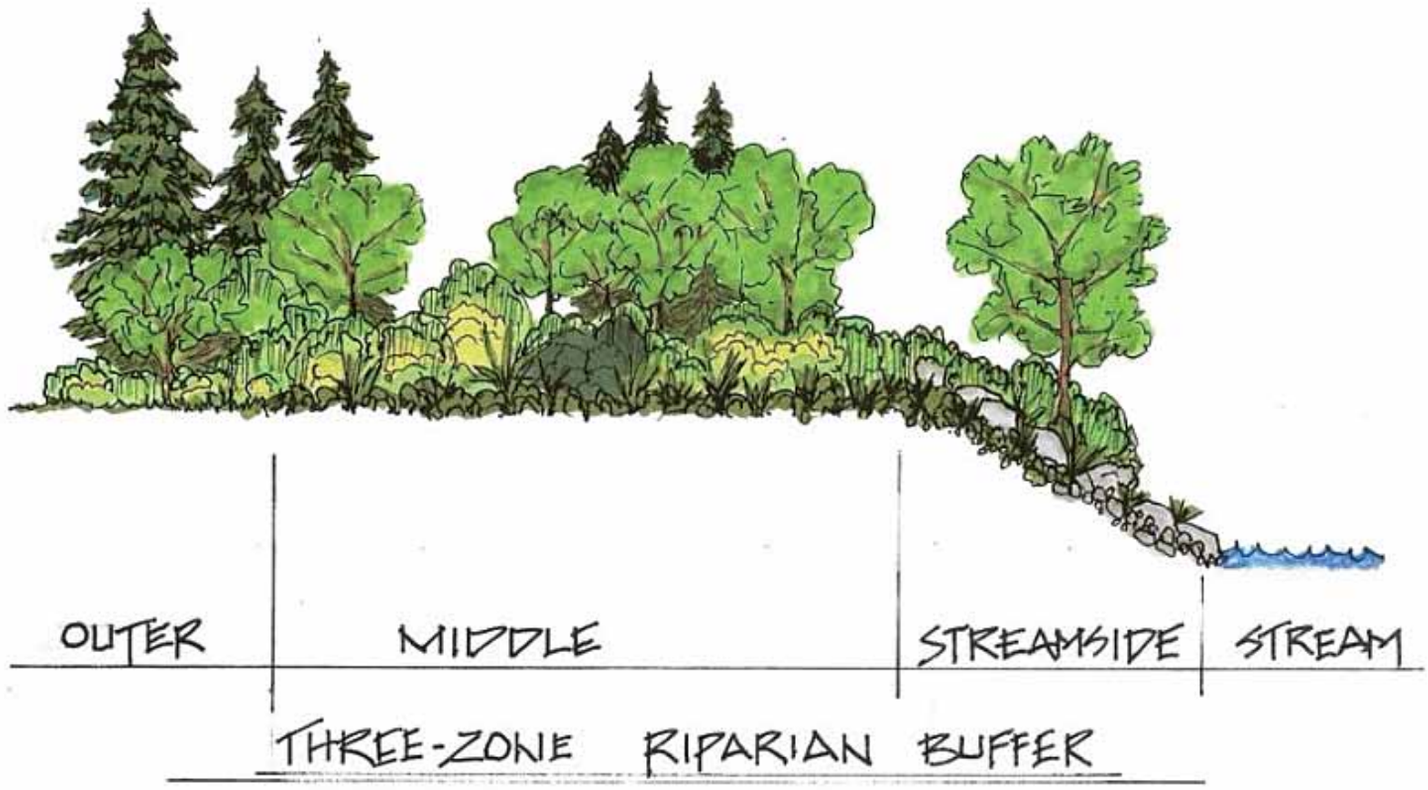
A THI technician monitors one of the organization's stream-restoration projects five years after biotechnical stabilization.

First, Do No Harm

By Luke Frazza
Photos courtesy of THI

Many landowners are surprised to learn that repairing their eroded stream banks with big rocks is not only a temporary solution; it's often one that does more damage than good. There is a better way, a more sustainable, eco-friendly way to restore impaired streams.

This eco-friendly approach is known by many names including soil bioengineering, biotechnical stabilization, biostabilization, green engineering and biotechnical erosion control – but the underlying concept for all is the same.



This cross-section diagram shows a healthy riparian buffer.

Michael Sprague is the president of Montana-based Trout Headwaters, Inc (THI). He travels the U.S. explaining that plants, often in combination with specialized organic reinforcement materials, can reduce the erosive forces of water and increase soil's resistance to those erosive forces. Sprague tells audiences that some organic stream bank covers, when applied correctly and paired with the correct vegetation, have proven to be more resilient and cost-effective than rock.

THI has provided more than 500 stream, river, wetland and habitat restoration

This streambank is severely eroded due to accelerated water velocity from newly installed upstream riprap.

Using a biodegradable erosion stream blanket and locally harvested willow fascine (living branches bound together in long tubular bundles) to decrease flow velocity near the banks, erosion is being controlled after one growing season.

This erosion-control blanket of coconut fiber and cotton string is completely biodegradable. Dormant wood stakes are used to anchor it.

Erosion-control blankets and cottonwood saplings are used to stabilize this streambank. As the trees mature, the roots will help stabilize the banks and the trees will shade the stream, both cooling it and offering fish cover from predators.

projects nationwide. Its mantra and guiding principle is, "First, do no harm." Just as physicians are taught to always consider the possible harm any intervention might cause, THI approaches any remedy or restoration project with the same caution. The very act of "restoring" any resource or habitat implies that you do no harm. Our natural environment plays host to an immense variety of species, many of them microscopic. That's why, whether reducing excessive erosion or enhancing habitat, THI recommends treading lightly on the delicate ecosystems while trying to protect and enhance them.

When stream banks and riparian vegetation are disturbed by human activity, the lack of native, woody vegetation to hold soil accelerates erosion. Naturally, landowners who lose property or have buildings damaged by erosion take quick action. Unfortunately, the action most frequently taken is to slope back the eroding banks and then armor them in place with

Before: This Yellowstone River streambank had eroded as much as 20 feet.

After: Turf reinforcement materials, an erosion-control blanket, wood material and native seed blends were used to restore the 1,200-foot streambank.

THI's Lisa Marr measures the depth of an eroded stream in Virginia to help formulate a sustainable restoration design.

stone known as riprap. However, industry experts and researchers have learned that this is an expensive solution, both economically and environmentally. Over time, it causes undesirable consequences to fish and wildlife habitat and to the long-term health of our stream and river ecosystems. When hard materials are installed, the energy of the water from one riprapped bank is deflected and displaced to another place on the stream. This in turn causes a domino effect as the trend to riprap rolls downstream.

Rock begets more rock as landowners and municipalities try desperately to hold onto eroding soils. The cumulative result is a laterally constrained river that's been robbed of its floodplain, unable to maintain the fluvial processes that are essential to maintaining a dynamic and healthy river ecosystem. As more vegetation is replaced with rock, floodwaters rush over banks, prompting the need for additional flood-retaining levees. In contrast, says Sprague, "free-flowing rivers and streams maintain natural flow regimes balancing sediment and water, cuing spawning, nesting, feeding, and migration behaviors for fish and wildlife." He says too many landowners think their stream or river stops at the high-water mark, not realizing a healthy stream or river extends into the magical real estate known as the riparian zone, the area of land directly adjacent to a stream, river or wetlands.

Where these margin areas are healthy, their lush riparian vegetation plays an integral role in protecting water quality, ecological integrity and biodiversity. Those wetlands near rivers and streams are also some of our most important habitats. They serve as wildlife nurseries to vast numbers of waterfowl, songbirds, shellfish and mammals. Their unique setting between water and land, and salt and freshwater, make these valuable habitats the choice of more than one-third of our country's threatened and endangered species. A Princeton University study found that restored wetlands are a magnet not only for wetland species, but also for mammals dependent upon wetlands for food, water and shelter. The study concluded, "If you build it they will come."

Healthy, natural floodplains and riparian areas are also able to absorb the force and volume of floodwaters by storing water and slowly releasing it back into the system. At the same time, plants filter water by trapping sediment and absorbing pollutants and excess nutrients, improving water quality. Deep-rooted woody plants anchor soil, preventing bank erosion while overhanging branches shade the banks, reducing water temperatures. Colder water holds more life-giving oxygen. Leaves from plants are broken down by aquatic insects which, in turn, provide food for fish and other wildlife. Wild rivers provide critical habitat, with studies showing 80 percent of all wildlife species depend in some way upon riparian zones.

Natural and restored buffer areas serve critical functions for nature and landowners. Besides providing water, healthy riparian zones provide shelter, food, shade and migration corridors for wildlife. Migrating birds use riparian areas as stopovers, often following river corridors hundreds of miles. Landowners can benefit from production of biomass for forage, energy, timber, native prairie seeds or berries and nuts from trees and shrubs. They can also benefit from greatly improved fishing, hunting, and wildlife habitat. Additionally, all residents in the watershed and society in general benefit from improved water quality, lower costs of cleaning sediment from major reservoirs and rivers, and increased diversity for wildlife.

While all stream-bank erosion control practices may need some maintenance, biotechnical techniques have the potential to self-repair because they are living systems. Since these treatments generally strengthen and improve over time, any maintenance costs are generally minimal as well.

Biotechnical methods are also considered especially appropriate for environmentally sensitive areas where improved recreation, aesthetics, fish and wildlife habitat, or native plants are highly desirable.

So, when you are ready to repair your property's stream bank, shorelines or wetlands, you might want to remember the "First, do no harm" mantra and make sure you are working with your valuable natural resources, not against them.

Luke Frazza is vice president for development at Trout Headwaters, Inc., an ecological restoration firm headquartered in Paradise Valley, Montana. He manages THI's Washington, D.C., office, focusing on new business as well as customer and government relations. THI is currently at work on more than 21,000 acres of stream, wetland and habitat restoration in the mid-Atlantic region.