

## How limestone sand is breathing life into WV's acid-damaged streams

By John McCoy Staff writer  
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By dumping piles of limestone sand into or next to acid-damaged streams, Division of Natural Resources officials have been able to restore fishing — mainly for trout — to more than 300 miles of formerly barren water. The sand dissolves into the water and neutralizes the acidity.

JOHN MCCOY | Gazette-Mail photos

Two decades ago in West Virginia, hundreds of miles of streams ran barren, devoid of insects or fish.

Today many of those streams have been brought back to life, resurrected by humble gray piles of limestone sand dumped strategically along their banks. It sounds like magic, but really it's just chemistry.

The sand in those piles happens to be limestone, and the water in the streams happens to be acidic. When acid water touches limestone, a chemical reaction occurs. The limestone dissolves, and as it dissolves it neutralizes the acid. So far, yearly treatments with limestone sand have turned more than 300 lifeless miles of water into productive miles of water that support insects, crustaceans and fish.

"And those are just the miles of water we directly treat with the limestone sand," said John Rebinski, an environmental resource specialist with the state Division of Natural Resources. "Most of the streams we treat are headwater streams. The benefits of the liming can continue far downstream into much larger waters."

Perhaps the most profound change has taken place in the Cheat River system, where treatments have taken place since the late 1990s. DNR biologist Pete Zurbuch experimented with limestone-sand treatments on the upper tributaries of Randolph County's Shavers Fork, a stream that couldn't support trout year-round because of acid snowmelt.

The treatments not only re-established trout fisheries on the tributaries, they restored year-round fishing to the main stem of Shavers Fork, as well. Subsequent treatments on other Shavers Fork tributaries re-established year-round trout fishing along the river's entire 89-mile length. Over time, the effects extended even farther downstream into the Cheat River, helping to create a vibrant smallmouth-bass fishery in the river and in Cheat Lake.

"The long-distance effects have been amazing," Rebinski said. "We're seeing them in the Gauley River now, thanks to treatments on tributaries of the Gauley and its tributaries, the Cranberry and Williams rivers."

## How it got started

DNR officials had known since 1964 that the addition of limestone to acid-tainted waters could restore damaged fisheries.

The early efforts centered on waterwheels loaded with limestone rocks. As the streams' currents turned the waterwheels, the rocks tumbling inside the wheels ground each other down, releasing tiny grains of limestone into the water.

The technique restored a brook-trout population to Randolph County's Otter Creek in 1964, and that success resulted in the construction of similar stations on Dogway Fork of the Cranberry in 1989, on the North Fork of the Cranberry in 1994, and on Beaver Creek of the Blackwater River in 1985.

The stations, while effective, proved costly to install, operate and maintain. In the search for less expensive alternatives, Zurbuch and his fellow DNR officials hit upon the limestone-sand method.

## How it works

Limestone-sand treatments require only two things: a dump truck filled with the sand, and a place to dump the stuff.

Sometimes it gets dumped directly into the stream. More often, it gets dumped at the edge of the stream and onto one of its banks.

The sand that falls into the water immediately gets swept up by the current, triggering the chemical reaction and immediately buffering the acid. What isn't dissolved falls to the bottom in a grayish-white deposit. When the water rises, more of the pile gets swept into the stream and some of the sand deposited on the bottom gets kicked back up into the current. Gradually, the sand — and its acid-buffering effects — get transferred farther and farther downstream.

Rebinski has discovered that the sand doesn't even have to be dumped directly into the stream itself. On the Middle Fork of the Williams River, the stream's location within the Cranberry Wilderness prevented access by any sort of motorized vehicle. Rebinski traced one tiny tributary of the Middle Fork to a ditch at the side of the nearby Highland Scenic Highway, just outside the wilderness boundary, and had a truckload of limestone sand dumped into the ditch.

The experiment worked; the Middle Fork's water chemistry improved, and the stream's native brook-trout population returned. Rebinski has since employed the technique to restore other remote streams that lack direct road access.

"As long as the limestone is in the watershed, the nutrients will eventually reach the stream," he said. "It's a slower approach, but it works."

## Why it works

Most people think that limestone treatment restores streams to productivity because it neutralizes acid. Water is considered acidic when its pH is below 7.0, and alkaline when it is above 7.0. Each whole number in the pH scale represents a tenfold increase in acidity or alkalinity. For example, a stream with a pH of 5.0 is 10 times more acidic than a stream with a pH of 6.0.

When limestone treatment lifts a stream's pH from 4.5 to 6.5, it reduces the acidity a hundredfold, which greatly reduces stress on aquatic organisms.

Reducing acidity is only part of the picture, though.

"The main effect of the limestone is that it gets rid of toxic metals in the water," Rebinski explained. "When acid rain falls on the ground, it leaches traces of aluminum, iron and copper out of the geology. Those metals get washed into streams and put into solution. Over time, they accumulate in the systems of insects and fish. The buildup becomes fatally toxic, and the animal dies."

Limestone treatments eliminate metals by taking them out of suspension.

"When the pH of the stream rises to 6.0 or above, metals precipitate out of solution and fall to the stream bottom, where they're no longer in contact with the gills of fish and aquatic insects," Rebinski said.

The calcium released from the limestone also acts as a nutrient that boosts the production of phytoplankton and zooplankton, tiny organisms that form the base of a stream's food chain.

"On an acid-damaged stream, there's not much plankton for insects and newly hatched fish to live on," Rebinski said. "Liming starts the food chain from the bottom up. Once the plankton are restored, insects and minnows have enough to eat. Once those populations are restored, larger fish have enough to eat." Liming also increases some species' ability to reproduce.

"For example, for brook-trout reproduction, pH is very important," Rebinski said. "If the pH falls down around 5, reproduction becomes impossible because the eggs can't survive and the fry don't have enough to eat. When the pH rises into the upper 5s, you start to get successful reproduction. Once it reaches 6 or above, you get good reproductive success."

On West Virginia's limestone-treated streams, the pH seldom drops below 6.0, Rebinski said.

"And when it does, it's usually when the water is rising fast from rainfall or snowmelt," he added. "The pH might drop to 5.9, but that only lasts until the water starts to drop."

## Showcase streams

The DNR will begin showcasing its success stories in 2019, when catch-and-release regulations for brook trout will be placed on four limestone-restored streams and their tributaries: Middle Fork of the Williams in Pocahontas and Webster counties; Tea Creek in Pocahontas County; Otter Creek in Randolph and Tucker counties; and Red Creek in Tucker County.

The regulations will encompass roughly 130 miles of brook-trout water. Rebinski said the object of the regulations is simple: "We're trying to protect the resource. There were no fisheries there before [limestone treatments], and now that we have fisheries there, we want to try to protect them."

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[https://www.wvgazettemail.com/news/limestone-bearing-helicopter-battles-acid-rain-in-monongahela-forest/article\\_839499d5-15f3-5e9c-b98b-4e423d952220.html](https://www.wvgazettemail.com/news/limestone-bearing-helicopter-battles-acid-rain-in-monongahela-forest/article_839499d5-15f3-5e9c-b98b-4e423d952220.html)



## Limestone-bearing helicopter battles acid rain in Monongahela Forest

By Rick Steelhammer Staff writer

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A helicopter-borne limestone sand spreader distributes part of its payload over a stretch of acid rain-damaged woodland in the Monongahela National Forest east of Dyer in Webster County.

Photo courtesy USDA Forest Service

For decades, the Division of Natural Resources has treated more than 50 streams in West Virginia's highlands with limestone sand to help neutralize the effects of acid precipitation.

That life-support system has allowed trout and other forms of aquatic life to survive and even thrive in waters that in many cases would otherwise be sterile.

Now, limestone sand is being used by the Monongahela National Forest to treat acid-damaged soil in an experimental project taking place in the Gauley Ranger District's Lower Williams River area near Dyer in Webster County. There, a two-rotor helicopter carrying four-ton bucketloads of limestone sand is engaged in the effort to combat the effects of long-term acid deposition in the soil.

"Applying limestone on the ground improves soil health and increases the ability of a watershed to resist the effects of acid rain," said Kelly Bridges, public affairs officer for the Monongahela National Forest.

The limestone sand is being spread over a total of 777 targeted acres of forest on both sides of the Lower Williams River, Bridges said. Soil sampling in the area identified parcels of forest where nutrient loss due to acid deposition was most severe.

The helicopter liming site is among the most acid-plagued locales in the Monongahela, although there are several areas even more severely damaged, including the Otter Creek Wilderness, according to project leader Stephanie Connolly, a soil scientist for the Mon.

"The driving factor that makes these particular landscapes susceptible is the underlying geology — the Pottsville Sandstones," Connolly said. "Soils forming from this geologic formation are not resilient to the high level of acid rain inputs that the region has received over the last century."

Sulfur dioxide emissions from coal-fired power plants and factories along the Ohio River Valley and prevailing winds from the west are blamed for bringing the high levels of acid precipitation to the highlands of the Mon.

While large scale liming treatments of forest soil have taken place in Canada and Europe, only one such project in the U.S. has preceded the effort now underway in West Virginia. That project, conducted 10 years ago in North Carolina's Pisgah National Forest's Linville Gorge Wilderness, involved less than 90 acres of acid and fire damaged forest.

Follow-up studies indicated that the Linville Gorge lime treatment had an initial positive effect on soil health, but a larger-volume initial treatment of lime or a series of follow-up treatments were needed to make long-term soil improvement possible.

"We are currently working with West Virginia University to try to sign an agreement for monitoring the results of the [lime] application over the next one to five years in the short term," Connolly said. "Long-term monitoring plans will be developed in the future as needed. Other resources such as wildlife and botany are being monitored by Forest staff as to any indirect effects."

Dr. Jeff Skousen, professor of plant and soil science at WVU, and Dr. Pamela Edwards, research forest hydrologist at the U.S. Forest Service's Northern Research Station at Parsons, have provided scientific advice for implementing and monitoring the project.

Connolly said the goal of the project now underway in the Mon is to develop a limestone sand treatment plan that produces decades-long improvements in soil quality.

For safety reasons during the helicopter-borne lime applications, two areas of the Gauley Ranger District will be closed to all public entry through the project's end, expected to occur at the end of this month. One closure site is the area north of Williams River Road between Forest Road 133 and Forest Road 735. The other is the area south of Williams River Road bounded by Forest Roads 101, 82, 272 and the top of the ridge between Johnson Run and Lick Branch.

Williams River Road will remain open to traffic, but drivers are urged to watch for additional truck traffic as limestone pickup points for the helicopter are replenished.

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