THE SCIENCE OF DIRT

SOIL STUDIES ARE USEFUL, AND MORE ARE NEEDED

BY GARY SPRUNG

LAST SUMMER I NOTICED 2 EXAMPLES of trail erosion caused by mountain bicycles in my hometown of Crested Butte, Colorado. The first didn't bother me; the second did.

Fat Tire Bike Week (FTBW) held a criterium through the middle of town. The course crossed an empty lot that I traverse on my way to work. Before the race, the footing was always difficult. Bushes and rocks blocked the route. But after, there was a smooth trail, the result of 75 bikes crossing 8 times each on a rainy day. Then I could walk to work in sandals.

Later that week, I rode Trail 401—one of my favorites—which begins at timberline and crosses a tundra blanketed with wildflowers. In '89, the trail was smooth and ridable all summer. But on this crossing, I found deep ruts and, in one section, a severe gully. In addition, several sidehill traverses had lost their downhill edge, making passage tricky.

I suspect that most of the damage occurred during the first few days of FTBW when it rained heavily. I know a lot of people rode the trail while it was wet. One local rider, who was on it a week before the festival, said he observed little erosion.

Both of these firsthand observations proved to me that mountain bikes can significantly affect soils and trails. By studying tread, foot and hoof prints, I've also concluded that bicycles generally produce more impact than hikers and less than horses and motorcycles. But these observations are casual, not scientific. For skeptical cyclists who doubt their bikes contribute to soil erosion and for land managers and private landowners who want to prevent resource damage, we need scientifically verifiable soil studies.

After several inquiries to soil scientists and federal land managers, I found only 2 studies that used scientific methodology to analyze mountain bike use on trails. The first, *Survey of Ecological Impact Considerations Related to Mountain Bicycle Use on the Edwards Field Trail at Joseph D. Grant County Park*, was prepared by Christopher Crockett for Santa Clara County, California, in 1986–87. Forty-five members of the Responsible Organized Mountain Pedalers (ROMP) rode their bikes 495 times over 12 study plots on the trail. Measurements were taken before and after. The process was repeated in dry, semi-wet, and wet conditions. The results showed mountain bikes and hikers caused comparable impact. The data prompted the county parks department to open mountain bike trails, despite opposition from equestrians.

Seney and 2 assistants rode a test plot 100 times on bike and horseback, and found that hooves were tougher on the trail than tires.

Joseph Seney, a graduate student at the Department of Earth Sciences at Montana State University, recently conducted a more comprehensive study. His work was funded by the Gallatin National Forest, which wanted data relevant to trails planning for a particular canyon, and by the International Mountain Bicycling Association (IMBA). He measured the impact of hikers, bicyclists, horses, and motorcyclists on 2 open trails and compared them with the conditions of a closed one. Each user group crossed the study plots 100 times. One trail's soil was clay and sandy clay, the other's loam and sandy loam. On some plots Seney wetted the

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soils with a sprinkler to simulate rainfall.

Seney's preliminary results on sediment yield (directly related to erosion) were: a) neither mountain bikes nor hikers produced significant sediment compared to horses and motorcyclists; b) on dry trails, only horses produced significant sediment; c) on wet trails, horses produced significant sediment, and motorcycles were borderline significant, except on steeper slopes, where motorcycle impact increased; d) normal, natural "geomorphic" processes cause significant erosion, independent of all users.

Seney also measured water runoff and found little evidence to differentiate users' impact. Slope steepness was the only significant variable, with steeper grades yielding more runoff. Seney also measured soil compaction with a penetrometer and profiled the trails to study roughness and changes in structure.

NATURE RULES

Seney's study concluded that natural processes predominate, overshadowing the ruts and churned soil produced by trail users. He supported his conclusions by citing 2 studies. Rebecca Summer observed the impact of horses on trails in Rocky Mountain National Park for 7 years. She wrote in the *Journal of Soil and Water Conservation* ('80 and '86): "Horse traffic was not the single, dominant process active on trails. Trail degradation was also a function of landform, climatic and catastrophic events, and geomorphic processes...." She found no relationship between trail widening and deepening and amount of use, but saw a strong connection between erosion and the landform and location. For example, weathered granite immediately below the crest of a hill deepened the most, whereas on the valley floor it "exhibited negligible incision," but widened significantly. Level, permeable terrace surfaces, outcrops, talus slopes, and floodplain or glacial lakes provided the most stable trail sites.

Sheila Helgath studied *Trail Deterioration in the Selway-Bitterroot Wilderness* (along the Montana-Idaho border). The results were published by the U.S. Forest Service in '75. She wrote: "Amount of use was less strongly and consistently related to deterioration than expected.... Low use trails [that were very steep] eroded most severely. High use results in trail damage, especially if perched and high water tables are present. On gentle slopes little damage would result even with high use on well-drained sites."

To Seney and several land managers, these studies show the importance of proper trail design. Water bars are essential to break the slope length. The farther water runs down a trail, the faster it travels, and speed is directly related to erosive power. Trail slope should not exceed 15% and trails should not run parallel to fall lines, Seney concludes.

Pre-construction planning is essential in minimizing erosion, notes a National Park Service planner. If a trail is routed over unstable soils or across steep slopes, rerouting can be extremely difficult. Poor trail construction can be corrected, but proper design saves time, energy, and the resources for building new trails. Unfortunately, most U.S. trails were built in the '20s and '30s without great forethought. In the Selway-Bitterroot study, Helgath notes that their purpose was primarily for forest-fire control: "Utility and convenience, not recreational use or protection of natural conditions, were the principal design criteria."

MINIMAL RESEARCH

Despite these conclusions about the predominance of nature, scientists and land managers agree that more investigation on user impact is needed. I looked for earlier studies comparing trail impact among hikers, equestrians and motorcyclists, but found very few. Dave Cole, a USFS researcher in Montana who has studied the difference between lug-soled and smooth-soled boots, says, "There's very little support for this kind of work, so not a lot has been done."

Seney asserts that his study is one of the few conducted on existing trails. Many observations are gathered on virgin ground. Bob Cron, a Forest Service trails planner in Washington, DC, notes that studies often identify types of vegetation and the changes that take place with human use. "If mountain bikes stay on the trail, impact on vegetation should not be a problem. Because various kinds of users don't always do that, we've done work to study off-trail impact," he says.

Howard Wilshire, a California geologist who has studied the impact of motorized ORVs on the Mojave Desert, contends that we don't need more soil-impact studies. It's generally known that hikers cause the least damage, motorized vehicles and horses the most, and that mountain bikers fall somewhere in between, he says. He would prefer studies that inventory the soils and plant and animal life of a region. Then land managers could determine where recreational use is appropriate and establish rules. Enforcing trail restrictions and maintaining the trails are important, says Wilshire. "If we do these things, we could at least accommodate the responsible users."

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Wilshire rejects the idea that a few bad apples ruin it for everyone. "It's closer to 40 percent of people who violate the rules," he says. "These aren't Hell's Angels or criminals. They're people who have little sensitivity to the environment."

Wilshire's conclusions, based on more than 15 years of research, point to the limitations of soil studies. Good science can lead to a good policy. But if mountain bikers aren't educated to follow the rules and ride ethically, studies and codes of conduct have little value. ●