

Sustainably Designed Trails: Recent Recreation Ecology Findings on Design Factors Affecting Soil Loss



- **The Challenge:** Achieving conservation objectives in protected natural areas requires the ability to sustain visitation while avoiding or minimizing adverse environmental impacts. Trails are an essential infrastructure component that limits resource impacts by concentrating use on hardened treads designed and maintained to sustain traffic. This is particularly challenging when visitation is heavy or when higher impacting uses, such as equestrian or motorized use, must be accommodated. Concentrated traffic from hikers, backpackers, mountain bikers, and horse riders on natural surfaced trails removes or prevents vegetative and organic litter cover on treads, compacts substrates, and increases water runoff and the erosion of soil. Soil loss is perhaps the most significant form of environmental impact because of its long-term nature and secondary impacts: eroded soil often enters waterways, causing impacts to aquatic environments.



- **The Science:** Recreation ecology research on trails is being conducted in several National Park Service units to investigate the influence of use-related, environmental, and managerial factors that influence trail sustainability. Sustainable trails are defined as well-designed and constructed trails whose treads remain in good condition over time with minimal tread maintenance. Unsustainable trails deteriorate quickly under traffic, are more difficult to use, and require substantially greater maintenance efforts. Soil loss has been a focus of several studies, including the development of more accurate and efficient research designs and methodologies for assessing soil loss on trails. Relational analyses employing multiple regression modeling have improved knowledge of the relative influence of factors affecting soil loss on unsurfaced trails.



- **The Future:** Additional research in diverse environments is needed to further develop and validate preliminary results. The modeling analyses also require the addition of new use-related, environmental, and managerial factors with improved assessment methods. Preliminary findings are being shared at scientific conferences and published in management reports and journal papers. Results are also being implemented at several protected areas in the design of new trails, segment relocations, and through ongoing trail maintenance.

Contact: Jeff Marion at 540-231-6603 or jeff_marion@usgs.gov