

### Minimum-Impact Research

In the 1960s, outdoor education began to teach the philosophies of “minimum impact” and “leave no trace” (LNT) in relation to how recreational users of the “wilderness” treat the natural world. These techniques have become widespread and well-disseminated, and they are continuously refined in response to our ever-changing world. Field scientists should take heed, because our impacts no longer go unnoticed. Trails, gear, and waste (human, chemical, science-related) are increasingly evident. Discussions with land managers from several U.S. federal agencies confirm that research-related impacts occur on all federally managed lands (personal communications).

Is the field impact of scientific research on federally protected lands large? No. The impact attributable to research activities is miniscule compared with that of the masses of people that visit Yellowstone National Park, for example. Grazing, logging, mining, drilling, and loss of biodiversity are far more invasive and serious impacts to ecosystems. Is the impact of field research a current issue or challenge? Yes. Based on personal observation during my research experiences in Yellowstone, I suggest that a problem looms, a problem that is scalable to any location where field research occurs.

What can be done? Simple awareness of potential damage is an important step toward sound conservation practice. A place to start is  the seven basic principles of The Leave No Trace Center for Outdoor Ethics (<http://www.lnt.org>).

(1) Plan ahead and prepare for field time, thoroughly. Practice field routines in advance. Important issues to be considered include vi-

sual impact—how and what you wear (visible, for public view, or cryptic, for nonpublic view)—and how and what you photograph (avoid site-identification features but still convey the work).

- (2) Travel, camp, and do field work on durable surfaces. This is generally, but not always, sand, rock, snow, and ice. Think about where and how you walk, transport equipment, and process samples. Avoid trampling sites, use trails where available, and minimize researcher traffic to study areas.
- (3) Dispose of waste properly. Human (Meyer 1994; Hampton, et al. 2003) and science-related wastes accumulate. Field researchers in Antarctica must carry out all waste, including human urine and feces. Where possible, leave nothing behind.
- (4) Leave what you find, or, if permitted, take only the smallest samples necessary for the study. Field researchers tend to sample more material than needed.
- (5) Minimize campfire impacts. If a campfire is necessary, learn how to build a minimum-impact fire (Harmon 1997; Harvey 1999; Hampton, et al. 2003).
- (6) Respect wildlife and all components of the ecosystem under study. Unless working with them, work around animals, particularly at sensitive times (nesting, mating, calving, winter). Do not feed animals, and store food rations securely.
- (7) Be considerate of other visitors and the resource managers responsible for sites of study. Field scientists and resource managers are often not fully aware of what the other understands, wants, or needs. Clear communication

and adherence to any permitting agency’s requirements facilitate research.

To these seven principles, I add one more: make an impact, in terms of the quality of work that is done, in a professional manner. The application of the LNT ethic is part of that professionalism. Our ability as researchers to continue to work in and understand diverse systems hinges on our ability to preserve “place.”

From public policy to collective action to personal practice, researchers have a responsibility to implement these principles. We should set an example not just of conservation, or preservation, but of respect for the ecosystems in which we work. Scientifically based field research has led us to new levels of knowledge and has greatly improved our quality of life. The paradox is that research has had some physical impact on what we study. A sign in a national park in Tanzania reads, “Let no one say, and say it to your shame, that all was beauty until you came.” We should take pause and consider the impact of our research footprints.

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