

A Relatively Nonrestrictive Approach to Reducing Campsite Impact

Caney Creek Wilderness, Arkansas

BY DAVID N. COLE AND THOMAS E. FERGUSON

Abstract: An excessive number of highly impacted campsites led managers of the Caney Creek Wilderness to attempt to reduce campsite impacts with a program of trail relocation, education, closure of selected campsites, and site restoration. The strategy involved increasing the concentration of use somewhat, without resorting to the restrictiveness of a designated campsite policy. To assess success, all campsites in the wilderness were inventoried in 1994 and their condition was assessed. A subsequent reassessment of campsites, in 2007, indicated the management program was highly successful. The total number of campsites was reduced by 40% and the number of highly impacted campsites declined substantially.

Introduction

Camping activities can cause substantial disturbance of soil and vegetation in wilderness. Common effects include vegetation loss, change in species composition, damage to standing trees, compaction of soils and truncation of soil profiles (Hammitt and Cole 1998; Leung and Marion 2000). Although such impacts are localized, most studies of trends in campsite impact have reported that impacts are increasing—more often as a result of site proliferation than

the deterioration of long-established sites (Cole 1993; Cole and Hall 1992). This finding of substantial and increasing campsite impact suggests that a laissez-faire approach to campsite management is problematic. To avoid ever-increasing campsite impact, active management strategies are needed. Common active strategies include Leave-No-Trace education, concentration of camping on selected campsites, closure and restoration of other campsites, and confinement of activities within campsites (Cole 1981; Marion and Farrell 2002).

Despite these suggestions and implementation of campsite management strategies in many parks and wilderness areas, only a few studies have assessed the effectiveness of these strategies. In a portion of the Selway-Bitterroot Wilderness, Montana, managers attempted to reduce disturbance on highly impacted campsites by temporarily closing them, diverting use to adjacent undisturbed sites. Cole and Ranz (1983) found that this action was counterproductive; it resulted in increased impact. They concluded that closures should be permanent rather than temporary and that success would be furthered by education and active restoration (unless sites are unusually resilient).



David N. Cole (left) photo by Linda Henderson. Thomas E. Ferguson (right) reading USFS book in the Caney Creek Wilderness. Photo by John Wesson.

PEER REVIEWED

Permanent campsite closure was successfully implemented elsewhere in the Selway-Bitterroot Wilderness. In the Seven Lakes basin, 12 of 18 campsites with substantial stock-related impact were closed to stock and actively restored. Campers with stock were only allowed on the remaining six sites; backpackers were allowed to camp anywhere other than on four closed campsites. This effort resulted in a 37% decrease in the total area of campsite disturbance over a five-year period (Spildie et al. 2000). A more restrictive confinement strategy was implemented in a portion of Shenandoah Wilderness, Virginia, with 73 campsites. Managers decided to only allow camping on 41 of these sites. Within three years, without active restoration, the total area disturbed by camping was reduced by about 50% (Reid and Marion 2004). Confinement was equally effective on canoe-accessed campsites in the Delaware Water Gap National Recreation Area, Pennsylvania-New Jersey, where managers decided to only allow camping on 81 of 179 existing campsites, plus six new campsites. They also concentrated camping on-site by installing anchored fire grates. Five years later, the total area disturbed by camping was reduced by 50%, without active restoration (Marion 1995).

Less successful—but not counterproductive—were two campsite confinement programs in the western United States. Around five lakes in the Three Sisters and Mt. Jefferson Wildernesses, Oregon, managers closed about one-half of the existing campsites and required all campers to use designated sites. Four years later, campsite proliferation had been halted but the number of campsites and the total area of disturbance remained unchanged, largely because closed sites did not recover much (Hall 2001). At Grand Canyon National Park, man-

agers only allowed camping on designated campsites so popular that they were used most nights of the primary use season. Here the number of campsites and area of disturbance has increased, due to substantial use of illegal campsites (Cole et al. 2008), but not at the rate it likely would have in the absence of a designated campsite policy. In each of these cases, despite the fact that ecosystems were much less resilient than those at Shenandoah and Delaware Water Gap, there was no attempt to actively restore campsites. With restoration, more improvement might have occurred.

Given these divergent results, from different parts of the United States, it seemed worthwhile to conduct further research on the efficacy of campsite management strategies. In this article, we report on the effectiveness of a campsite management program, implemented in the Caney Creek Wilderness, Arkansas, that sought to reduce the extent of campsite impact without the restrictiveness of a designated campsite policy.

Specifically, we report on change in the number and condition of campsites following an effort to reduce campsite impact through education, trail relocation, permanent closure of a few selected campsites, and site restoration.

Caney Creek Campsite Management

Caney Creek Wilderness covers 14,460 acres (5830 ha) of the Ouachita Mountains of west-central Arkansas (see figure 1). Vegetation is a dense cover of oak-hickory-pine forest. Topography is dominated by two parallel creeks, Caney Creek and Short Creek, separated by long ridges with local relief of more than 1,000 feet (300 m). Although there are about 20 miles (32 km) of trail in the wilderness, most use occurs along the 9-mile (14.4-km) trail that follows Caney Creek. Most of the Short Creek drainage is trailless, but not difficult to traverse. Use is quite heavy in the wilderness, estimated at more than 12,000 visitor days in the early 1990s.



Figure 1—Overview of the Caney Creek Wilderness from the Tall Peak trail. Photo by Thomas Ferguson.

The campsite management program implemented in Caney Creek Wilderness has been effective in reducing campsite impact.

Although measures of use are lacking, long-term ranger observations suggest relatively stable use levels over the past few decades.

In 1994, campsites were inventoried across the entire wilderness—on and off trail. A total of 91 campsites were located, many of which were highly disturbed. Local managers decided that this number of campsites and degree of impact was excessive. So they developed a management strategy to reduce the number of campsites and, thereby, the magnitude of camping impact. Trail relocation, education, campsite closure, and site restoration were all employed.

More than 2 miles (3.2 km) of creek-bottom trail were rerouted. This reduced the number of trail-accessible desirable places to camp. For example, the original Caney Creek Trail, east of

Katy Creek, had 11 creek crossings in about 3 miles and was in the creek for substantial distances in several places. The relocated trail crossed in four places and the trail was up the side slope away from the creek most of the time. Trail relocation meant that many former campsites were no longer visible from the trail.

In addition, between 1994 and 1996, 16 well-established campsites were closed to use and restored. Soil was scarified and planted with seed and locally collected transplants. Large rocks were buried in tent pads to make the site less conducive to camping (see figure 2). Plantings were watered and mulched. Ribbon was tied between trees to cordon off the site, and a “No Camping” sign was posted. In addition, fire rings and fire remains were scattered at 26 lightly impacted sites.



Figure 2—Student Conservation Association crew planting transplants among buried rocks on a closed campsite. Photo by Thomas Ferguson.

Education programs emphasized camping at already-impacted sites and staying off closed sites. Although camping on closed sites was prohibited, camping on existing sites was not mandatory (as in a designated campsite program).

Most of the closed campsites did not require ongoing work. However, two of the 16 closed sites required additional work every year for five years, and another two required ongoing work 10 years after closure. “No Camping” signs have been left at six of the campsites.

Methods

As noted above, there were 91 campsites in the Caney Creek Wilderness in 1994. On 48 of these sites, the primary impact was campfire remains, with or without a fire ring. There was little if any long-term disturbance. The only information collected on these “trace sites” was their location. On the 43 well-established campsites, we rapidly assessed different types of impact on every campsite, and we took detailed measurements on a sample of 12 sites. The rapid assessment, which took fewer than 10 minutes per site, quantified nine parameters: campsite area, devegetated area, vegetation loss, increase in mineral soil exposure, damage to tree trunks, exposure of tree roots, social trails, developments, and cleanliness (McEwen et al. 1996). For each parameter, a rating of 1, 2, or 3 was assigned to the site, depending on the level of impact. These ratings were summed to obtain the overall impact index.

In addition, we assigned each site a modified Frissell (1978) condition class rating. Condition classes, ranging from 1 to 4, were (1) minimal impact (assigned to trace sites as well), (2) vegetation loss confined to the central portion of the site, (3) vegetation lost

over most of the site but little mineral soil exposure, and (4) vegetation lost and mineral soil exposed over most of the campsite. Where it was difficult to decide between adjacent condition classes, midpoints were used. For consistency, the same individual evaluated all sites each year. Although formal evaluations of precision have not been made, the ratings of trained evaluators seldom differ by more than 0.5.

On the 12 campsites evaluated more precisely, we buried nails that could be relocated and we established permanent plots. We spent an hour or more on each site, taking careful measurements of campsite area, ground cover conditions, and tree damage, using techniques first used in the Eagle Cap Wilderness, Oregon (Cole 1982).

Campsite measurements were repeated in 2007. We searched for campsites in the entire wilderness. Rapid assessment procedures were done on all campsites, except the trace sites. Detailed measures were taken on six of the 12 sites studied in detail in 1994. Permanent markers could not be found on two of the original 12 sites, and the other four sites were closed, restored, and, therefore, no longer recognizable as campsites. This sample of six long-established campsites is small and results should be treated cautiously. However, when expressed as a proportion of the population of long-established sites, the sample size seems less limiting. The six campsites in the sample represent 38% of the 16 campsites that were well established (i.e., not trace sites) in both time periods. Moreover, results are consistent with studies of long-term trends with larger sample sizes (e.g., Cole and Hall 1992).

Results

Between 1994 and 2007, the number of campsites declined 40%, from 91

in 1994 to 54 in 2007 (see table 1). Both trace and well-impacted sites decreased in number, but the largest decrease was in the number of highly impacted campsites. The number of sites with a condition class rating of 3.5 or 4.0 (sites that had experienced widespread loss of vegetation and organic litter cover) decreased from 15 to 3 (see table 1). Based on the impact index ratings, the number of sites in the highest impact index class (22–27) decreased from 7 to 0 (see table 2), and the mean impact index decreased from 13 to 12.

Table 3 can be used to describe the fate of individual sites in the period between 1994 and 2007. Read down columns to determine the condition in 2007 of all campsites of a given impact index class in 1994. For example, of the 15 campsites in the 10–15 impact index class in 1994, 10 disappeared (index = 0), four improved to become trace sites (index = 9), and one deteriorated (index = 16–21). No sites in this class were stable. From this table we can conclude that between 1994 and 2007:

- 16 campsites improved, but were still campsites;
- 58 campsites improved so much that they were no longer recognizable campsites;

Table 1—Condition class of Caney Creek campsites in 1994 and 2007

Condition Class ^a	1994	2007
	—campsites—	
1.0	48	29
1.5–2.0	11	13
2.5–3.0	17	9
3.5–4.0	15	3
Total	91	54

^aModified Frissell condition class (refer to text for definitions).

Table 2—Impact index of Caney Creek campsites in 1994 and 2007

Impact Index ^a	1994	2007
	—campsites—	
9	48	31
10–15	15	13
16–21	21	10
22–27	7	0
Total	91	54

^aSum of ratings for 9 parameters (refer to text for details).

- 14 campsites were unchanged in condition;
- 3 campsites deteriorated; and
- 21 new campsites were created.

Of the new campsites, 16 were minimally impacted trace sites, but five were more substantially disturbed.

Most of the sites that improved or disappeared were in places that were no longer readily accessible once the

Table 3—The number of Caney Creek campsites in each impact index class in 1994 and 2007^a

		1994 impact index					Total
		0	9	10–15	16–21	22–27	
2007 impact index	0		37	10	7	4	58
	9	16	9	4	2	0	31
	10–15	4	2	0	7	0	13
	16–21	1	0	1	5	3	10
	22–27	0	0	0	0	0	0
	Total	21	48	15	21	7	112

^aCampsites with an impact index of 0 in 1994 are new sites in 2007, whereas those with an index of 0 in 2007 disappeared. Sites above the shaded boxes improved, and those below the shaded boxes deteriorated.

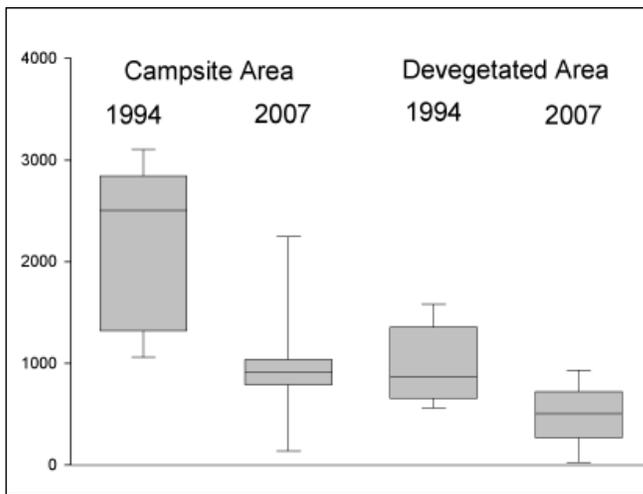


Figure 3—Change in campsite and devegetated area, 1994 to 2007; box plots show the median campsite, as well as the 5th, 25th, 75th, and 95th percentiles.

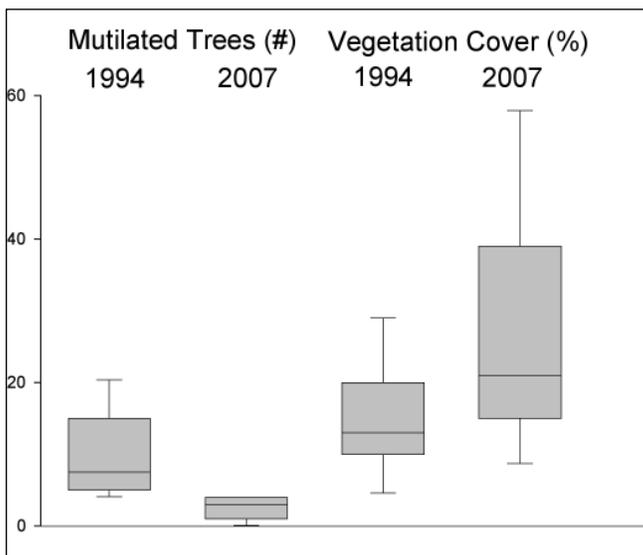


Figure 4—Change in number of mutilated trees and percent vegetation cover on campsites, 1994 to 2007; box plots show the median campsite, as well as the 5th, 25th, 75th, and 95th percentiles.

trail was rerouted or were sites that had been closed and restored. None of the sites that deteriorated were in the more popular destinations along Caney Creek. Two were located on the Buckeye Mountain trail, which had been recently improved. The 21 new campsites were widely distributed throughout the wilderness, but they were particularly abundant along trail-less Short Creek. However, the new campsites that developed in more popular places along Caney Creek

disappeared. The number of mutilated trees decreased significantly from a median of 7.5 to 3.0 ($Z = 2.0$, $p = 0.04$), and vegetation cover increased significantly from a median of 13% in 1994 to 21% in 2007 ($Z = 2.0$, $p = 0.04$) (see figure 4).

Discussion and Conclusions

Clearly, the campsite management program implemented in Caney Creek Wilderness has been effective in reducing campsite impact. The number

generally were more highly impacted than those along Short Creek.

Although limited in quantity, the data from detailed measures on the sample of sites also suggest a dramatic decrease in campsite impact. Disregarding the two sites that could not be remeasured, four of the remaining 10 campsites had recovered so substantially that we did not remeasure them. On the remaining six sites, median area of campsite disturbance decreased from 2,500 feet² (232 m²) in 1994 to 915 feet² (85 m²) in 2007 (see figure 3). This difference is statistically significant (Wilcoxon signed ranks test, $Z = 2.2$, $p = 0.03$). Devegetated area decreased significantly from a median of 866 feet² (80 m²) in 1994 to 506 feet² (47 m²) in 2007 ($Z = 2.0$, $p = 0.05$). These declines would be even greater if we included data from the four campsites that almost completely

of campsites has decreased greatly (see figure 5), as has the magnitude of impact on the most severely disturbed campsites in the wilderness. Most of the work that contributed to success was accomplished over a period of four years. A Student Conservation Association crew (six members plus crew leader) worked four weeks a year—for three years on the trail rerouting and one year on the site closure and restoration. Cost was approximately \$18,000 per year, along with about 1.5 months per year provided by Forest Service or other volunteer personnel, for visitor contact and education. The program is being maintained with an ongoing investment of about one-half month of work per year.

Earlier studies of stricter and more restrictive confinement strategies (where camping is only allowed on designated sites) suggest that this strategy can be successful in limiting campsite impacts (e.g., Marion 1995; Reid and Marion 2004). At Caney Creek, impacts were reduced not by implementing restrictions requiring the use of designated campsites. Rather, the strategy involved reducing the number of places where visitors are likely or allowed to camp. This was accomplished using multiple approaches. Trail relocation, education, permanent closure of selected campsites and assisted site restoration all contributed to success. It was particularly important to ensure that staff was available for education and monitoring during the times when most visitors were in the wilderness. The high resilience of these sites (i.e., they can recover rapidly) was an important factor, as was the decision not to close so many sites that people had a hard time finding an open campsite.

The fact that 21 new campsites developed over the study period suggests that a designated site policy might



Figure 5—Highly impacted campsite (a) in 1993, one year before closure and (b) in 1999, five years after closure. Photographs by Thomas Ferguson.

be even more effective in limiting campsite impact. Although that is possible, recent research at Grand Canyon National Park shows that new campsites are often created even in places with designated campsite policies (Cole et al. 2008). Moreover, a large proportion of the new campsites at Caney Creek were in trailless areas, where campsites are few and far between. Future success might be most dependent on the ability to persuade visitors to use established sites in popular places and to eliminate all trace of their camping activities when they visit trailless places. **IJW**

References

- Cole, D. N. 1981. Managing ecological impacts at wilderness campsites: An evaluation of techniques. *Journal of Forestry* 79: 86–89.
- . 1982. *Wilderness Campsite Impacts: Effect of Amount of Use*. Res. Pap. INT-284. Ogden, UT: USDA Forest Service, Intermountain Research Station.
- . 1993. *Campsites in Three Western Wildernesses: Proliferation and Changes in Condition over 12 to 16 Years*. Res. Pap. INT-463. Ogden, UT: USDA Forest Service, Intermountain Research Station.
- Cole, D. N., and B. Ranz. 1983. Temporary campsite closures in the Selway-Bitterroot Wilderness. *Journal of Forestry* 81: 729–32.
- Cole, D. N., P. Foti, and M. Brown. 2008. Twenty years of change on campsites in the backcountry of Grand Canyon National Park. *Environmental Management* 41: 959–70.
- Cole, D. N., and T. E. Hall. 1992. *Trends in Campsite Condition: Eagle Cap Wilderness, Bob Marshall Wilderness, and Grand Canyon National Park*. Res. Pap. INT-453. Ogden, UT: USDA Forest Service, Intermountain Research Station.
- Frissell, S. S. 1978. Judging recreation impacts on wilderness campsites. *Journal of Forestry* 76: 481–83.
- Hall, T. E. 2001. Changes in wilderness campsite conditions resulting from implementation of a designated-site camping policy. Unpublished report on file at USDA Forest Service, Aldo Leopold Wilderness Research Institute, Missoula, MT.
- Hammit, W. E., and D. N. Cole. 1998. *Wildland Recreation: Ecology and Management*, 2nd ed. New York: John Wiley.
- Leung, Y., and J. L. Marion. 2000. Recreation impact and management in wilderness: A state-of-knowledge review. In *Wilderness Science in a Time of Change Conference. Vol. 5. Wilderness Ecosystems, Threats and Management*, comp. D. N. Cole, S. F. McCool, W. T. Borrie, and J. O'Loughlin (pp. 23–48). Proceedings RMRS-P-15-VOL-5. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.
- Marion, J. L. 1995. Capabilities and management utility of recreation impact monitoring programs. *Environmental Management* 19: 763–71.
- Marion, J. L., and T. Farrell. 2002. Management practices that concentrate visitor activities: Camping impact management at Isle Royale National Park, USA. *Journal of Environmental Management* 66: 201–12.
- McEwen, Douglas.; Cole, David N.: Simon, Mark. 1996. Campsite impact in wildernesses in the south central United States. Research Paper INT-RP-490. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.
- Reid, S. E., and J. L. Marion. 2004. Effectiveness of a confinement strategy for reducing campsite impacts in Shenandoah National Park. *Environmental Conservation* 31: 274–82.
- Spildie, D. R., D. N. Cole, and S. C. Walker. 2000. Effectiveness of a confinement strategy in reducing pack stock impacts at campsites in the Selway-Bitterroot Wilderness, Idaho. In *Wilderness Science in a Time of Change Conference. Vol. 5. Wilderness Ecosystems, Threats and Management*, comp. D. N. Cole, S. F. McCool, W. T. Borrie, and J. O'Loughlin (pp. 199–208). Proceedings RMRS-P-15-VOL-5. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.

DAVID N. COLE is research geographer with the Aldo Leopold Wilderness Research Institute, Rocky Mountain Research Station, USDA Forest Service, 790 East Beckwith, Missoula, MT 59801, USA; email: dcole@fs.fed.us.

THOMAS E. FERGUSON is retired as wilderness, trails, and wild and scenic rivers specialist, Ouachita National Forest, Hot Springs, AR; email: tferguson623@sbc-global.net.