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WILDERNESS CAMPSITE IMPACTS: CHANGES OVER TIME

David N. Cole and Jeffrey L. Marion

ABSTRACT: How wilderness campsite impacts change over time was the object of both a 5-year longitudinal study in the Eagle Cap Wilderness, OR, and a cross-sectional study in the Boundary Waters Canoe Area, MN. Conclusions from the two studies generally support each other. The major types of impact that increase substantially after the first few years a site is used are campsite area, tree damage, loss of organic horizons, exposed mineral soil, and perhaps bulk density. Even with these types of impact, most change appears to occur within the first 5 to 10 years after a site is developed. Suggestions for minimizing long-term campsite deterioration are offered.

INTRODUCTION

Wilderness managers must contend with the fact that pronounced impacts are inevitable on campsites that receive more than very low levels of use. In the Eagle Cap Wilderness, OR, for example, even sites used no more than about 5 nights per year had changed substantially. Most of the trees had been injured; most tree seedlings had been eliminated; most vegetation cover had been lost; soils had been compacted resulting in low infiltration rates; and pronounced changes in soil pH, organic matter content, and nutrient content had occurred (Cole 1982). Pronounced impact, even on lightly used campsites, has also been reported in the Mission Mountains Tribal and Rattlesnake Wildernesses, MT (Cole and Fichtler 1983) and the Boundary Waters Canoe Area Wilderness, MN (Frissell and Duncan 1965; Marion and Merriam 1985).

Wherever use levels are moderate to high, impacts will be minimized by concentrating use on a small number of sites (Cole 1981). The use concentration strategy has been implemented by either requiring parties to camp at designated sites or encouraging the use of sites that are already well impacted. In 1980, about 14 percent of wildernesses required use of designated sites, at least in some places; another 13 percent encouraged camping on previously used sites (Washburne and Cole 1983). One of the major concerns with this strategy is that these sites may deteriorate over time, under the pressure of heavy use, to the point where they are seriously degraded and no longer desirable places to camp.

Few data on how campsite conditions change over time are available to evaluate whether continual deterioration is likely to be a problem. In this paper we present data from two separate studies of wilderness campsites. One, undertaken in the Eagle Cap Wilderness, used a longitudinal research design to follow change on 16 long-established campsites over a 5-year period. The other, undertaken in the Boundary Waters Canoe Area, used a cross-sectional approach to compare impacts on 96 campsites in three age classes: 5 to 10 years old, 10 to 13 years old, and more than 13 years old. The relationship between site impacts and age of sites is clarified by the different perspectives that these two methodological designs provide.

PREVIOUS RESEARCH

In 1967, Merriam and his students at the University of Minnesota began a study of changes on newly developed campsites in the Boundary Waters Canoe Area. After 2 years of use, penetration resistance (a measure of compaction using a soil penetrometer) had increased substantially, as had the percentage of trees that were dead or that had exposed roots (Merriam and others 1971). Area of bare soil had not enlarged and the original size of the site had increased an average of about 10 percent. Between the second and fifth years of use, penetration resistance actually declined. Tree mortality and root exposure increased, as did exposure of bare soil. Sites also continued to enlarge; after 5 years they were, on average, over 50 percent larger than when initially developed. From these results, Merriam and others (1973) concluded that impacts generally level off after the first 2 years of use, but site enlargement continues. This conclusion may overlook increases in tree damage and soil exposure that occur beyond the 2-year point.

In 1974 and 1981, 7 and 14 years after original site development, Merriam and his students repeated measurements on a small sample of these sites (Merriam and Smith 1975; Merriam and Peterson 1983). Comparable results are available, over this 14-year period, for only four campsites. Bare soil continued to increase; after 14 years it was about twice as extensive as after 5 years. Both the area without undergrowth and penetration resistance also increased

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over this period, but the magnitude of change was small. Root exposure did not increase, because most trees had exposed roots after just 5 years; but tree mortality continued. Site enlargement also continued, but only on certain sites and not at the rate that occurred between the second and fifth years.

Merriam's conclusion that impacts level off after just 2 years of use supported the results of a study of a newly developed car campground in Pennsylvania (LaPage 1967). In that study, loss of vegetation cover was most pronounced after just 1 year of use. For the next 2 years, cover actually increased, as a few trampling-resistant species became more abundant on the sites. Species diversity continued to decrease for at least 3 years, but continued loss of vegetation was not a problem.

Changes on campsites in the Sylvania Recreation Area, a roadless area in Michigan, were followed over the third and fourth years of campsite use (Legg and Schneider 1977). Litter cover varied seasonally, but appeared to have reached equilibrium levels by the second year of use. Bulk density appeared to approach a maximum after 3 to 4 years. Macropore space was still declining after 4 years, although it was approaching minimal levels on heavy use sites. Depth to the A2 horizon was also still declining after 4 years, although it was already zero on the heavy-use sites. This supports the conclusion that, at least on more heavily used sites, most soil change occurs during the initial years of use.

Two studies have followed change over a 5-year period on long-established car campgrounds. Magill (1970) examined five campgrounds in California; Echelberger (1971) examined nine campgrounds in New York. Magill found a consistent loss of saplings over 5 years, amounting to as much as 24 percent of the saplings on one campground. There was little change in number of seedlings or in number and growth of large trees. Vegetation and litter cover actually increased over the 5 years, although either abnormally high precipitation or establishment of a barrier system to keep cars off the site may have been the cause. Finally the depth of litter decreased over the period. These results led Magill to conclude that campgrounds may be able to adjust to impact rather than be subject to continued deterioration. Echelberger also found little deterioration except for a more than 50 percent loss of trees over 20 feet tall.

On the basis of these studies, the conventional perception of campsite change is that increases in the severity of impact are minimal after the first few years of use; the major ongoing change is site expansion. However, some of these data suggest that other impacts, particularly tree damage and exposure of mineral soil, may also increase over time. Rates of change may not be as great as during the initial break-in period, but they may be sufficient to represent substantial deterioration over the long run. Moreover, only the study in the Boundary Waters Canoe Area examined wilderness campsites. Rates of change on wilderness campsites, where use levels are relatively low, may be quite different from rates in more heavily used areas.

STUDY AREAS AND METHODS

The two studies reported here were undertaken separately. Consequently, study methods are not always comparable. Both studies are included here because they offer the unique opportunity to evaluate change over time from the differing perspectives of a cross-sectional and a longitudinal study. Longitudinal studies evaluate change through repeated measures on the same sites over time. Cross-sectional studies evaluate change by comparing conditions on sites of various ages. The longitudinal approach is preferable to the cross-sectional approach because temporal differences are measured directly. In cross-sectional studies, temporal differences must be inferred from spatial differences that are likely to reflect variables other than campsite age. The advantages of cross-sectional studies are that: (1) they are less time consuming, so sample sizes can be larger; (2) campsites that differ greatly in age can be compared without waiting decades for results; and (3) some impact measurements are so affected by weather conditions that measures of change over time may reflect weather as much as a difference in impact. This is particularly true for soil conditions, such as penetration resistance and infiltration rates.

The Eagle Cap Study

Twenty-two long-established campsites were examined in the Eagle Cap Wilderness, OR, in 1979 (Cole 1982). All were around subalpine lakes at elevations of 7,050 to 7,800 feet. All were located in forests with an overstory primarily of *Abies lasiocarpa* and an understory of *Vaccinium scoparium*. Of these sites, six were closed to use; thus, the analysis of change over time was confined to the 16 sites open to use. Of these, six were low-use sites (with estimated use of less than 5 nights per year), six were moderate-use sites (10 to 20 nights per year), and four were heavy-use sites (25 to 50 nights per year).

Each sample site consisted of both a campsite and an undisturbed control site in the vicinity. The distances from an arbitrarily established center point to the edge of the disturbed campsite and to the first significant amount of vegetation were measured along 16 transects. This defined the camp area and the barren central core (bare area). Tree "seedlings" (0.5 to 4.5 ft tall) were recorded within the camp area, excluding any untrampled "islands"; larger trees were counted within the entire camp area. Trees that had been damaged (that had, for example, trunk scars, nails, or broken branches), that had been felled, or that had exposed roots were counted. In 1984, the center point--a buried

nail--was relocated. Distances to the edge of the disturbed campsite and to the first significant amount of vegetation were remeasured and new camp and bare areas were calculated. The boundaries of the 1979 camp area were laid out again and seedlings, damaged trees, felled trees, and trees with exposed roots were counted as in 1979.

On each campsite, approximately 15 quadrats, 1 m by 1 m square (3.3 by 3.3 ft), were located along four transects, originating at the center point and oriented perpendicular to each other. Percent coverage of total ground vegetation and each plant species, and percent exposed mineral soil were estimated for each quadrat. Coverages were estimated to the nearest percent if under 10 percent or, in 10 percent coverage classes, between 10 and 100 percent. The midpoints of each class were used when calculating mean coverages for the campsite. The thickness of the organic horizons was measured at four points, between 1 and 2 m (3.3 and 6.5 ft) from the center point, along each transect. In 1984, nails at the end of each transect were relocated. This permitted precise relocation of the transects and quadrats. Coverages were estimated and organic horizon thickness was measured as in 1979.

On the control plots, which varied in size between 980 and 2,164 ft^2, percent coverage of total ground vegetation and each plant species, and percent exposed mineral soil were estimated for the entire plot. Seedlings were counted on a 50-m^2 (538-ft^2) subplot placed in the center of the control. Organic horizon thickness was measured at four regularly distributed points. Measurements were repeated in 1984.

The amount of change that had occurred on campsites prior to 1979 was inferred from comparisons of campsites and controls. Absolute difference is the campsite measure minus the control measure. Change in species composition was estimated by comparing the composition of campsites and controls, using the following coefficient of floristic dissimilarity:

$$Fd = 0.5 \Sigma |p_1 - p_2|$$

where p_1 is the relative cover of a given species on the control site and p_2 is the relative cover of the same species on the campsite.

The magnitude of change between 1979 and 1984 was expressed as the median difference between 1979 and 1984 values. Where appropriate, change in both campsite measures and absolute differences (the campsite-control comparison) was used. The statistical significance of these changes (the extent to which the changes measured on these sample sites are applicable to all sites in the area) was evaluated with the Wilcoxon matched-pairs, signed-ranks test. This nonparametric test was selected because data for many variables were not normally distributed and the sample size was small. Differences between 1979 and 1984 were considered significant if probability values were 0.05 or less.

The Boundary Waters Canoe Area Study

In the Boundary Waters Canoe Area, MN, 96 lakeside campsites were examined. These sites were located in a variety of forested plant communities. Twenty-eight sites were low use (estimated use of less than 12 nights per year), 38 were moderate use (20 to 40 nights per year) and 32 were high use (more than 60 nights per year). Sites were also classified according to their age. Twenty-two sites were 5 to 10 years old, 34 were 11 to 13 years old, and 36 were more than 13 years old. Sites in the oldest category were user created; the younger sites were developed by the Forest Service.

Each study site consisted of both a campsite and a control. Camp area was measured with steel tapes. Seedlings and larger trees were counted on this area. Larger trees were classified as to severity of tree damage and root exposure. These classifications were used to derive indexes of tree damage and root exposure. Each index could vary between 1 (no damaged trees) and 4 (all trees with severe damage). Refer to Marion (1984) for more detail. Seedlings were also counted on the 50-m^2 (538-ft^2) control plots.

For the campsite as a whole, and for the control site, percentages of dense vegetation, litter, exposed mineral soil, exposed rock, exposed root area, and each individual species were estimated. Dense and sparse vegetation were combined for an estimate of total vegetation cover. Four soil samples were also taken, below the organic horizons, both on campsites and controls. The irregular hole method for determining bulk density was used due to the large proportion of coarse fragments in the soil (Howard and Singer 1981). Soil samples were analyzed for moisture content, stone-free bulk density, and organic content. Organic horizon thickness and penetration resistance (measured with a pocket soil penetrometer) were measured at 12 points, both on the campsite and the control.

As in the Eagle Cap study, absolute difference was used to infer amount of change. An overall impact scale was constructed using standardized measures of eight impact variables: root exposure index, tree damage index, floristic dissimilarity, camp area, and absolute differences for bare mineral soil, dense vegetation cover, bulk density, and organic horizon thickness.

The relationship between these impact parameters and campsite age was examined through two-way analyses of variance, with age and use level as independent variables. This approach was necessary because use level and age were correlated and there was often a significant relationship between impact and use level. Differences between age categories were considered significant

if probability values were 0.05 or less. Through multiple classification analysis, means for each age class are presented, after being adjusted for use level effects.

RESULTS AND DISCUSSION

The Eagle Cap Wilderness Study

Between 1979 and 1984, campsite area increased on 14 of the 16 sites. The median increase was 237 ft^2 (table 1). This represents an 11 percent increase in area above the median camp area in 1979. The largest increase was over 1,600 ft^2, an increase of three and one-half times. This was one of the few variables for which differences between 1979 and 1984 were statistically significant. This result confirms the finding of Merriam's studies that site enlargement is a consistent long-term change on campsites. Bare area (the central area devoid of vegetation) increased on 10 sites. The median increase was 54 ft^2, a 10 percent increase from the 1979 bare area. The largest increase was 775 ft^2, a 124 percent increase; the largest decrease was 194 ft^2, a 33 percent decrease. Again this is comparable to findings in Merriam's studies. Increases in both camp area and bare area are general trends. The camp area increases are more pronounced and also more consistent.

Changes in tree damage were inconsistent. The number of damaged trees increased on three sites, decreased on six sites, and was unchanged on seven sites. The median number of damaged trees declined slightly between 1979 and 1984. Declines in number of damaged trees were usually the result of tree felling. The number of felled trees increased on half of the sites. The most extreme example was one site where the number of felled trees increased from 8 to 19. Inexplicably, the number of felled trees decreased on three sites. The number of trees with exposed roots increased on four sites and decreased on three sites; the median change was zero. These results suggest that yearly increases in tree damage are typically very small, although they can be substantial on some sites. This is quite different from the results of Merriam's studies. Shallow soil on campsites in the Boundary Waters Canoe Area makes root exposure and tree mortality unusually prevalent.

Vegetation cover increased on nine sites and decreased on six sites. The largest increase in cover was 9 percent; the largest decrease was 7 percent. The median increase was only 0.3 percent. Vegetation cover increased even more on controls. Consequently, absolute differences became more negative over this time period. In 1984, the median campsite had 46 percent less vegetation than its paired control, compared to a median difference of 45 percent in 1979. This represents a median increase in vegetation loss of 1.5 percent. The difference in species composition between campsites and controls (floristic dissimilarity) increased on 10 sites. Increases were generally small, with a median change of just 2 percent. These findings agree

Table 1.--Change in impact on 16 campsites in Eagle Cap Wilderness between 1979 and 1984[1]

Impact parameter	Campsite				Absolute difference			
	1979	1984	Change	p	1979	1984	Change	p
	Median				Median			
Camp area (ft^2)	2,131	2,508	237	0.001				
Bare area (ft^2)	915	1,119	54	0.03				
Mutilated trees (#)	9.0	7.5	0	0.17				
Felled trees (#)	4.0	5.0	1.0	0.08				
Trees with exposed roots (#)	3.5	3.5	0	0.26				
Floristic dissimilarity (%)	50	50	2	0.17				
Seedlings (#/acre)	110	122	1	0.35	-813	-787	-90	0.03
Vegetation cover (%)	7.2	7.5	0.3	0.20	-45.3	-46.2	-1.5	0.27
Exposed mineral soil (%)	24.3	42.0	4.8	0.06	16.5	29.0	5.1	0.07
Organic horizon thickness (in)	0.10	0.04	0	0.30	0.10	0.12	0	0.39

[1]p values refer to Wilcoxon matched-pairs, signed-ranks tests between 1979 and 1984 values. Absolute differences are control values minus campsite values.

with those of Magill who found no continued vegetation deterioration on long-established campsites.

As with vegetation cover, the number of seedlings on campsites generally increased between 1979 and 1984. Seedlings increased on eight sites and decreased on four sites. However, the median increase was only one seedling per acre. The number of seedlings on controls decreased over this period. Consequently, absolute differences changed more dramatically. The median difference between campsites and controls decreased 90 seedlings per acre. This reduction in seedling loss is statistically significant. Even in 1984, however, over 90 percent of the seedlings have been eliminated from campsites. Seedlings are reduced to very low levels by initial use; thereafter the number of seedlings probably fluctuates around these low values. Seedlings that survive initial use are likely to survive prolonged use.

Amount of exposed mineral soil increased on 12 sites. The largest increase was 34 percent. Although this increase is not quite statistically significant, the magnitude and consistency of this increase suggests it is a general trend that would probably have been statistically significant with a larger sample size. Between 1979 and 1984, the number of sites with more than 50 percent mineral soil increased from five to eight. This represents a substantial increase in impact that is somewhat disguised by the low median increase of only 5 percent. Mineral soil exposure on controls changed very little, so estimates of change based on absolute difference were comparable to those based on campsite conditions. Again this confirms the finding of Merriam's studies that area of bare soil usually continues to increase over time. The thickness of organic horizons increased on six sites and decreased on seven sites. The median change was zero. The number of samples and measurement techniques used were probably insufficient to reveal the small changes occurring. Moreover, samples were taken close to the center of the site where one might expect most change to have occurred prior to 1979. Median values for campsites in 1979 and 1984 suggest that slight reductions in thickness may be ongoing even close to the center of the site. The fact that exposed soil is increasing, for the entire campsite, suggests that thickness is being reduced more dramatically further from the center.

The Boundary Waters Canoe Area Study

The impacts for which there are statistically significant increases on older campsites are tree damage, increase in amount of bare mineral soil and bulk density, and decrease in organic horizon thickness. These differences are sufficient to make the relationship between impact scale and age significant (table 2). For most of these impact parameters the difference between 5- to 10-year-old and 11- to 13-year-old sites is minor compared with the difference between these younger sites and the sites that are over 13 years old. However, the largest difference is always the difference between controls and the 5- to 10-year-old sites.

Greater tree damage on older sites was expected because such damage is cumulative over time. Once a tree is damaged, it is damaged for life. The relationship between tree damage and age is more pronounced here than on Eagle Cap sites, probably because a longer time period was examined in this cross-sectional study. New tree damage must occur relatively infrequently; consequently, changes over just 5 years are relatively small on most sites. The increase in mineral soil also supports the Eagle Cap results. Absolute difference is identical to campsite coverage because exposed mineral soil is not found on controls.

Increase in bulk density is significantly related to age, but campsite bulk density is not. Neither campsite penetration resistance nor increase in penetration resistance is significantly related to age. All of these impact parameters do exhibit a tendency to increase with age, however.

Increase in bulk density is significantly related to age, but increase in penetration resistance is not. In contrast, penetration resistance is significantly related to use level but bulk density is not. The difficulty of interpreting these results illustrates the problem with relying exclusively on cross-sectional studies. For both variables, differences between sites in different age classes are much more pronounced on more lightly used campsites, and differences between sites in different use level classes are more pronounced on younger sites. This suggests that compaction tends to level off both with increasing use and age. Theoretically this makes sense, because there is a limit to the pressure recreational use can exert on soil. This places a limit on compaction levels--a limit that is likely to be reached before too many years of use. Thinner organic horizons on older sites are likely to increase susceptibility to compaction. This may explain the more pronounced increases in bulk density on older sites.

Organic horizons are thinner on older sites, but absolute loss of organic horizons (the campsite-control comparison) is no greater. Again this is difficult to explain other than to suggest that controls did not provide sufficiently accurate measures of conditions prior to use. The thinner horizons and more pronounced increase in exposed mineral soil on older sites strongly suggest that net loss of organic horizons continues on campsites.

It is interesting to note that one-way analyses of variance also showed significant relationships between campsite age and both camp area and root exposure. However, the significance of

Table 2.--Relation between age and amount of impact on 96 campsites in the Boundary Waters Canoe Area[1]

Impact parameter	Campsite age (years)						p
	5-10	11-13	>13	5-10	11-13	>13	
	- Unadjusted means - -			- - Adjusted means - -			
Camp area (ft^2)	1,888	1,920	3,109	2,396	2,339	2,403	0.92
Root exposure index	2.48	2.44	2.75	2.50	2.46	2.71	0.26
Tree damage index	2.64	2.73	3.07	2.67	2.76	3.03	0.05
Bare mineral soil (%)	7	6	17	9	8	14	0.05
Seedlings							
campsite (#/acre)	161	155	68	129	125	116	0.98
absolute difference (#/acre)	-1,236	-726	-1,116	-1,315	-811	-984	0.17
Vegetation cover							
campsite (%)	38	45	25	33	41	32	0.28
absolute difference (%)	-57	-51	-66	-60	-53	-61	0.43
Bulk density							
campsite (g/cc)	1.21	1.32	1.37	1.22	1.34	1.34	0.19
absolute difference (g/cc)	0.14	0.26	0.36	0.14	0.27	0.36	0.002
Penetration resistance							
campsite (ton/ft^2)	3.2	3.6	4.2	3.5	3.8	3.8	0.17
absolute difference (ton/ft^2)	2.0	2.2	2.9	2.2	2.3	2.6	0.13
Organic horizon thickness							
campsite (in)	1.1	0.9	0.4	1.0	0.8	0.6	0.01
absolute difference (in)	-1.4	-1.3	-1.7	-1.5	-1.4	-1.5	0.60
Soil organic content							
campsite (%)	6.2	5.8	6.7	6.5	6.1	6.2	0.89
absolute difference (%)	0.9	0.5	0.7	1.2	0.7	0.4	0.52
Impact scale	-0.32	-0.24	0.41	-0.17	-0.12	0.21	0.002

[1]p values are taken from two-way analyses of variance. Adjusted values are means after using multiple classification analysis to take differences in use level into account. Absolute differences are control values minus campsite values.

these two relationships disappears when differences related to use level are accounted for. The adjusted means for root exposure do show an increase in exposure with age; apparently site-to-site variability is simply too high for these differences to be statistically significant.

Camp area, for any given use level, is simply not any larger on old than on young campsites. This is surprising in light of the finding, from longitudinal studies, that a major ongoing change on campsites is an increase in area. Merriam and Peterson (1983) showed that campsite enlargement on Boundary Waters Canoe Area campsites continues for at least 14 years, although the rate of increase decreases over time. The tendency for sites to expand over time may have been negated by the imposition of a party size limit of 10 persons, in 1975, and a campsite maintenance program that actively attempts to limit expansion.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

These two studies contribute a more detailed view of how impacts on wilderness campsites change over time. In the forested environments examined, the most sizable changes that continue beyond the break-in period appear to be site expansion (in the absence of stringent limits on party size) and loss of organic matter. Tree damage is also cumulative, but most damage occurs shortly after sites are developed and yearly increases thereafter are generally quite small. Nevertheless, because recovery from damage is minimal, cumulative effects over time can be large, particularly on certain campsites. There is also some indication that soil compaction increases over time. This may reflect increasing compaction on campsites as organic horizons are removed. Organic horizons tend to cushion soil from trampling pressure and inhibit compaction. Ground-level vegetation--tree seedlings, shrubs, and herbaceous vegetation--

appears to equilibrate at low cover levels after several years. This seems to be the case despite small increases over time in the size of the barren core of campsites. Change in species composition also appears to stabilize. Changes occur but they tend to fluctuate around equilibrium conditions.

The implication of these findings, at least in the areas studied, is that managers should expect continued deterioration of campsites over time. Highest levels of impact usually occur on the oldest and most frequently used sites. Site expansion, tree damage, and loss of organic horizons are likely to be the impacts that intensify most over time. However, even these impacts occur most rapidly during the first few years a campsite is used. Therefore the option of rotating sites is likely to be self-defeating except where use levels are low.

There are a number of ways of mitigating these impacts on designated sites or wherever long-term use occurs. Educating visitors about the problems of cumulative impact is an important first step. This is really the only means of avoiding tree damage. It can also reduce the likelihood of campers unnecessarily expanding the site. Expansion can also be controlled through limitations on party size, careful selection of campsite locations, and proper design and layout of campsites. Of these options, limiting party size is the obvious first choice and the only viable choice where use is widely dispersed and visitors are allowed to camp wherever they want. Maximum party sizes will have to be less than the current common limits of 15 or 25 before this is likely to be effective. Where sites are designated, they can be located in thick vegetation and rough topography, where visitors will be unlikely to utilize offsite areas. Areas with poor drainage or any other condition likely to encourage offsite use should be avoided. Improvement of onsite tent pads will also encourage onsite use. Finally, large rocks, logs, and trees can be used to close off places where site enlargement is occurring.

Avoiding problems resulting from loss of organic matter is more difficult. Perhaps the best solution is locating sites in forests with naturally thick organic horizons. This would minimize exposure of mineral soil and soil compaction.

Campsite impacts are inevitable wherever use occurs. In situations where use levels are moderate to high, there is little option but to concentrate use on carefully selected sites that will remain functional and desirable for a long time. While such a strategy avoids the problem of a proliferation of substantially impacted sites, it creates the problem of how to maintain conditions on a small number of heavily used and impacted sites. This problem is similar in many ways to maintenance of campgrounds outside of wilderness. Certain types of impact are cumulative and/or tend to intensify over time. Recognizing which problems do increase over time should improve the ability of managers to counter these tendencies.

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