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Low-Impact Recreational Practices for Wilderness and Backcountry

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PREFACE

This report summarizes information on low-impact recreational practices in backcountry and wilderness areas. The first section describes common problems caused by recreational use of backcountry and factors that influence the magnitude of these problems. Low-impact practices capable of substantially attenuating these problems are listed.

The second section—the bulk of the report—describes each low-impact practice, using a standard format. First, the practice is described along with sample messages for recreationists. Then the rationale for each practice is discussed, as is the importance and likely effectiveness of the practice. Controversial aspects of recommended practices and knowledge needed to increase specificity or reduce controversy are discussed. The frequency with which each practice is recommended is noted, and costs to visitors are described.

A third section discusses practices that have been recommended but that might result in problems. This section is followed by a discussion and examples of messages that emphasize visitors' understanding the rationale behind recommended low-impact practices and messages tailored to different environments and user groups. A final section discusses major research gaps in knowledge about behaviors capable of minimizing problems.

This report is intended to serve as a source book of information on low-impact practices. Managers can use the discussion of problems to identify practices they might want to recommend to visitors. The descriptions of individual practices can be used to decide more specifically what practices to recommend. The sections on developing effective messages can provide ideas and examples on how to put together a coherent set of recommended practices. The section on research gaps might prove useful to researchers seeking important topics for study.

There are three primary ways of accessing information on specific practices. Someone interested in all of the practices useful in avoiding specific problems can use the lists following the discussions of each management problem. Major categories of practices, such as all those that pertain to the use of campfires, can be located in the table of contents. Specific practices are listed in appendix A.

CONTENTS

Introduction	1
Education—A Personal Perspective	2
Management Problems	3
Trail Problems	3
Campsite Problems	5
Litter Problems	8
Crowding and Visitor Conflict	8
Deterioration of Grazing Areas	10
Human Waste	11
Wildlife and Fishery Impacts	11
Water Pollution	12
Other Problems	13
Recommended Low-Impact Practices	13
Trip Preparation	15
General Conduct	23
Backcountry Travel	30
Campsite Selection and Behavior	41
Campfires	57
Waste Disposal and Sanitation	71
Additional Practices for Parties With Stock	78
Practices That Can Be Counterproductive	90
Practices That Are Appropriate Only in Certain Situations	100
Developing Low-Impact Messages	100
Tailoring the Message to Different Environments	100
Tailoring the Message to Different User Groups	101
Tailoring the Message to Different Audiences and Media	102
Research Gaps	102
References	104
Appendix A: List of Recommended Practices	108
Appendix B: Source Materials on Low-Impact Practices	111
Appendix C: NOLS Conservation Practices	115
Appendix D: NOLS Regional Guidelines	123

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INTRODUCTION

Wilderness and backcountry areas have been designated for a variety of purposes and permit a variety of uses. These various purposes and uses often conflict with each other, causing management problems. Recreational use is a good example. Recreational use can alter vegetation, animal behavior, soil, and water, compromising the integrity of ecological, geological, scientific, scenic, and historical values. By diminishing opportunities for solitude, recreational values can also be compromised. Management problems resulting from recreational use of wilderness and backcountry (terms that will be used interchangeably hereafter) can and have been dealt with in many ways. Cole and others (1987) discuss the pros and cons of alternative strategies for dealing with these common problems.

As wilderness use and its impacts have grown in magnitude, so have restrictions on that use. Regulations have proliferated, resulting in a new problem—restriction of the free and spontaneous nature of wilderness recreation. Ever-increasing regulation has precipitated concern that management has become unnecessarily authoritarian (Lucas 1982). An alternative approach has been advanced, stressing information and education. If informed users will voluntarily behave in ways that minimize problems, then regulation can be less pervasive.

The notion that management through voluntary compliance is preferable to authoritarian control has considerable appeal to managers and visitors alike. Most managers are uncomfortable with the “police” role that regulation requires of them, and visitors usually prefer to retain freedom of choice. Consequently, both managing agencies and advocates of recreational use have been quick to express their support for information and education programs (Frome 1985). Considerable progress in the development of written materials about low-impact practices has been made. Techniques are taught in “how-to” books (for example, Hart 1977; Petzoldt 1974; Simer and Sullivan 1983), books specifically on low-impact techniques (Hampton and Cole 1988; Waterman and Waterman 1979), popular articles (for example, Curtis 1982; Hart 1980; Manning 1980; Wallace and DeBell 1982), and in brochures and pamphlets developed by land-managing agencies and user groups. Low-impact practices are also presented through such media as video, slide tapes, and face-to-face contact between rangers and visitors (Martin and Taylor 1981).

Although much thought has gone into development of these materials, there has been virtually no formal evaluation of the accuracy or effectiveness of the practices that have been recommended. Most recommendations are commonsense judgments derived from personal experience and are generally accepted. Some of these recommendations are contradictory and controversial, however. Moreover, research results relevant to predicting likely consequences of recommended actions have often been overlooked, and rationales for recommended actions have seldom been developed.

Considering the time and effort being expended on developing low-impact educational programs, it seemed worthwhile to systematically review current knowledge and experience. The development of effective wilderness education will require understanding of both *what* information to provide and *how* to convey this information to visitors. This report addresses the “what” aspect, the content of educational messages. What should we be telling wilderness visitors?

This report does *not* address the question of how to effectively deliver these messages. This subject will require innovative thinking, experimentation, and analysis. To date, Martin and Taylor (1981) have compiled the most comprehensive report on this subject.

Most of this report consists of two sections. The first section describes major management problems, and the characteristics of visitor use and behavior that aggravate each problem. Practices are identified that will minimize each problem. By linking recommended practices to specific problems, it is easier to provide a rationale for practices and to evaluate the likely

effectiveness of each recommendation. Providing good reasons for recommendations is generally considered important to getting visitor compliance. Clear definition of linkages between problems and practices is also critical when evaluating the appropriateness of recommendations that have both positive benefits and negative consequences.

The second major section describes both generally recommended low-impact practices and frequently recommended practices that may be counterproductive. To prepare this section, 90 examples of low-impact materials were collected from a variety of sources and regions of the Nation. The recommendations provided were evaluated for consistency among sources and with the results of research. Most practices can be generally recommended. A number of recommended practices are controversial, however. Some have potentially negative consequences. For some of these, the negative consequences can be predicted given current knowledge; for others, tests of effectiveness are needed. Controversy also results from making recommendations that are arbitrary, overly specific, or that apply in some situations but not in others. Finally, a number of recommendations would be more useful if they were more specific, but further research is needed to provide this specificity.

In this report, "controversy" refers to differences of opinion about appropriate low-impact recommendations or situations where research results conflict with recommendations. A major objective of this report is to highlight and, where possible, resolve these controversies. The term is not used to refer to recommendations that are controversial to users who object to a generally recommended practice. For example, there is little controversy about the validity of recommending that stoves be used instead of fires in popular timberline destination areas. Nevertheless, many visitors may find this recommendation controversial because they are accustomed to and enjoy campfires.

In addition to the two major sections, this report discusses the importance of, and how to tailor, low-impact messages to specific user groups and environments. Although some practices are universal, the applicability of others varies, depending on whether the user travels on horseback or carries a backpack; and whether the visit is to desert or to alpine tundra. Comprehension and retention are likely to be greater when information is targeted more specifically and the information provided can also be more specific, making it more useful. Other sections of this report describe gaps in knowledge, provide examples of educational materials, and describe some desirable characteristics of such materials.

EDUCATION—A PERSONAL VIEW

Many of the low-impact educational materials I reviewed were simply lists of "do's and don'ts"—things to do and things not to do. Such lists are strikingly similar to lists of rules and regulations. The primary difference is that the lists of do's and don'ts used words such as "discouraged" instead of "prohibited", or "encouraged" rather than "required." Often the only difference in phraseology is whether or not the statement is backed up by Federal regulations. It has been argued that this difference is important because visitors retain freedom of choice (Lucas 1982). I do not disagree, and I believe that lists of do's and don'ts can be useful. But I also believe that the type of education that is needed to reduce impacts substantially is something very different.

Educational programs need to do more than teach visitors what to do. Such programs must change the way people think about their behavior. Simply changing what visitors do would be effective if it were possible to list a set of practices that were appropriate in all circumstances. Unfortunately, this is not possible. The right practice in one situation can be the worst thing to do in another situation. For example, when following a trail, parties should walk single file down the middle of the trail. When walking off-trail, however, people should spread out to avoid creating a trail.

Visitors need to be taught how to evaluate and weigh a variety of factors, and how to select the course of action most likely to minimize problems. They need to use judgment, as well as follow specific techniques for minimizing impact.

Teaching visitors how to evaluate different situations would produce additional benefits. It would provide a framework for incorporating new information and experience. As will become obvious in the entries for "knowledge needs" in the descriptions of practices, there is a lot that we do not know about low-impact practices. A framework for organizing new knowledge would help each person to continually improve low-impact skills. Commitment to low-impact techniques is also likely to be greater if visitors possess a framework for evaluating appropriate behavior. Satisfaction should be greater after having figured out the right thing to do, instead of simply complying with a recommended practice. The reasons for and importance of behaving in certain ways should also be more apparent.

Educational programs tend to provide little rationale for recommendations. For example, visitors are commonly asked not to camp close to lakes; however, defensible reasons for this request are seldom offered. Without a rationale, visitors may not understand why the action is important and may decide that it is *not* important. They are more likely to interpret recommendations incorrectly, and they are less likely to think of additional means of mitigating the problem. The need to pay more attention to rationale is the primary motivation for the discussion of problems in the subsequent section.

Programs also suffer from a common belief that it is necessary to state practices as universal rules. This tendency reflects a common opinion that most visitors are incapable of making complex judgments—a debatable point. Unfortunately, it is not possible for all recommendations to be simple rules that apply everywhere. Walking silently to maintain solitude seems to be a universally good idea, but in grizzly bear country one wants to make lots of noise to avoid surprising bears. Advice about where to camp is much more complicated, with many more variations and tradeoffs. It simply cannot be reduced to a set of universal do's and don'ts. Clearly the best choice is to train visitors in the art and science of making judgments based on a variety of factors.

In sum, low-impact wilderness education must be an ethic and a way of thinking if it is to realize its full potential. It is more a matter of attitude and awareness than of rules and regulations. Otherwise, educational programs will differ little from a system of officially sanctioned rules and regulations. Visitors need to be aware of the most critical management problems and the actions they can take to minimize those problems. They must learn how to evaluate a variety of factors—such as soil, vegetation, wildlife, weather, the amount and type of use a place receives—and then use this analysis and past experience to select appropriate practices. This requires both respect for and trust of visitors. A large proportion of wilderness visitors are well educated (Roggenbuck and Lucas 1987). Where visitors will not cooperate voluntarily, there is little choice other than management through regulation and law enforcement.

Implementing low-impact education is a difficult task that will take considerable time and effort. It represents a long-term goal. Similarly, certain recommendations in this report may appear overly "pure." They clearly would require dramatic changes on many users' part; however, they are not as "pure" as some reviewers wanted. Again, I advance these practices as reasonable long-term goals.

In the short term, practical considerations will preclude highly ambitious educational programs and expectations of immediate changes in behavior. It will be necessary to begin by teaching relatively simple practices and concepts and to nudge users away from traditional high-impact practices. Nevertheless, it is important to keep long-term goals in mind.

MANAGEMENT PROBLEMS

Management problems could be discussed at various levels of generalization. All problems resulting from recreational use of wilderness could be sorted into two categories—adverse ecological impacts and adverse impacts on visitor experiences. At the other extreme, it would be possible to list scores of different types of ecological impacts at campsites (tree damage, vegetation loss, campfire damage, and so on). A useful intermediate level of analysis used elsewhere (Cole and others 1987) identifies eight major types of problems, several of which have been divided into subproblems. These will be discussed in order of their perceived prevalence in wilderness (Washburne and Cole 1983). After each subproblem, the low-impact practices judged to be most important to minimizing problems are listed.

Trail Problems

Most problems associated with constructed trails result from poor trail construction and maintenance rather than either too much use or improper use of the trail (Cole 1983a; Helgath 1975). Two useful guides to trail construction and maintenance are Birchard and Proudman (1981) and Proudman and Rajala (1981). Although most deterioration problems would not occur if trails were properly located and/or engineered (management actions outside the realm of visitor education), certain types of visitor behavior aggravate trail deterioration. A second subset of trail problems results from the development of user-created trails in places where trails are unwanted. These two subproblems will be treated separately.

Deterioration of Constructed Trails—The most common types of deterioration on constructed trails are erosion, muddiness, trail widening (often the result of a muddy trail), and the creation of multiple trails and switchback shortcuts (Cole 1987b). As just mentioned, proper location, engineering, and maintenance of constructed trails are the most effective

means of avoiding these problems. In certain locations, without necessary engineering, any use will result in erosion and muddiness. The tendency, however, for visitors to leave the constructed trail, where these conditions exist, exacerbates these problems. Where trails are narrow and deep, or wet and muddy, the natural tendency is to walk along the edge of the trail rather than in the trail tread. This causes widening of muddy quagmires and/or the development of multiple parallel trails. Similar problems result from leaving the trail to shortcut a switchback. The shortcut becomes a trail (usually steep), is used more frequently, and deteriorates rapidly.

Two other factors influence the severity of deterioration problems. Trails are more prone to muddiness, widening, and the development of multiple trails when the ground is wet and water-saturated. While these conditions may occur sporadically and unpredictably (such as after summer thunderstorms), they may be particularly prevalent at certain seasons, such as during and shortly after snowmelt. Avoiding use at this time can effectively reduce the potential for trail deterioration.

Finally, compared to hiking parties, parties with packstock have more potential to cause trail deterioration (Weaver and Dale 1978). Where parties with packstock leave the constructed trail, deterioration occurs rapidly. Similarly, the potential for damage during seasons when soils are water saturated is particularly high when parties travel with stock. Therefore, all of the low-impact practices intended to minimize deterioration of constructed trails are considerably more important for parties with packstock.

For hiking parties the most important low-impact practices are:

- Avoid trips where and when soils are wet and muddy (page 20).
- Walk single file and keep to the main tread (page 31).
- Do not shortcut switchbacks (page 34).

All of these practices are particularly important for parties that travel with stock. In addition, the following important practices are unique to parties with stock:

- Use properly trained stock (page 78).
- Minimize the number of stock (page 80).
- Stock should stay on established trails as much as possible (page 81).
- Remove trail obstacles instead of skirting them (page 82).
- Lead stock on the trail, rather than loose-herd them (page 83).

Development of Undesired User-Created Trails—Undesired user-created trails develop along popular cross-country routes and in popular destination areas. They result from too many feet trampling the same strip of vegetation and ground. Many of these trails were previously animal trails, altered by the trampling of animal hooves. The problem is that obvious paths tend to attract more use, which results in further development of a trail system. Unplanned trail systems are often poorly located, so erosion can be particularly severe even with low use. They also tend to braid and proliferate widely, eventually resulting in more alteration than would have been the case with construction of a planned trail. More areas are developing specific objectives to keep areas trailless; such trail systems clearly defeat these objectives.

User-created trails result from too many people following in precisely the same path. The major way to avoid this is to have people spread out. This reduces the frequency any single place gets stepped on. The number of times any place can be stepped on before a trail develops depends on the fragility of the ground surface and the destructive force of the trampler. Therefore, trails are more likely to develop on fragile vegetation and ground surfaces or during seasons when the ground is water-saturated. They are also more likely to develop when trampled by stock, rather than by hikers (Weaver and Dale 1978). Similarly, where it is difficult to spread out, trail development is more likely following the passage of a large party because more feet are likely to fall on the same path.

In some places, use levels are so high that spreading out would simply create many trails all over the place. Ideally, management should establish an "official" trail system in such places (or reduce use levels dramatically). Where managers have taken neither of these actions, users can help the situation by treating the most obvious of the user-created trails as a constructed trail and staying on it. While this will not avoid the creation of user-created trails, it will limit their proliferation.

For hiking parties, the most important low-impact practices are:

- Keep party size small (page 18).
- Avoid trips where and when soils are wet and muddy (page 20).
- Avoid off-trail travel unless prepared to use extra care (page 22).
- Avoid walking on closed trails and/or developing user-created trails (page 30).
- Spread out when walking off trail (page 37).
- Do not mark cross-country routes (page 38).
- Choose a cross-country route that crosses durable surfaces (page 39).
- When traveling cross country, use extra care when ascending or descending steep slopes (page 40).

All of these practices are particularly important for parties that travel with stock. Except in resistant environments, it is difficult for a party of stock to not create a new trail. Therefore, use of existing trails is always preferable to cross-country travel; parties that do choose to travel cross country must use extra care. In addition to the preceding practices, the following are unique to parties with stock:

- Use properly trained stock (page 78).
- Minimize the number of stock (page 80).
- Stock should stay on established trails as much as possible (page 81).

Campsite Problems

The nature and magnitude of campsite problems are influenced by a variety of factors. The most important factors are how frequently the site is camped on, the type of party that uses the site (particularly size of party and whether or not they have stock), the behavior of campers (including, particularly, whether or not they have a campfire), and the fragility of the site (Cole 1987b). Season of use can also affect fragility and, therefore, is sometimes a significant factor. Low-impact practices are available that can take advantage of the influence of each of these factors.

Extensive research has shown that the relationship between frequency of use and amount of impact is complex; it varies with the use levels being compared (Cole 1987b). When comparing two infrequently used campsites, the more frequently used site is likely to have experienced considerably more impact. This is not the case when comparing more frequently used sites, however. Levels of impact may be comparable on sites receiving quite different levels of use. The major implications of this finding are: (1) keeping use of infrequently used sites to very low levels is an effective means of minimizing impact on these sites; (2) on the other hand, lightly used and lightly impacted sites, if used more frequently, are likely to deteriorate dramatically; and (3) on frequently used sites, neither increasing nor decreasing use is likely to have a substantial effect on amount of impact (Cole and Benedict 1983). But whenever use levels are reduced on certain sites, other sites will be used more frequently and the potential for the creation and deterioration of new sites increases. As long as use frequencies remain extremely low on all sites, deterioration may not occur and use dispersal may not lead to site proliferation. Where it is not possible to maintain very low frequencies on sites, use dispersal will merely increase the number of impacted sites (Cole 1982a).

These findings and implications suggest two positive ways to limit campsite problems and one situation that should be avoided. Because increased use of frequently used sites is not likely to cause much further damage, camping on sites that are already well impacted will confine deterioration to a small number of sites. Alternatively, where it is possible to use sites so infrequently that they never deteriorate, camping on apparently undisturbed sites will avoid the creation of campsites entirely. The situation to avoid is use of a large number of sites at low-to-moderate frequencies sufficient to cause site deterioration. This situation can occur either in popular places or in remote, little-used places. In popular places, it results from camping on less-disturbed sites rather than on sites that are already heavily impacted. In remote places, the problem results from camping on sites that have already been disturbed. This is likely to cause further disturbance, which is likely to attract further use, which is likely to cause further disturbance, and so on. *The key—in both popular and remote places—is to never camp on sites that are obviously but lightly disturbed* (Cole and Benedict 1983).

Type of use and visitor behavior can have a substantial influence on the severity of campsite problems. Large parties and parties with packstock will disturb a larger area than will a small hiking party (all other factors being equal) because they must occupy a larger area (Cole 1983b). Campsites used by outfitted parties tend to be particularly large because these parties usually consist of a number of unaffiliated groups, each seeking some privacy (Cole and Marion 1988). Unless such parties can find an existing site that is already large enough to accommodate their group, they are likely to enlarge the area of disturbance. Enlargement is the most common detrimental ongoing change on well-established campsites (Cole 1986a). Large parties and parties with stock will also tend to disturb a pristine site more rapidly than will a small hiking party. This follows from the facts that stock hooves cause more disturbance than human feet (Weaver and Dale 1978) and that the frequency any place is trampled will increase as party size increases. Therefore, large parties and parties with stock must use extra care when camping in little-used places.

Regardless of type of use, certain behaviors cause unnecessary impact while other behaviors minimize impact. Campfires, particularly if not used with restraint and caution, cause some of the most obtrusive impacts on campsites. Parties that carry and use stoves and do not build fires avoid these impacts. Damage can also be reduced by building fires carefully, only in appropriate places, and by cleaning up after fires. Avoiding any intentional site alteration and camouflaging any inadvertent disturbance that does occur are also important, as is traffic flow on the site. Again, the appropriate principle is that it is best to spread use and impact on undisturbed sites and to concentrate use and impact on areas that are already highly impacted. Thus, on already impacted sites, tents and activities should be confined to the most disturbed parts of the site. Conversely, tents and activities should be spread out on undisturbed sites. Large groups can minimize their disturbance of pristine places by breaking up into small groups that camp some distance from each other.

Finally, it is possible to take advantage of the fact that sites vary in their ability to tolerate use. Differences in the durability of vegetation are greater where use levels are low rather than high (Cole 1987a). This follows from the fact that, given sufficiently frequent use, even resistant vegetation (such as the turf of a football field) will be removed. This means that seeking out resistant sites is most important when using an apparently undisturbed site. Sites that are entirely devoid of vegetation are always preferred. Sites on rock, unconsolidated mineral soil (for example, beaches or dry washes), snow, or ice are best for minimizing impact; however, they may not be attractive to many campers. Where vegetation is present, sites with resistant vegetation are preferred. Vegetation resistance is highly variable, making it difficult to provide generalizations that apply in different regions or even within local areas. Vegetation types dominated by grasses and grasslike plants, particularly if growth is dense and short, are usually relatively resistant, as are vegetation types with large, tough shrubs with bare soil between (Cole 1986b). On frequently used sites, no vegetation type is tough enough to survive; however, some sites have a greater ability to avoid mineral soil exposure than others. This is significant because soil compaction and erosion tend to be more severe where soil exposure is pronounced. Potential for soil exposure is least on flat sites with thick organic horizons (Cole 1985).

As with trail problems, it is useful to divide campsite problems into two subproblems. The first is excessive deterioration of established campsites, whether officially designated or spontaneously created by users. This is the type of problem most readily envisioned—large areas of barren, compacted, and eroded soil; hacked-up and sawed-down trees with exposed roots; numerous firerings with charcoal spread over the site; plank seats; tables; ditched tent sites; and so on. The second subproblem is the proliferation of undesired user-created campsites. This problem can occur at popular destinations where every “campable” site is disturbed because camping is not confined to a small number of frequently used campsites (Cole 1982a). It also occurs in little-used places, such as lake basins that have a number of moderately disturbed campsites, despite use levels so low that encounters between parties are highly unlikely. The importance of the factors affecting amount of impact and the recommendations for appropriate use differ between these two subproblems.

Deterioration of Established Campsites—On frequently used established campsites, loss of vegetation cover and soil disturbance are inevitable. The major “problems” occur where the disturbed area becomes extremely large, where trees are damaged unnecessarily, where campfire impacts are widespread, and where widespread erosion occurs. As mentioned earlier, the factors with the most influence on the severity of these problems are the type of camping party and the behavior of those campers. Enlargement is related primarily to party size and the presence of stock and occurs when too little attention is paid to

confining traffic to already impacted areas. Tree damage is a result of intentional damage, improper stock handling, and improper firewood selection. Campfire impacts result from lack of care in use of fire; erosion results primarily from selection of a site that is prone to erosion. Selection of a durable site is generally less important to avoiding deterioration of established sites than it is to avoiding site proliferation. It is most important to find a flat site with a ground surface that, before camping, would have been either unconsolidated mineral soil or thick organic horizons and, if possible, sparsely vegetated.

For hiking parties, the most important low-impact practices are:

- Select a site that is large enough to accommodate your party (page 46).
- Select a durable site (page 47).
- Minimize intentional site alteration and the building of structures (page 50).
- On established campsites, confine tents and activities to already impacted areas (page 52).
- On established campsites, dismantle any structures you built and any other inappropriate structures; leave the site clean and attractive (page 53).
- Limit the use of campfires where firewood is not plentiful (page 57).
- In places with well-impacted campsites, build fires in existing firerings or on fire scars (page 61).
- Gather firewood away from camp; disperse your gathering (page 63).
- Use only dead and down firewood that you can break by hand (page 64).
- Burn charcoal to ash; soak ashes; scatter excess firewood (page 68).
- On preexisting fire sites, leave the firering clean and attractive; dismantle extra firerings (page 70).

All of these practices apply to parties with stock. In contrast to the practices designed to minimize trail problems, these practices are not more important for stock parties; however, the following practices are unique to parties with stock:

- Use properly trained stock (page 78).
- Minimize the number of stock (page 80).
- Keep stock off campsites as much as possible (page 86).
- Keep lengths of stay at one place short (page 87).
- Use existing hitch rails and corrals where available (page 92).
- Where confinement is necessary, use a hitch line on a durable site away from water (page 93).
- Avoid tying stock to trees, particularly small trees (page 94).
- Renovate pawed-up areas; scatter manure; remove picket pins and excess feed and salt (page 95).

Proliferation of Campsites—Creation of new campsites occurs whenever use of previously undisturbed sites exceeds very low levels. In popular places this occurs where visitors do not camp on sites that are already well impacted. This situation was documented in the Eagle Cap Wilderness where 221 campsites (more than half of which had suffered substantial vegetation loss) were found in a 325-acre area around two popular subalpine lakes (Cole 1982a). In remote, little-visited places, new campsites are created where visitors camp on sites that have already been disturbed and/or that are fragile, and where visitors are not careful to minimize impact and camouflage evidence of their stay. The magnitude of proliferation problems is influenced by frequency of use and site durability, as well as type of party and visitor behavior. Apparently undisturbed sites, without vegetation or with resistant vegetation, are preferred for campsites. Widespread dispersal of activities and traffic, as well as special care to minimize and camouflage disturbance, are also important. Large parties and parties with stock must use extra care, given their potential to cause rapid damage. Substantial off-trail use by parties unprepared to use extra care is likely to result in a proliferation of sites.

For hiking parties, the most important low-impact practices are:

- Keep party size small (page 18).
- Avoid off-trail travel unless prepared to use extra care (page 22).
- In popular locations, select a well-impacted campsite (page 41).
- In remote locations, select a previously unused campsite (page 42).
- Never camp on a lightly impacted campsite (page 45).
- Select a durable site (page 47).
- Wear soft-soled shoes around camp (page 49).

- Minimize intentional site alteration and the building of structures (page 50).
- Avoid trampling vegetation (page 51).
- On previously unused sites, disperse tents and activities (page 54).
- On previously unused sites, keep lengths of stay short (page 55).
- On previously unused sites, camouflage any disturbance (page 56).
- Limit the use of campfires (page 57).
- Build fires on mineral soil where trees, roots, vegetation, or rocks will not be scarred (page 60).
- In places with well-impacted campsites, build fires in existing firerings or on fire scars (page 61).
- In places without well-impacted campsites, do not use existing firerings or scars; dismantle any rings (page 62).
- On previously unused fire sites, build fire in a shallow pit or on a mound of mineral soil (page 65).
- Do not ring a fire with rocks (page 66).
- Keep fires small (page 67).
- Burn charcoal to ash; soak ashes; scatter excess firewood (page 68).
- On preexisting fire sites, leave the firering clean and attractive; dismantle extra firerings (page 69).
- On previously unused fire sites, remove all evidence of the fire (page 70).

All of these practices are important for parties with stock as well. Low-impact practices that are unique to parties with stock include:

- Use properly trained stock (page 78).
- Minimize the number of stock (page 80).
- Keep lengths of stay at one place short (page 87).
- Use existing hitch rails and corrals where available (page 92).
- Where confinement is necessary, use a hitch rail on a durable site away from water (page 93).
- Avoid tying stock to trees, particularly small trees (page 94).
- Renovate pawed-up areas; scatter manure; remove picket pins and excess feed and salt (page 95).

Litter Problems

Litter is a common problem in wilderness and is one of the more important factors detracting from the experience of visitors. But it is perhaps the simplest problem to correct. It is the only problem that can conceivably be eliminated. Although a simple solution is not necessarily an easy solution, there is some evidence that litter problems have diminished in recent years (Lucas 1985).

Clearly, the cause of litter problems is improper disposal of items brought into the wilderness. The general policy of "pack-it-in, pack-it-out," if strictly followed, could eliminate littering. Several problems arise, even for conscientious visitors, however. Certain items (used toilet paper, leftover food scraps, and so on) are unpleasant to pack out. Other items are easily misplaced and left behind. This has prompted suggestions about items to bring or not to bring. An example might be packaging food in "zippered" plastic bags, rather than in bags with "twist-ties" that are easily left behind. Other problems result from attempting to burn items that will not burn (such as aluminum foil).

The few important low-impact practices relevant to this problem are:

- Carry appropriate equipment (a trash bag) (page 16).
- Pack out nonorganic litter (or burn readily burned litter) (page 71).
- Pack out or burn organic garbage (or scatter fish viscera) (page 73).

All of these practices are important for parties with stock, as is the following additional practice:

- Scatter manure; remove picket pins and excess feed and salt (page 95).

Crowding and Visitor Conflict

Interaction between parties is a frequently cited source of visitor dissatisfaction (Stankey and Schreyer 1987). As with campsite problems, the magnitude of crowding and conflict problems is influenced by the frequency of interaction, the types of parties encountered, the behavior of individuals in those parties, and the location of encounters (Manning 1986).

A basic assumption of wilderness management is that as interaction between wilderness visitors increases, opportunities for solitude and therefore the quality of the wilderness experience decrease. Research, however, has had surprising difficulty in showing a strong negative relationship between frequency of encounters and satisfaction. Stankey (1973, 1980) found a strong preference among wilderness visitors for low levels of contact, but responses were based on hypothetical encounter levels. In real wilderness situations, researchers have seldom been able to effectively isolate the effect of frequency of contact on the experience. It is clear that as interaction increases, opportunities for solitude (a critical goal of management) will tend to decrease; moreover, many visitors express the desire not to see "too many other people." Therefore, it is safe to conclude that high levels of interaction cause problems.

One of the reasons for the difficulty in finding a correlation between contact levels and satisfaction is the importance of variables other than frequency of contact. Mode of travel is one important mediating factor. Interactions between hiker and stock parties are more dissatisfying, particularly to the party of hikers, than interactions between similar parties (Stankey 1973). The same is true for contacts between parties using motorized and nonmotorized boats, a situation that occurs in portions of a few wilderness areas. A similar situation occurs in some contacts between parties traveling with and without dogs. Party size is another mediating factor. Stankey (1973) has also reported that visitors prefer seeing many small groups to a single large group.

In all of these cases, there is an asymmetrical relationship between two different types of party. Hikers, nonmotorized boaters, parties without dogs, and small parties are often disturbed by contact with their opposites, despite little reciprocal concern. The concerned parties apparently perceive the other type of use as inappropriate or undesirable and, consequently, conflict occurs when the parties interact. Conflict also results when any individual breaks someone else's norms of appropriate behavior and is observed in the act, or the consequences of that act are observed. Examples include raucous behavior, shooting guns, littering, or any other observable environmental impact.

Finally, the location of contacts can influence problem severity. Interaction between parties camped close to each other is generally more of a problem than contacts along the trail or elsewhere (Stankey and Schreyer 1987). Encounters that occur in more remote portions of the wilderness also tend to be more troubling than encounters close to the edge of the wilderness (Stankey 1973). This tendency, along with the fact that satisfaction is strongly related to expectations about number of encounters (Stankey and Schreyer 1987), suggests that visitors in little-used portions of the wilderness will have less tolerance for contacts than will visitors to popular places, regardless of proximity to trailheads.

It is possible to differentiate between problems resulting simply from meeting too many other people (too many encounters) and problems resulting from the type of encounter (conflict). The distinction is not always clearcut, and each subproblem aggravates the other. Visitors are likely to feel particularly crowded if many contacts are of a conflicting nature. Conversely, a perception of conflict is more likely if contacts are frequent. Nevertheless, the distinction is useful because certain low-impact practices are relevant to one or the other of the subproblems.

Too Many Encounters—The number of encounters judged to be "too many" differs between visitors and with a number of situational factors. Nevertheless, because many visitors desire low levels of interparty contact, the goal of low-impact practices should be to minimize interaction with other parties, particularly where they are camped and in remote and little-used portions of the wilderness. Interaction extends beyond mutual visual contact to include other people viewing you (and particularly your camp) without your knowledge and other people hearing you.

Perhaps more than for any other problem, it would be possible to carry attempts to minimize encounters to extremes. Encounters with others could always be minimized by never walking on trails or by never visiting places at times of the year when others do. The following low-impact practices can help minimize problems without requiring drastic changes in preferences and behavior:

- Choose clothing and equipment colors that blend with surroundings (page 15).

- Be quiet in the wilderness (page 24).

- Take trailside breaks off trail on a durable site (page 35).

- Select a concealed campsite away from trails, occupied campsites, lakes, and other water bodies (page 48).

Two other commonly suggested practices cannot be generally recommended because, in my view, their negative consequences may outweigh their positive benefits. Those practices are "visit wilderness during less popular days of the week and/or seasons" (see page 96) and "avoid visiting more popular places in the wilderness" (see page 97). Each of these practices, if successful, would decrease encounters in some places and at some times, but they would tend to increase encounters in other places and at other times. The times and places where and when encounters would increase are those where and when encounter levels are currently low. Although data are scanty and merely suggestive, these are the situations where visitors appear to be most intolerant of increased interaction with others. There certainly are situations in which the tradeoffs implicit in either of these practices suggest a positive benefit/cost ratio (an obvious example is any situation where even after the shift in use, no encounters occur), but these practices appear to be risky as general recommendations.

Visitor Conflicts—Although influenced by the number and location of encounters, the major factors that determine severity of conflict are the type of party encountered and the behavior of individual visitors. Hiking parties can minimize problems with the following low-impact practices:

- Keep party size small (page 18).
- Keep pets under restraint or leave them at home (page 23).
- Be quiet in the wilderness (page 24).
- Step off the trail, downslope, when encountering a stock party (page 36).

While these are the practices that will minimize face-to-face conflict, all of the practices to minimize litter, human waste, campsite, trail, and grazing area problems will also reduce conflict. These other impacts, if recognized, are signs of inappropriate behavior and therefore contribute to perceived conflict.

All of the stock-handling low-impact practices are important in that they will minimize the impacts caused by stock, impacts that many feel result from inappropriate use of wilderness. Practices with particularly direct abilities to reduce conflict are:

- Minimize the number of stock (page 80).
- Tie stock off trail, on a durable site, when taking a break (page 84).
- Keep stock off campsites as much as possible (page 86).
- Renovate pawed-up areas; scatter manure; remove picket pins and excess feed and salt (page 95).

Deterioration of Grazing Areas

Packstock cause substantial problems in some backcountry areas. They contribute to problems on trails and campsites, as well as crowding and visitor conflict. Practices important to minimizing these problems have already been listed. One additional impact unique to parties with stock is deterioration of grazing areas. Places where stock are confined and/or allowed to graze are altered by frequent defoliation of plants and by trampling. This causes cover loss, shifts in species composition, and loss of forage, and can result in destabilization of streambanks, lowering of water tables, and invasion of "weedy" species (DeBenedetti and Parsons 1979). This in turn can have adverse impacts on wildlife through competition for limited forage and reductions in forage production.

The effects of packstock grazing on natural ecosystems in wilderness are not well understood; neither are the factors that influence amount of deterioration. Results of range studies conducted elsewhere suggest that low to moderate levels of grazing may not cause adverse impacts, as long as stock are kept off fragile sites. One primary cause of severe deterioration is excessive grazing pressure. This can result from having too many animals, staying in one place too long, or not rotating stock frequently enough. This problem can be partially alleviated by packing in weed-free supplemental feed so there is less demand for limited forage. But even then trampling damage can be serious. The other primary cause is grazing of places that are particularly fragile or grazing at times of the year when fragility is high. Grazing of wet meadows and riparian strips, as well as grazing during times of year when soils are water saturated, can be particularly destructive.

This suggests the value of the following low-impact practices:

- Avoid trips where and when soils are wet and muddy (page 20).
- Use properly trained stock (page 78).
- Minimize the number of stock (page 80).
- Avoid places that have already been heavily grazed (page 85).
- Keep lengths of stay at one place short (page 87).

Water stock downstream from drinking sources on a durable spot (page 88).
Carry an appropriate amount of weed-free supplemental feed (page 89).
Place feed and salt on a tarp or in a feedbag or container (page 90).
Minimize confinement of stock when grazing; move picketed stock frequently (page 91).
Renovate pawed-up areas; scatter manure; remove picket pins and excess feed and salt (page 95).

Human Waste

Human waste generally cannot be treated in a pack-it-in, pack-it-out manner, although this has become increasingly common on boating trips. Instead, it must be left in the wilderness. The presence of human waste in the wilderness is not a problem; problems result when other humans come into contact with waste, either directly or through drinking contaminated water. This suggests the obvious behavior necessary to minimizing impact—depositing feces away from lakes and streams, and places where others might come into contact with them. This latter constraint has not been considered a major problem because of the widespread belief that buried feces will decompose rapidly. Recent research in the Rocky Mountains found, however, that pathogenic organisms can survive in buried feces for a year or more (Temple and others 1982). Decomposition is not rapid. Therefore, it is important to bury human waste in places where it is unlikely to be uncovered for years.

Generally, human waste problems are serious only in destination areas where use is quite high and toilets are not provided. In these places, in addition to being careful to bury waste in a location away from water, it is important to walk a considerable distance away from campsites to find a burial site. Otherwise, there is a significant risk of contracting disease by unearthing feces with viable pathogens. In less popular places, widespread dispersal is less critical and in very remote places, surface disposal has even been recommended. This latter recommendation can be beneficial, particularly at high elevations where digging a hole can create an unnecessary disturbance that might take years to recover; however, the risk it presents in inappropriate situations makes it a controversial practice. Toilet paper, as with other nonorganic waste, should either be burned or packed out. Burial is a less desirable alternative—but accepted practice in many places.

Important low-impact practices are as follows:

Carry appropriate equipment (trowel) (page 16).
Pack out (or burn) nonorganic litter (toilet paper) (page 71).
Use toilets if provided (page 74).
Dispose of human waste in a properly located cathole (page 75).

Wildlife and Fishery Impacts

Although a number of case studies of recreational impacts on animals have been conducted (Boyle and Samson 1983), we lack an understanding of the prevalence or significance of impacts on animals or fisheries. There is also little understanding of the importance of factors that influence amount or type of impact; consequently, few specific recommendations about low-impact behavior can be made. This is clearly a critical information gap. Nevertheless, it is possible to speculate about some influential factors that are likely to be important.

Amount and frequency of disturbance are likely to be important. There are probably cases where occasional human intrusion would elicit little response, while frequent intrusion would cause displacement, nest abandonment, or some other undesired effect. But in a study of the effects of cross-country skiers on elk and moose, Ferguson and Keith (1982) found that movement occurred following the first encounter with humans; the passage of additional skiers caused no further disturbance. Some researchers have found that animals become habituated to human intrusion, making them less disturbed by human presence (Schultz and Bailey 1978). Others report more substantial disturbance of populations that have had more frequent encounters with humans. Although fewer encounters would generally be desirable, it is not clear what the aggregate effect of changes in the distribution of human use would be. Shifting more recreational use to places and seasons of the year that are currently little used certainly has the potential to increase problems.

Party characteristics appear unlikely to influence amount of disturbance substantially. Parties with packstock can compete with animals for limited forage in some places. Generally, however, the behavior of individuals is probably more important than characteristics of the party. For example, whether or not individuals engage in hunting or fishing can have a pronounced effect on disturbance; so can decisions about where to camp and one's care in approaching animals for a better view or a photograph.

Disturbance is more likely to occur at certain times of the year—for example, during birthing seasons or other times of stress. Disturbance is also more likely in some places than others. For example, human presence at desert waterholes will be much more disruptive than in places away from water.

Three distinct subproblems can be identified: (1) Unintentional harassment of animals, usually scaring them by approaching too closely or being some place they want to be. (2) Feeding animals or attracting them through improper camping techniques. This can cause adverse changes in feeding habits. (3) Competition with wildlife where excessive grazing occurs. (Hunting and fishing also cause disturbance; these intentional disturbances are not treated here.)

Animal Harassment—Disturbance of wildlife is most strongly related to user behavior and where and when disturbance occurs. Few specific practices can be suggested; the following suggestions are appropriate:

- Avoid trips where and when animals are particularly vulnerable to disturbance (page 21).
- Avoid off-trail travel unless prepared to use extra care (page 22).
- Keep pets under restraint or leave them at home (page 23).
- Avoid harassment of animals (page 27).
- Select a campsite away from lakes and other water bodies (page 48).

Disturbance of Feeding Habits—The severity of this problem is related primarily to visitor behavior. Animals should not be fed anywhere. It is also important to protect food from animals and, particularly at campsites, to avoid attracting animals. Specific practices are:

- Do not feed animals (page 28).
- Protect food from animals (page 29).
- Pack out or burn organic garbage (or scatter fish viscera) (page 73).

Competition—Competition with wildlife occurs only where there is excessive grazing of forage needed by wildlife. It is unclear how serious a problem this is. The factors that would likely influence problem severity include amount of grazing, grazing behavior, and where and when grazing occurs. Practices with the potential to minimize competition include:

- Avoid off-trail travel unless prepared to use extra care (page 22).
- Minimize the number of stock (page 80).
- Keep lengths of stay at one place short (page 87).
- Carry an appropriate amount of weed-free supplemental feed (page 89).

Water Pollution

Of all recreation-related management problems, water pollution is probably the least understood. We know little about the severity, prevalence, or even the nature of problems. Health hazards due to fecal contamination have been the primary concern. Studies that have attempted to quantify the incidence of fecal contamination and identify causal links to recreational use usually generate negative results. Bacterial contamination is seldom a problem (see, for example, Silverman and Erman 1979), and is often more problematic in places without recreational use because wild animals are the primary vectors of contamination (Stuart and others 1971). Contamination with *Giardia* spp. is a more common problem in wilderness. In the Sierra Nevada, Suk and others (1986) found *Giardia* cysts in 27 of 78 water samples, and cysts were particularly common in samples collected just downstream from popular campsites. Practices designed to mitigate this problem were discussed in the section on human waste. In addition, visitors are more often turning to water filtration or treatment to deal with the problem.

More insidious, and even less frequently documented, are more subtle changes in aquatic ecosystems. For the same lakes where bacterial contamination was not a common problem, Taylor and Erman (1979) documented changes in ion concentrations and aquatic flora and fauna. They speculated that these changes resulted from increases in the concentration of limited nutrients as a result of camping, bathing, washing, and other recreational activities close to the lakeshore. These changes, along with the changes related to stocking fish and angling, suggest that alteration of aquatic ecosystems may represent our greatest failure to “preserve natural conditions” in wilderness.

The primary influences on problem severity are related to where recreational activities occur. The most important low-impact practices are:

Select a campsite away from lakes and other water bodies (page 48).
Dispose of human waste in a properly located cathole (page 75).
Bathe, wash, and dispose of waste water away from water bodies (page 77).

Stock users should also practice the following:

Water stock downstream from drinking sources on a durable spot (page 88).
Where confinement is necessary, use a hitch line on a durable site away from water (page 93).

Other Problems

A few other practices do not apply to any of these specific problems, but relate to avoiding unnecessary disturbance of natural and cultural features. Important practices for all users include:

Minimize disturbance of natural features (page 25).
Do not disturb cultural artifacts or archeological sites (page 26).
Do not build a fire where fire danger is high (page 59).

RECOMMENDED LOW-IMPACT PRACTICES

In the sections that follow, recommended low-impact practices are described in detail. These are practices judged to be likely to contribute to minimizing impact problems. They have been grouped into seven categories. A complete list of recommended practices can be found in appendix A.

1. *Trip preparation.* Planning can be important to minimizing impact. Clothing and equipment are important (practices 1 and 2), as are party size (practice 3) and deciding where and when to visit (practice 4-6).
2. *General conduct.* Behavioral guidelines that apply at all times during a backcountry visit pertain to handling of pets (practice 7), noise levels (practice 8), disturbance of natural and cultural features (practices 9 and 10), and disturbance of animals (practices 11-13).
3. *Backcountry travel.* Appropriate practices when traveling in the backcountry differ between travel on existing trails (practices 14-18) and cross-country travel (practices 19-22).
4. *Campsite selection and behavior.* Camping practices pertain to both selection of a site and appropriate behavior once a site has been selected. Campsite selection criteria (practices 23-28) include level of previous impact, size of the site, durability, and location. Certain behavioral practices apply to all campsites (practices 29-31). Some practices apply only when using well-established campsites (practices 32 and 33); others apply only when using previously unused sites (practices 34-36).
5. *Campfires.* Minimizing impacts associated with campfires begins with deciding whether or not a campfire is appropriate and, if it is, where it should be built (practices 37-42). Other practices pertain specifically to firewood selection and gathering practices (43 and 44), construction of a fire on a previously unused site (practices 45 and 46), and campfire use and cleanup (practices 47-50).
6. *Waste disposal and sanitation.* These practices apply to disposal of garbage (practices 51-53) and human waste (practices 54 and 55), as well as to proper methods of bathing and washing (practices 56 and 57).
7. *Additional practices for parties with stock.* Parties that travel with stock need to consider all of the preceding 57 practices. In addition, there are a number of additional practices of critical importance to minimizing impacts unique to stock parties. Specific practices pertain to equipment and trip preparation concerns (practices 58-60), practices when traveling on existing trails (practices 61-64), campsite selection (practice 65), campsite behavior (practices 66 and 67), watering, feeding, and grazing stock (practices 68-71), confining stock (practices 72-74), and cleanup (practices 75).

The treatment of each practice provides the following information:

Description—This section provides a short narrative description of the recommended behavior.

Sample Message(s)—One or more good examples from low-impact materials illustrate the practice. Numbers in parentheses allow ready reference to the materials listed in appendix B.

Problem(s) Addressed and Rationale—Problems are cross-referenced to those just discussed. More detail is provided on why the practice should minimize problems. Visitor commitment to low-impact practices is likely to be greater where the rationale behind recommendations is communicated to visitors.

Importance—This section provides an estimate of the importance of the recommended practice. Both the effectiveness of the practice in minimizing problems and the importance of problems are considered. Importance is judged high only where the practice is effective and the problem addressed is significant. Clearly, when developing a low-impact message, highest priority should be given to those practices that effectively minimize the most important problems.

Controversial Elements—For some practices, recommendations are controversial or inconsistent. Attempts to be overly specific or quantitative often result in inconsistency. Attempts to provide universally applicable recommendations, when practices are only appropriate in certain situations, also result in inconsistency. This section includes discussions of controversial and inconsistent elements and suggests means of minimizing controversy. This section does *not* refer to how controversial recommendations may be to visitors who might dislike a recommendation that is generally considered to be worthwhile.

Knowledge Needs—Information needs that would allow more effective application of the practice are described. This section spells out further information needed by researchers and managers, not information that needs to be transferred to visitors. Major research gaps are also highlighted in a subsequent section.

Frequency of Recommendation—How frequently each practice is recommended is estimated from the sample of source materials in appendix B. Very common practices are those recommended by at least 50 percent of the sources, while common practices are recommended by 20 to 50 percent of the sources. Uncommon practices are recommended in 5 to 20 percent of the sources. Rare practices are those that have been recommended, but by less than 5 percent of the sources.

Costs to Visitors—An estimate of the extent to which applying the practice is a burden to visitors. Time, effort, the extent of behavioral change required, and the number of visitors affected are all considered. Costs are highest where large numbers of visitors are asked to give up an activity for which there is no perceived substitute (for example, not having a campfire for esthetic purposes). Replacing large wall tents with small, lightweight tents is an example of a practice that is less costly because a reasonable substitute is available. Some comfort and convenience may be lost, but the function of keeping dry is retained.

Special Situations—This category is provided only for practices that are modified under certain circumstances.

Practices that have been recommended by some—but that may cause more problems than they correct—are described in a section on practices that can be counterproductive (see pages 96-99). The division into practices that are generally recommended and those that may be counterproductive, as well as the resolution of controversial elements are my opinions. These opinions are based on considerable research and experience as well as analysis of low-impact materials and widespread review of this report. These opinions are open to debate. Further research may suggest new ideas and practices and will undoubtedly increase the specificity and usefulness of recommendations.

Trip Preparation

PRACTICE 1—CHOOSE CLOTHING AND EQUIPMENT COLORS THAT BLEND WITH SURROUNDINGS

DESCRIPTION	The colors of clothes and equipment should be muted so that they are not visible from long distances.
SAMPLE MESSAGE	"To help you travel and camp inconspicuously, select dark-colored tents, clothing, and packs when you buy new gear. Earth-tone rusts, browns, and greens blend in best with the forest. Oranges, blues and other bright colors stand out like spotlights and contribute to a crowded feeling." (8)
PROBLEM ADDRESSED AND RATIONALE	Too many encounters. When visitors wear clothes and carry equipment in bright colors that contrast with surroundings, they are more likely to be observed. The more frequently visitors observe each other and their camps, the less solitude they feel. Therefore, selection of clothes and equipment in colors that blend with the surroundings can reduce the number of encounters and increase feelings of solitude.
IMPORTANCE	Moderate. Avoidance of bright colors is only a partial solution to crowding problems. It is much more useful in dealing with crowding problems at campsites and away from trails than with problems along the trail. Colors are less likely to help avoid an encounter along the trail, and visitors are less sensitive to encounters on trails than at campsites (Stankey 1973). This also suggests that brightly colored tents are the most serious problem. The color of equipment is also more important in places with long vistas (such as Alaskan tundra) than in places where visibility is limited (such as eastern forests).
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Common.
COSTS TO VISITORS	Low. The only loss to visitors is one of stylishness and brightness. On a gloomy day, a bright blue and yellow tent can add a little cheer. And perhaps a stylish red parka can make a person look or feel more attractive. But most of this is a matter of taste, which can be quite transitory. There is no significant cost in the form of decreased comfort, convenience, or impact on activity. Most safety concerns can be addressed by carrying some bright orange flagging and/or a mirror.
SPECIAL SITUATIONS	Major exceptions are the increased safety provided by bright equipment for winter camping (to improve visibility during inclement weather) and bright clothes during hunting season (to decrease the likelihood of being shot). Bright equipment during winter is not a problem because the likelihood of encounters is generally low. Bright equipment during hunting season is a problem that must be resolved by choosing safety (bright clothes) over reduced crowding.

PRACTICE 2—CARRY APPROPRIATE EQUIPMENT

DESCRIPTION

Certain equipment items can be helpful in reducing impacts. The most commonly suggested items are a small stove, a fire blanket, tents with poles and waterproof floors, trashbags, trowel, soft-soled shoes for around camp, hammock, and large water container. Items not to carry are more controversial. These items do not necessarily cause problems; they increase the potential for impact. Suggestions include cans and bottles, axes and saws, guns, lug-soled boots, radios and tape players, wire, and nails.

SAMPLE MESSAGES

"Carry a backpacking stove; stoves do not scar the landscape as campfires do. Repackage foods from boxes, bottles, and cans into plastic bags to save weight and space. Leave canned and bottled food home. Empty bottles, cans, and aluminum foil must be packed home. Take a trash bag or two to pack out your garbage—and litter that others may have left behind. A lightweight shovel, trowel, or ice axe will help you dispose of human waste." (8)

"Carry a collapsible water container to reduce the number of trips between water sources and your campsite." (86)

"Take lightweight soft shoes for around camp. Leave radios and tape players at home." (54)

"Leave your axe at home. They leave unnatural, unnecessary scars on trees and add weight to your pack. Seasoned users have found them to be unnecessary because of the abundance of downed wood." (58)

"Use a hammock for sleeping to minimize ground cover damage." (90)

PROBLEMS ADDRESSED AND RATIONALE

(1) Excessive campsite deterioration. Tents with poles and waterproof floors make it unnecessary to cut down trees for tent poles or to excavate a ditch around the tent. A portable stove makes a campfire unnecessary (Berger 1979), or at least reduces the dependence on local firewood supplies. Waterbags reduce the number of trips between campsite and water supply, minimizing the formation of undesired trails. Hammocks reduce ground cover damage, as may use of soft-soled shoes (Harlow 1977; Waterman and Waterman 1979). *Not* carrying axes and saws reduces the likelihood of scarring trees and logs around campsites. As long as fires are built with wood that can be broken by hand (practice 44), axes and saws are unnecessary for gathering firewood. Stock parties may want to carry these for clearing trail. (2) Litter. Carrying trashbags makes it easier to avoid littering and to pack out other people's litter. *Not* carrying food in cans, bottles, or even aluminum foil reduces the likelihood that these items will be left behind as litter. (3) Human waste. A trowel is useful in properly disposing of human waste. (4) Visitor conflict. *Not* bringing a radio or tape player reduces the chance that your noise will disturb others. A radio/tape player with earphones is another option.

IMPORTANCE

Ranges from high to low. Carrying a stove is probably most important. Use of a stove is critical to reducing the impacts of fire scars on campsites and the reduction of wood supplies around campsites. The other items make it more convenient to avoid causing impact.

CONTROVERSIAL ELEMENTS

None.

KNOWLEDGE NEEDS

None.

FREQUENCY OF RECOMMENDATION

Ranges from common for carrying a stove to rare for carrying a hammock and *not* carrying axes and saws.

COSTS TO VISITORS

Low. None of these items are either prohibitively expensive or heavy. The items *not* to bring will actually decrease weight. None of these substantially reduce convenience and some increase convenience. The proportion of visitors carrying gas stoves has increased dramatically in recent years (Lucas 1985) to where it is probable that a majority of overnight users carry a stove.

SPECIAL SITUATIONS

Rafts, and to a lesser extent canoes and kayaks, have the ability to carry specialized and often heavy equipment designed to minimize impact. The most common and important is a fire pan, a piece of equipment that minimizes the ecological impact of campfires and facilitates the disposal of charcoal and ash. A box for carrying out charcoal and ash further reduces the esthetic impact of campfires. Finally, portable toilets of varying degrees of sophistication have become an increasingly common means of dealing with problems of human waste at popular campsites (Hampton and Cole 1988). Information on how to acquire this equipment is available from agencies that manage many of the more popular whitewater rivers.

PRACTICE 3—KEEP PARTY SIZE SMALL

DESCRIPTION	Keep the number of people in your party as few as possible, but remember that visitors traveling alone take more risk.
SAMPLE MESSAGES	"Limit your party size. Large groups tend to have more impact than you would expect from increased numbers alone (for example, social trails developing between tent sites)." (42) "Groups larger than 10 people traveling together are discouraged. This size wears out campsites by compacting soil, destroying ground cover, and using up available wood supplies, and their gregarious behavior tends to destroy the wilderness solitude of others visiting the area. Plan your trip with only a few companions." (45)
PROBLEMS ADDRESSED AND RATIONALE	(1) Excessive deterioration of campsites. Large parties require large campsites. Reducing party size would allow campsites to be smaller, provided that efforts are taken to rehabilitate and keep campers off peripheral parts of campsites (Marion and Sober 1987). (2) Proliferation of trails and campsites in little-used areas. Large parties will not necessarily cause more impact to established campsites large enough to accommodate the party; however, they will cause more rapid impact to previously undisturbed places (Hammitt and Cole 1987). Therefore, small parties are critical to avoid the creation of new campsites and trails in little-used places. (3) Visitor conflict. Encountering a large party has been shown to do more to diminish feelings of solitude than encountering the same number of people in small parties (Stankey 1973). This suggests that smaller party sizes would eliminate a potential source of visitor conflict. Large parties can reduce their impact by traveling and camping as several smaller groups and by avoiding places without constructed trails and well-established campsites (practice 6).
IMPORTANCE	Moderate. Should be very effective in reducing problems with dissatisfaction from encountering large groups, but its effects on ecological problems are likely to be less dramatic than many assume. The effectiveness of reduced party sizes in reducing resource damage is greatest where impact is likely to occur quickly (for example, in fragile areas, in little-used and relatively undisturbed areas, and where parties travel with stock). Limits on party size must be quite low (certainly no larger than 10) to be worthwhile. Current limits on party size—25 was the most common limit in 1980 (Washburne and Cole 1983)—are often so high as to be virtually meaningless.
CONTROVERSIAL ELEMENTS	Attempts to supply a specific recommended limit on party size have been widely divergent. Recommendations ranged from "4-6" to "less than 15." Aside from the general recommendation to keep party size small, the most common recommendation was "no more than 10." There is little basis for any recommendation beyond the general one to keep size as small as possible. Once a party exceeds a certain number (perhaps four to six), special care must be taken in off-trail travel, campsite selection, and avoidance of visitor conflict.
KNOWLEDGE NEEDS	Although not critical to evaluating the appropriateness of this suggestion, more information on the effects of various party sizes on the visitor experience and on resources would be useful. Research might be able to more precisely identify thresholds in group size that either result in perceived conflict between groups or that cause particularly rapid ecological impact. Such thresholds would certainly differ between backpackers and parties with stock. Of parties of the same size, those with stock would tend to cause more social and ecological impact.
FREQUENCY OF RECOMMENDATION	Common. Regulations limiting party size are also widespread (Washburne and Cole 1983).

COSTS TO VISITORS

Low for most parties. Median party size is usually about three; in nine western backcountry areas, only about 6 percent of parties were larger than 10 persons (Lucas 1980). Costs would be high for those parties who prefer or must travel in large groups (for example, outfitted or organized groups). Such costs could be reduced by condoning large parties, but recommending that they break up into small groups of four to six people to travel, that they disperse locally in camping areas and take care not to enlarge established sites, and that they use well-established routes and destinations.

SPECIAL SITUATIONS

In grizzly bear country it is safer to travel in groups of four or more. There is little advantage to a very large group, but parties of less than four are more likely to surprise a bear and less likely to repulse an attack (Hampton and Cole 1988; Herrero 1985).

PRACTICE 4—AVOID TRIPS WHERE AND WHEN SOILS ARE WET AND MUDDY

DESCRIPTION	Avoid visiting places during seasons when soils are water saturated. The season during and immediately after snowmelt is the most important time to avoid, particularly by parties with stock (Price 1985).
SAMPLE MESSAGES	"If trails are muddy following spring snowmelt, give them time to dry out before your trip. Then you will not have to wade through the mud and churn up the trail surface, making it rough for others to follow." (8) "If possible, plan your trip to avoid the wet soil conditions common early and late in the season." (12)
PROBLEMS ADDRESSED AND RATIONALE:	(1) Deterioration of trails, (2) creation of undesired trails, and (3) deterioration of grazing areas. Trails and meadows (or other places frequently trampled by stock) are particularly susceptible to deterioration when soils are water saturated (Cole 1987b). Constructed trails can be damaged easily and unwanted trails can develop spontaneously (fig.1A). The temporal distribution of wetness can be both unpredictable (as in the case of sporadic thunderstorms) and predictable (as in the case of the season immediately following snowmelt). Staying out of the wilderness during seasons when soils are predictably wet will reduce deterioration of trails and grazing areas. Certain places are more prone to these problems than others. This is particularly important when traveling with stock.
IMPORTANCE	Low to high. In places that are seasonally wet, but relatively durable at other times, avoiding use during wet seasons can reduce impact substantially. In places where wetness is prolonged or unpredictable, or where durability is low even when soils are dry, this practice is less important. It is most critical for stock parties in mountainous areas in the West.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	Improved information on unfavorable seasons, variation in seasonality from year to year, and places that are particularly prone to problems with seasonal wetness and communication of this information to users would make it easier for users to comply. At Sequoia and Kings Canyon National Parks, parties with stock are not allowed until after an opening date (when conditions have dried out) that varies with general climatic conditions for that year and with the specific places to be visited. Monitoring data have indicated where and when early season stock use is a problem. Opening dates are decided on well before the season starts, to give parties a chance to plan their trips (DeBenedetti and Parsons 1983). Similar programs of information and recommended opening dates could be implemented, relying on voluntary compliance rather than regulation.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low to moderate. Most visitors will not have to alter their behavior because many areas do not have pronounced and predictable wet and dry seasons. Where wet and dry seasons are pronounced and predictable, most visitation occurs during dry seasons. Substantial costs are borne only by those who cannot shift trips to less-vulnerable seasons.

PRACTICE 5—AVOID TRIPS WHERE AND WHEN ANIMALS ARE PARTICULARLY VULNERABLE TO DISTURBANCE

DESCRIPTION	Avoid visiting places at times when animals are likely to be adversely affected by your visit (for example, when they are giving birth or are weak).
SAMPLE MESSAGE	None.
PROBLEMS ADDRESSED AND RATIONALE	Harassment of wildlife. Animals are particularly vulnerable to disturbance at certain times of the year (Ream 1979). For example, the consequences of fleeing, when scared by an approaching human, are often more pronounced during birthing season (when young may be left vulnerable to predation) and winter (when animals are already stressed and attempting to minimize unnecessary activity) than during midsummer.
IMPORTANCE	Uncertain. To the extent that harassment is a problem, this practice would be an effective means of minimizing problems. To evaluate importance, we need more information on the vulnerability of animals at different times of the year.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	Current knowledge is so poor that we are seldom able to provide specific behavioral suggestions. Consequently, this recommendation is of little practical value. We need to know more about impacts of recreationists on animals and seasonal differences in vulnerability. Many different animal types from varied regions and ecosystems should be studied.
FREQUENCY OF RECOMMENDATION	No examples were found.
COSTS TO VISITORS	Low to moderate. Most visitors will not have to alter their behavior. Costs may be most pronounced for cross-country skiers, where animals are particularly vulnerable during winter. Again, we need more information.

PRACTICE 6—AVOID OFF-TRAIL TRAVEL UNLESS PREPARED TO USE EXTRA CARE

DESCRIPTION	When traveling off trail, it is particularly important to take care to avoid impact. Route selection and traveling behavior (practices 19-22), and campsite selection and behavior (practices 27, 34-36) require more thought and time. Large parties and parties with stock should avoid off-trail travel unless they are willing to be extremely cautious. Traveling on trails will minimize all problems except excessive encounters and human waste.
SAMPLE MESSAGE	"The impacts associated with cross country travel are minimized when group size is small, routes are carefully selected to avoid fragile terrain and critical wildlife habitat and special care is taken to avoid disturbance." (30)
PROBLEMS ADDRESSED AND RATIONALE	(1) Development of undesired user-created trails. Constructed trails are already highly disturbed, and in many cases have been designed to accommodate heavy use. Leaving trails introduces the risk of creating undesired trails. The potential for this is minimized if parties are small, travel on foot, and select dispersed and durable routes. (2) Animal harassment. Off-trail travel, by accessing relatively undisturbed places, increases potential for disturbance of animals that have sought out remote places. (3) Proliferation of campsites. The potential for creation of new campsites is also high because off-trail travel provides access to relatively undisturbed places. Again, this simply means that special care is needed.
IMPORTANCE	High. If only those parties capable of and committed to practicing minimum impact visited off-trail areas, it would be possible to avoid problems in these places.
CONTROVERSIAL ELEMENTS	Some low-impact materials recommend that hikers avoid trails entirely. This seems unwise unless concern for avoiding visitor contact problems on trails is given a much higher priority than all other problems. Increased off-trail travel will increase contact in places where those encounters are likely to be much more disruptive than along trails.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low. Most visitors choose to travel on trails and most visitors who do travel off trail are experienced and capable of minimizing their impact. Most costs are borne by large groups and parties with stock that wish to travel off trail but are not willing to exert the special care required. These visitor costs are low compared with the benefits of reduced impact, however.

General Conduct

PRACTICE 7—KEEP PETS UNDER RESTRAINT OR LEAVE THEM AT HOME

DESCRIPTION

Where pets are allowed (they are prohibited in all National Parks and in some backcountry areas managed by other agencies), they should be kept under vocal or physical restraint (leashed).

SAMPLE MESSAGES

"Keep dogs under control at all times; they disturb wildlife, hikers, and campers." (5)

"You may bring dogs into the BWCA, but respect other visitors' rights. Keep dogs on a leash while on portages and prevent excessive barking." (58)

PROBLEMS ADDRESSED AND RATIONALE

(1) Visitor conflict. Dogs can disturb other visitors (Waterman and Waterman 1979). Unrestrained dogs on trails can spook stock, creating problems. (2) Animal harassment. Unrestrained dogs can also chase and harass animals. These problems can be minimized by leaving highly aggressive dogs at home and keeping all dogs under restraint.

IMPORTANCE

Low to moderate. There is little evidence that pets are a major source of conflict or wildlife disturbance. Keeping them under restraint can effectively minimize problems that do occur. For many dogs, carrying a moderately heavy backpack is an effective means of controlling them on the trail. Restraint at campsites is most important where other parties are camped close by. This problem can be reduced by seeking out more isolated campsites when traveling with pets.

CONTROVERSIAL ELEMENTS

Recommendations that all pets be left at home are increasingly common. While this would be even more effective in eliminating this source of problems, it unnecessarily eliminates a traditional use of wilderness that many visitors value highly. The problems that result from travel with pets are minor compared with those that result from travel with stock, for example. Therefore, as with stock, it seems more appropriate to seek means of permitting use but reducing negative consequences. Pets are already prohibited in National Park wilderness.

KNOWLEDGE NEEDS

We need more information on visitor conflict related to pets and the significance of impacts on animals.

FREQUENCY OF RECOMMENDATION

Common.

COSTS TO VISITORS

Low. Visitors with pets must accept more responsibility for those pets. This may mean more time and effort restraining them, but these efforts need not be substantial. Using a dog backpack would lighten pack loads, and seeking out campsites away from other parties is generally recommended behavior anyway. Only those owners with highly aggressive animals that should be left at home must forgo anything. Even these owners will probably have a more enjoyable experience because they need not worry about conflict.

PRACTICE 8—BE QUIET IN THE WILDERNESS

DESCRIPTION	Avoid making loud noises, such as by yelling or playing recorded music.
SAMPLE MESSAGE	"Stay as quiet as possible and enjoy the quietness." (54)
PROBLEMS ADDRESSED AND RATIONALE:	(1) Too many encounters. Making loud noises makes it more likely that other parties will know you are there. This will tend to reduce solitude. (2) Visitor conflict. Of more importance, loud human noises are often considered to be inappropriate in wilderness. Encounters with parties acting in ways deemed to be inappropriate can lead to serious conflict and perceived crowding problems (Manning 1986).
IMPORTANCE	High. This behavior is less important where there are no other parties around; however, loud noises may also disturb wildlife.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Common.
COSTS TO VISITORS	Minimal.
SPECIAL SITUATIONS	The major exception to this practice is in areas with grizzly bears. There it is important to make noise, particularly while traveling, to alert bears to your presence. That gives them time to move away without confrontation (Hampton and Cole 1988; Herrero 1985).

PRACTICE 9—MINIMIZE DISTURBANCE OF NATURAL FEATURES

DESCRIPTION	Try to "leave things as they are." Avoid unearthing rocks, picking wildflowers, and cutting or uprooting trees and other plant life. Use restraint when gathering edible plants and animals to avoid long-term depletion.
SAMPLE MESSAGES	"Leave rocks and flowers where you find them so others can enjoy them as you do. Minimize disturbance of stones, soil, and plant life, so as not to disturb the conditions in which plants and animals live." (86) "Please do not dig up plants, pick wildflowers, or cut branches from live trees." (80) "Enjoy an occasional edible plant, but be careful not to deplete the surrounding vegetation or to disturb plants that are either rare or do not reproduce in abundance (such as many edible lilies)." (30)
PROBLEM ADDRESSED AND RATIONALE	This practice addresses concern with recreational impacts in general, without reference to any specific location such as trails or campsites. Disturbance is most concentrated along trails, around campsites, and at attraction sites.
IMPORTANCE	High. Although this practice is quite general, it is an attitude that is critical to avoidance of unnecessary disturbance.
CONTROVERSIAL ELEMENTS	Although this attitude is accepted in principle, it is not always applied to standing trees, both dead and alive, which are often cut down for tent poles or firewood.
KNOWLEDGE NEEDS	The vulnerability of edible plant and animal populations to harvesting is poorly understood. Information on species and places with high vulnerability is needed.
FREQUENCY OF RECOMMENDATION	Common.
COSTS TO VISITORS	Low. Some activities (picking wildflower bouquets, collecting edible plants) may be curtailed. Desired campsites may need to be bypassed if they require removal of rocks or vegetation. Parties may have to carry self-supporting tents and forgo the comfort of large wall tents; they may have to search further for downed firewood and reduce their wood consumption. But all of these inconveniences affect few users in small ways.

PRACTICE 10—DO NOT DISTURB CULTURAL ARTIFACTS OR ARCHEOLOGICAL SITES

DESCRIPTION	Historical and archeological sites should not be disturbed. Cultural artifacts should not be removed.
SAMPLE MESSAGE	“(Archaeological sites) are not renewable and cannot be replaced. Look, photograph, enjoy. But do not disturb. Climbing in, on or around ruins will speed up destruction of the site. Touching rock art will leave oils from your skin on the rock, these oils hasten the deterioration of the art work. Do not remove artifacts! Give someone else the chance to experience the thrill of discovery as you have. It is also against the law. Have respect and appreciation for the time and energy these ancient inhabitants put into their work. It has survived for hundreds of years. Help us preserve it for future generations.” (74)
PROBLEM ADDRESSED AND RATIONALE	Maintenance of cultural and historical artifacts and sites.
IMPORTANCE	High. These practices are critical to the preservation of this element of heritage.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. The ability to explore sites may be inhibited, and visitors must resist the desire to remove artifacts. But these are relatively insignificant to the wilderness experience and necessary if others are to have similar opportunities.

PRACTICE 11—AVOID HARASSMENT OF ANIMALS

DESCRIPTION	Visitors should avoid approaching animals if it causes them to flee, particularly where this causes animals to abandon sites where they give birth or water sources, feeding grounds, or shelter, particularly when they are weak.
SAMPLE MESSAGES	"Observe animals from a distance—do not disturb." (86) "Respect the needs of . . . animals for undisturbed territory. When tracking wildlife for a photograph or closer look, stay downwind, avoid sudden movement, and never chase or charge any animal. [Taking these precautions] is particularly important at birthing or nesting sites and at watering or feeding grounds, especially during times of year, such as winter, when animals are already stressed. Find out as much as you can, before entering the area about species, places and times when disturbance is likely." (30)
PROBLEM ADDRESSED AND RATIONALE	Harassment of animals. Numerous case studies have documented situations in which animals have been disturbed by the intrusion of recreationists. (For annotated bibliographies, see Boyle and Samson 1983; Bromley 1985; Ream 1980.) Birds can abandon nests, leaving eggs vulnerable to predation; large mammals forced to flee in winter can find it difficult to find food to replace lost calories. While these studies show that problems exist, we know little about how serious or prevalent these problems are.
IMPORTANCE	Uncertain. It is a truism that this general recommendation is an effective means of avoiding harassment. What is not clear is what specific behaviors are effective or where and when these behaviors are important. It is probable that only certain species are highly susceptible to disturbance and, even for these species, potential for disturbance is confined to certain critical habitats and seasons. But we do not know which species are vulnerable or when and where harassment is particularly damaging. One partial exception is bighorn sheep. Research has shown that bighorn sheep are more profoundly disturbed by hikers with dogs and hikers who approach from over a ridge than by those without dogs and those who remain below (MacArthur and others 1982). Thus, in bighorn country harassment can be reduced by not bringing dogs and by keeping to valley bottoms. More research into and presentation of information of this type is needed to make this practice effective.
CONTROVERSIAL ELEMENTS	None, except that we do not know enough to agree about where and when disturbance is a substantial problem and what sorts of behavior are most appropriate.
KNOWLEDGE NEEDS	For many, the presence of abundant wild animals is synonymous with high-quality wilderness. And yet, except for a few species such as the grizzly bear, we know nothing about how they react to recreationists. Information is inadequate on most aspects of recreation-wildlife encounters and appropriate behavior for minimizing disturbance. We need to learn about how serious impacts are; where and when they occur; the susceptibility of different species, at different seasons and places; and how amount, frequency, timing, and type of use, as well as visitor behavior, influence amount of impact. Moreover, because answers to these questions will be somewhat unique to each area, research must be conducted in a variety of places.
FREQUENCY OF RECOMMENDATION	Rare. Usually quite general (and of little practical value) when included at all.
COSTS TO VISITORS	Low to moderate. Most visitors will not have to alter their behavior. Costs include not visiting or not camping in certain critical places at certain critical times and not approaching animals to get a better view or a photograph. By carrying a telephoto lens and/or binoculars, visitors can view wildlife from a distance.

PRACTICE 12—DO NOT FEED ANIMALS

DESCRIPTION	Do not give animals food. This also applies to either accidentally or deliberately leaving food scraps behind (see practice 53).
SAMPLE MESSAGE	"Feeding wild animals produces numerous undesirable effects. It creates unnatural, unbalanced populations which become dependent on unnatural foods. This causes increased susceptibility to disease, and unnatural stresses within the population. Serious personal injury from the larger animals may result as they lose their fear of man. Please—help maintain a natural, balanced ecosystem—don't feed them." (86)
PROBLEM ADDRESSED AND RATIONALE	Disturbance of feeding habits. Feeding of animals can alter animal nutrition and behavior and, ultimately, population structure and distribution.
IMPORTANCE	Low to high, varying greatly between species. Not feeding animals is critical for species that tend to be attracted to and scavenge human food. For bears, feeding can cause behavioral changes that ultimately result in their having to be destroyed. For many other species, the effect of feeding on habits is negligible compared to other sources of disturbance.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon, except in the National Parks.
COSTS TO VISITORS	Low. Some enjoyment derived from feeding animals, such as squirrels and jays, must be forgone.

PRACTICE 13—PROTECT FOOD FROM ANIMALS

DESCRIPTION	Store food, either overnight or when away from camp, in such a way that animals cannot get it. Hanging food away from bears is particularly important.
SAMPLE MESSAGE	"Getting your week's supply of food ripped-off by a bear is bad enough. But if the bear should smell the raisins you have stashed in your sleeping bag, and you are also in the bag, you could get injured. In bear country the rule is: Hang all your food in a tree at night, at least 8 feet off the ground, and at least 4 feet out on a small limb. Then camp well away from the food." (14) Similar recommendations could be developed for other animals (such as rodents) that can get into food.
PROBLEM ADDRESSED AND RATIONALE	Disturbance of feeding habits. If animals develop an affinity for human food, their behavior and distribution change. When this happens with bears, problems can be particularly severe because problem bears frequently must be destroyed.
IMPORTANCE	Low to high, varying among species. Most animals are little affected by food storage techniques; however, for the grizzly bear, proper food storage may be critical to their survival.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon. Almost always confined to concern with bears.
COSTS TO VISITORS	Low. Some additional time and preparation are required, primarily for gathering together and hanging food. Research on an informational program on food storage techniques to reduce bear depredation at Yosemite National Park suggests that visitors have difficulty translating this knowledge into behavior. While 95 percent of visitors received a brochure on proper techniques, and 92 percent believed they were properly storing food, checks of actual behavior found only 3 percent storing their food properly (Graber 1986).

Backcountry Travel **PRACTICE 14—AVOID WALKING ON CLOSED TRAILS AND/OR DEVELOPING USER-CREATED TRAILS**

DESCRIPTION	In places where undesired user-created trails are developing, or where trails have been closed to use, they should not be used. Either walk on open constructed trails or walk off trail some distance away from the developing or closed trails. This may be difficult in popular places where user-created trails are proliferating. Here it may be best to treat one trail as the officially sanctioned one and confine use to that trail.
SAMPLE MESSAGES	"[In areas without established trails] don't follow trampled paths." (86) "Cross country travel is undesirable where user-created trail systems are developing . . ." (30) "When you step off a trail make sure that you are the first to do so in that spot. If you can see the tracks of one other person, you will be contributing to trail cutting, erosion, and vegetation loss." (71)
PROBLEM ADDRESSED AND RATIONALE	Development of undesired trails. Low levels of trampling are capable of causing substantial impact (Bell and Bliss 1973; Cole 1985; and others). Therefore, incipient paths are likely to deteriorate quickly if use continues and closed trails will not recover if use continues (fig.1A).
IMPORTANCE	High. The primary cause of unwanted trails is too many people following the same route off trail. If developing and closed trails were strictly avoided, problems with trail proliferation would be minimal.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low to moderate. Places where user-created trails are developing, or established trails have been closed, are often attractive routes or destinations. Costs to visitors of having to avoid these areas can be reduced by providing access on established trails to the same or comparable places.

PRACTICE 15—WALK SINGLE FILE AND KEEP TO THE MAIN TREAD

DESCRIPTION	When following an existing trail, walk single file down the middle of the trail. Do not walk on the side of the trail. If there are several braids to the trail, stay to the main tread even if the footing is bad. Do not walk on developing parallel trail treads.
SAMPLE MESSAGES	"Walk single file in the center of the trail. Stay on main trail even if wet or snow-covered." (54) "Always stay on the trail, even if it's wet and muddy. Don't step off to the side; that will create a new trail, which will soon become wet and muddy, so people will start stepping off to the side, cutting a new trail . . . This is one of the prime causes of the multiple trails that create a freeway look in the backcountry." (25)
PROBLEM ADDRESSED AND RATIONALE	Deterioration of constructed trails. Where trails are muddy, snow covered, or deep and narrow, people are tempted to leave the main trail to find better footing. As illustrated in figure 1B, this creates either a single wide tread or a stretch of multiple parallel trails (Price 1985). To avoid these problems, hikers and horseback riders need to resist the temptation to leave the main tread. They also should walk single file to minimize the lateral spread of traffic.
IMPORTANCE	Moderate. Trail widening and the development of multiple trails are two of the more common trail deterioration problems (Cole 1987b). They result entirely from lateral spread of trail use and therefore can be eliminated if hikers and stock users keep to the center of the established tread. This practice can eliminate these problems (and therefore must be considered highly effective); however, these problems are not among the most significant in wilderness, in that they do not substantially compromise either the integrity of wilderness ecosystems or the quality of wilderness experiences. More effective solutions to this problem, where trails are muddy or deep and narrow, are improved trail location and engineering (Price 1985).
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Common.
COSTS TO VISITORS	Moderate. The primary costs are muddy boots and forgoing walking side by side. For stock users, the only cost is the effort and skill it takes to keep stock single file and on the muddy or narrow trail.



A

Figure 1—Trail problems and appropriate low-impact practices. (A) Meandering systems of user-created trails develop in popular destination areas. Avoid walking on either closed trails or developing user-created trails (practice 14). (B) Muddy trails that widen into quagmires and/or become systems of braided trails are a common problem. Important practices include avoiding trips where and when soils are wet and muddy (practice 4) and, if on a muddy trail, walking single file down the main tread (practice 15). (C) To reduce the likelihood of creating undesired user-created trails, cross-country hikers should spread out (practice 19). Hikers should not mark their route (practice 20) and should select a route that crosses durable surfaces (practice 21).



B



C

Figure 1 (Con.)

PRACTICE 16—DO NOT SHORTCUT SWITCHBACKS

DESCRIPTION	When approaching a trail switchback, stay on the trail. Do not follow a shorter route between trail levels.
SAMPLE MESSAGE	"Never short-cut switchbacks." (54) "Shortcutting switchbacks on steep trails damages soil and plants, leading to severe erosion problems. Switchbacks are designed and built into trails on steep terrain to minimize erosion and to conserve your energy as well." (86)
PROBLEM ADDRESSED AND RATIONALE	Deterioration of constructed trails. Shortcuts between switchbacks usually erode severely. This can also cause erosion of and deposition on the constructed trail.
IMPORTANCE	Moderate. This practice, if followed, would virtually eliminate the problem of erosion of switchbacks. This problem, however, is not one of the most serious in the backcountry. Therefore, the practice is highly effective, but probably not extremely important.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Very common.
COSTS TO VISITORS	Minimal. The frustration of a stretch of switchbacks is seldom alleviated by shortcutting them. Costs can be reduced through more careful design of switchback trails.

PRACTICE 17—TAKE TRAILSIDE BREAKS OFF TRAIL ON A DURABLE SITE

DESCRIPTION	When taking a break along the trail, move far enough off the trail so other parties can pass by without noticing you. Try to select a durable stopping point, such as a rock outcrop, a non-vegetated site, or a site with resistant vegetation.
SAMPLE MESSAGE	“When taking a break along the trail, move off the trail some distance to a durable stopping place. Here you can enjoy more natural surroundings and other parties can pass by without contact. Durable stopping places include rock outcrops, sand, other non-vegetated places and sites with durable vegetation, such as dry grasslands.” (30)
PROBLEMS ADDRESSED AND RATIONALE	Too many encounters. Allowing other parties to pass without being aware of another party in the vicinity will increase perceived solitude. Selecting a durable stopping point will avoid unnecessary disturbance of natural features.
IMPORTANCE	Low to moderate. This practice will not eliminate problems with frequent trail encounters, but it can reduce them somewhat.
CONTROVERSIAL ELEMENTS	This action could lead to substantial off-trail disturbance if visitors are not careful to minimize disturbance at their stopping point.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Minimal. The cost of more time spent seeking an appropriate stopping point should be more than compensated for in the increased solitude and appreciation of the natural environment.

PRACTICE 18—STEP OFF THE TRAIL, DOWNSLOPE, WHEN ENCOUNTERING A STOCK PARTY

DESCRIPTION	To avoid spooking horses along a trail, hikers need to (1) move off the trail, (2) preferably on the downhill side, (3) avoid sudden movement, and (4) sometimes talk to the lead rider in a low voice. If you have a pet, make sure the animal is restrained and quiet.
SAMPLE MESSAGE	"Horses are easily spooked by strange sights and sounds. When hikers and riders meet along the trail, bucking horses and possible injuries to riders can be avoided if hikers will step off the downhill side of the trail, stand still, and speak softly until the horses pass." (8)
PROBLEM ADDRESSED AND RATIONALE	Visitor conflict. This behavior is a common courtesy extended by hikers to stock users. It avoids one source of conflict between these two groups.
IMPORTANCE	Moderate. This is another practice that is important in the sense of being a simple means of avoiding a problem for some users (those with stock that spook easily). It is not so important in the context of avoiding situations that seriously compromise overall wilderness objectives.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon (perhaps common in places with substantial amounts of stock use).
COSTS TO VISITORS	Minimal.

PRACTICE 19—SPREAD OUT WHEN WALKING OFF TRAIL

DESCRIPTION	When walking off trail, a group of people should spread out and not follow in each other's footsteps (fig. 1C). When selecting a cross-country route, select routes that permit people to spread out.
SAMPLE MESSAGE	"If you choose a route without trails . . . a group should spread out rather than walk one behind the other (especially in tundra or meadow areas). Ten people tramping in a row can crush plant tissue beyond recovery and create channels for erosion." (6)
PROBLEM ADDRESSED AND RATIONALE	Development of undesired user-created trails. Even infrequent trampling can destroy plants and create an incipient trail (see, for example, Cole 1985). Once recognizable, incipient trails attract additional use, and the end result is a pronounced trail. To avoid initiating this chain of events, it is important to minimize the number of times any plant is trampled. The key is for hikers to spread out. This will dilute the trampling impact of a group of people, hopefully enough to avoid damage. This is particularly important with a large party. Sometimes topography and vegetation tend to force single-file travel; such places should be avoided when selecting off-trail routes.
IMPORTANCE	Low to high. Importance varies with use levels and the priority placed on maintaining areas in a trailless condition. As use levels increase in trailless areas, spreading out and avoiding developing trails becomes increasingly important.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low to moderate. Where terrain and vegetation are open and gentle, spreading out is easy. In other cases, however, there is a single path of least resistance. It can be difficult to avoid this route. Often such a route has already been affected by game traffic.

PRACTICE 20—DO NOT MARK CROSS-COUNTRY ROUTES

DESCRIPTION	When traveling off trail, do not mark the route with cairns, tree blazes, or in any other way. Let the next party find their own way.
SAMPLE MESSAGE	“Avoid leaving your mark (cairns or blazes) when bushwhacking or traveling cross-country. Leave it as undisturbed as possible, so that the next group will have the same experience of traveling through trail-less country.” (23)
PROBLEM ADDRESSED AND RATIONALE	Development of undesired user-created trails. Where trails have not been constructed, spontaneous trail development should be discouraged. This requires minimizing use of cross-country routes. Blazing or marking routes will encourage further use of that route, leading ultimately to trail development. It also conflicts with objectives of minimizing unnecessary disturbance of natural features and evidence of human use.
IMPORTANCE	High. Maintaining trailless areas in wilderness is one of the more difficult challenges facing management. Marking of routes will eliminate any chance of avoiding trail development, except in places where use levels are negligible. Therefore, this practice is very important in maintaining the undisturbed qualities of trailless areas that are receiving use.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Minimal. The only conceivable cost is having to rediscover the route on a later trip.

PRACTICE 21—CHOOSE A CROSS-COUNTRY ROUTE THAT CROSSES DURABLE SURFACES

DESCRIPTION	When walking off trail, attempt to walk, as much as possible, on surfaces that will not be disturbed by trampling, such as nonvegetated surfaces, snow, or rock.
SAMPLE MESSAGE	"If you strike out away from trails, select rocky or hard ground or forested routes rather than meadows and wet places. Then, like the way of the Indians, your tracks will not be visible." (8) "[When traveling in areas without trails] walk on snow and rock where safe." (42) "If you wish to explore off-trail you are welcome to do so. Travel on slickrock and in dry washes leaves no trace of your passing." (71)
PROBLEM ADDRESSED AND RATIONALE	Development of undesired user-created trails. Durable surfaces can be walked over more frequently than fragile surfaces before an evident trail develops. The keys to avoiding trail development, then, are minimizing use frequency and maximizing surface durability. In general, surfaces that are dry, stable, and nonvegetated are most durable. Where off-trail routes keep to such surfaces as bare rock, ice and snow, sand- and gravel-covered riverbeds or washes, and nonvegetated forest floors, even moderate use can leave no trace. But relatively infrequent use of routes that cross steep and unstable slopes, moist and boggy areas, or places with lush and fragile vegetation will cause trail development. When considering appropriate routes through vegetation, both vegetation density and durability should be considered. Trails will develop more slowly in sparse vegetation, except where the plants that make up the cover are particularly fragile (a common situation underneath forest canopies). Some of the more durable vegetated types include those with virtually no ground cover, those with abundant large shrubs and little ground cover, and dry grasslands and meadows (Cole 1987b; Kuss 1986).
IMPORTANCE	Moderate to high. Importance increases with use level and the importance attached to maintaining trailless areas.
CONTROVERSIAL ELEMENTS	Specific recommendations about durable surfaces are frequently contradictory. This reflects inadequate knowledge about durability and attempts to make inappropriately broad generalizations. More research, more site-specific recommendations, and fewer broad generalizations are needed.
KNOWLEDGE NEEDS	We need more information, for specific places and environments, about the durability of different surfaces, particularly different vegetation types. This will permit the development of specific recommendations for individual areas.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low to moderate. The principal costs are more time needed to select a durable route, as well as possibly avoiding more desirable routes because of fragility concerns. For many visitors these costs would be outweighed by the satisfaction of knowing that they have used their skills and knowledge to avoid creating a trail in an undisturbed area.

PRACTICE 22—USE CAUTION WHEN ASCENDING OR DESCENDING STEEP SLOPES

DESCRIPTION	When it is necessary to ascend or descend steep slopes off trail, special care is needed to avoid severe erosion. It is important to spread out and avoid developing trails, to switch-back, to move slowly, and to avoid digging boots into the slope.
SAMPLE MESSAGE	"In mountainous areas, follow the backbones of gradual ridges instead of cutting down steep side slopes. If you must hike on a steep slope, make your own switchback as you ascend and descend. Do not glissade down gravel or scree slopes." (26)
PROBLEM ADDRESSED AND RATIONALE	Development of undesired user-created trails. Steep slopes are often particularly vulnerable to trail development (Weaver and others 1979). Therefore, it is important to minimize use and the impact caused by each hiker. Spreading out dilutes the trampling stress; moving slowly, switchbacking, and not digging boots into the slope reduce the impact of trampling.
IMPORTANCE	Moderate to high. Importance increases with use level. Where use is sufficient to result in trail development, this practice is critical to avoidance of severe erosion.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low to moderate. It can be difficult to resist following a developing trail rather than spreading out. It also is often tempting to rapidly descend slopes, particularly where they are gravel and scree slopes.

Campsite Selection and Behavior

PRACTICE 23—IN POPULAR LOCATIONS, SELECT A WELL-IMPACTED CAMPSITE

DESCRIPTION

This recommendation applies to consistently used destination areas, as opposed to places where camping occurs infrequently. In such places, choose a campsite that already has experienced substantial impact (fig. 2B). Do not select a previously unused or lightly impacted site.

SAMPLE MESSAGE

"[In areas with trails and established campsites] camp in an established site so as to prevent the spread of bare areas." (86)

PROBLEM ADDRESSED AND RATIONALE

Proliferation of campsites. In places that receive consistent camping use, use of previously unused and lightly impacted sites is likely to lead to the creation and deterioration of new campsites. Sites that are already well impacted, if used with care, need not deteriorate substantially over time (Cole 1986a). Impacts are confined to these sites instead of being allowed to proliferate (Marion and Sober 1987).

IMPORTANCE

High. Not selecting sites that already are well impacted is the primary cause of ongoing campsite deterioration problems in popular destination areas (Cole 1986a). Moreover, this is among the most pervasive recreation management problems in wilderness (Washburne and Cole 1983). Therefore, it is of critical importance. Where not heeded, destination areas will be afflicted with numerous unnecessary and highly disturbed sites (see, for example, Cole 1982a).

CONTROVERSIAL ELEMENTS

Some have recommended that well-impacted campsites be avoided. While this recommendation is appropriate in remote places (see practice 24), it will cause widespread campsite impact in popular places. This is a case where what is appropriate in one situation is to be avoided in others. Attempts to make universal generalizations are counterproductive.

KNOWLEDGE NEEDS

Controversy about whether to use well-impacted or previously unused sites will not be resolved by research; it is a question of defining different situations in which each strategy is more appropriate. Research could perhaps help define more precisely the situations in which each strategy is appropriate.

FREQUENCY OF RECOMMENDATION

Common.

COSTS TO VISITORS

Low. Visitors must camp on sites that are already highly impacted. Most wilderness campers select such sites by habit (Cole 1982a; Heberlein and Dunwiddie 1979). Visitors who do prefer more pristine environments can simply visit more remote and little-used places.

PRACTICE 24—IN REMOTE LOCATIONS, SELECT A PREVIOUSLY UNUSED CAMPSITE

DESCRIPTION	When looking for a campsite in places away from trails or where camping occurs infrequently, select a site that shows no evidence of having been used before.
SAMPLE MESSAGE	"[When in areas without trails and established campsites] camp where there is no evidence that others have camped before." (86)
PROBLEM ADDRESSED AND RATIONALE	Proliferation of campsites. In places where overnight use is infrequent, careful use of durable sites need not cause disturbance (fig. 2A). The key idea behind this action is to minimize use frequency. If sites are not camped on after disturbance becomes evident, they should still be capable of recovering rapidly. Widespread dispersal and rotation of use between sites prevent any site from deteriorating substantially. For this strategy to be successful, however, use levels must be quite low. This action must also be accompanied by careful selection of a durable site (practice 27) and extra care in avoiding and camouflaging disturbance (practices 29-31, 34-36).
IMPORTANCE	High. This practice is critical to avoiding the development of established campsites in relatively undisturbed areas. It will be successful only when applied in places where use levels are low. In more popular areas, this practice is likely to result in proliferation of campsites (see, for example, Cole 1982a); in such places practice 23 (select a well-impacted campsite) is more appropriate.
CONTROVERSIAL ELEMENTS	Some low-impact materials recommend that all camping be confined to well-impacted campsites. While this recommendation is appropriate in popular places (see practice 23), it will cause unnecessary campsite impact in infrequently used places. This is a case where what is appropriate in one situation is to be avoided in others. Attempts to make universal generalizations are counterproductive.
KNOWLEDGE NEEDS	Controversy about whether to use well-impacted or previously unused sites will not be resolved by research; it is a question of defining different situations in which each strategy is more appropriate. Research could perhaps help define more precisely the situations in which each strategy is appropriate.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low to moderate. Visitors must avoid obvious, established campsites. Presumably, most visitors in the more remote portions of the wilderness would value the less disturbed environment, but considerably more care in site selection and use is required. Those preferring traditional established campsites have the option of visiting more frequently used and heavily impacted places.
SPECIAL SITUATIONS	Many wilderness areas, particularly those managed by the National Park Service, prohibit camping except on designated campsites. One should always adhere to regulations of the managing agencies.

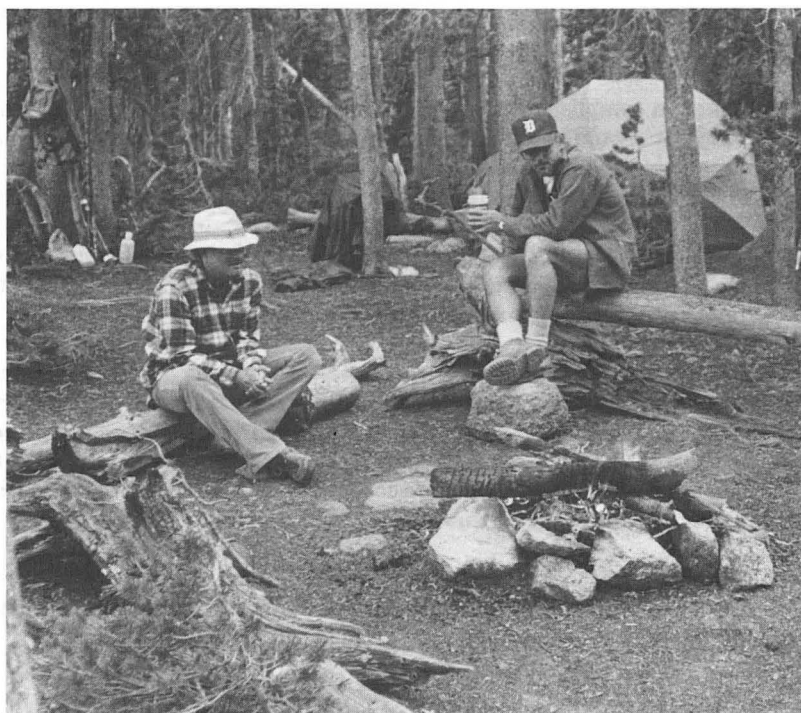
PRACTICE 25—NEVER CAMP ON A LIGHTLY IMPACTED CAMPSITE

DESCRIPTION	Avoid camping on an obviously disturbed but lightly impacted campsite (such as one in which there is obvious vegetation loss, but only on a small portion of the site [fig. 2C]). It is more appropriate to camp either on a more heavily impacted site (in popular places) or on a site with no evidence of use (in remote places).
SAMPLE MESSAGE	"Lightly impacted sites—those that have obviously been used but with a substantial amount of vegetation surviving on-site—should always be avoided; such sites will deteriorate rapidly with further use, while if unused they should recover rapidly." (30)
PROBLEM ADDRESSED AND RATIONALE	Proliferation of campsites. Lightly impacted campsites are on the verge of becoming permanent, well-impacted sites; continued use will cause this deterioration. If their use is curtailed, however, they still are capable of recovering. Therefore, it is better to camp on heavily impacted sites—where the most severe damage has already occurred—or on undisturbed sites that are capable of supporting infrequent use without deteriorating (Cole and Benedict 1983).
IMPORTANCE	High. This practice is critical to avoiding widespread campsite proliferation in popular destination areas and unnecessary campsite impact in relatively undisturbed places. In both situations there are more appropriate sites to select for camping.
CONTROVERSIAL ELEMENTS	Some low-impact materials suggest that visitors should select lightly impacted campsites. This recommendation appears to ignore the research findings that campsites at this stage of deterioration are most vulnerable to further deterioration with continued use (Cole 1987b).
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low. More appropriate sites are always available.



A

Figure 2—Campsite impacts and appropriate low-impact practices. (A) In remote locations, it is most appropriate to camp on a previously unused site (practice 24). It is also important to select a durable site (practice 27), to spread out tents and activities (practice 34), to keep lengths of stay short (practice 35), and to camouflage any disturbance (practice 36). (B) In popular locations, it is most appropriate to camp on a well-impacted site (practice 23). It is also important to select a site that is large enough to accommodate your party (practice 26), to select a concealed campsite (practice 28), to confine tents and activities to already impacted areas (practice 32), and to leave the site clean and attractive for the next party (practice 33). (C) Lightly impacted sites, like this one, should not be used (practice 25). If the campfire ring is dismantled and the wood and rocks are scattered, this site should recover rapidly. With continued use, however, it will soon deteriorate into a well-impacted campsite.



B



C

Figure 2 (Con.)

PRACTICE 26—SELECT A SITE THAT IS LARGE ENOUGH TO ACCOMMODATE YOUR PARTY

DESCRIPTION	Select an established campsite with an already impacted area that is large enough for your party. It should be possible to locate the kitchen and all sleeping places in areas that are already highly disturbed. Select a larger site elsewhere, rather than risk enlarging the site by camping on its periphery.
SAMPLE MESSAGE	"Large parties and parties with packstock do the most damage and special efforts should be made to encourage them to select sites that already have been substantially altered and are large enough to accommodate their party size." (20)
PROBLEM ADDRESSED AND RATIONALE	Deterioration of established campsites. Most of the deterioration occurring on long-established campsites consists of the outward expansion of zones of impact (Cole 1986a; Merriam and others 1973). This occurs when parties camp on the periphery of sites, either because they choose to camp there or because they are too large for the site. The former cause can be alleviated by more carefully confining activities (see action 33); the latter cause is the one addressed by this action.
IMPORTANCE	Moderate to high. Site expansion is among the most serious campsite impact problems, and improper site selection is one of the causes of site expansion. But most parties naturally tend to seek out sites large enough to accommodate their group.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low to moderate. Most parties are small enough to be unaffected by this concern. Where campsites are few and far between, this practice may require traveling and searching more than a large party wants. This cost could be reduced by planning in advance to camp in places likely to have large campsites available. Managing agencies could also provide large parties with specific directions to suitably sized campsites.

PRACTICE 27—SELECT A DURABLE SITE

DESCRIPTION	Select a site that is durable enough so that your stay will not cause impact. Durability concerns differ between well-impacted sites and previously unused sites. Selecting a durable site is generally more important on unused sites; on well-impacted sites, the potential for damage has already been reduced by previous impact. Flat sites, without vegetation or easily disturbed soils, are always preferable. Selection of a site with durable vegetation is most important on previously unused sites. On well-impacted sites, vegetation will be lost regardless of durability; durable sites are those that have little erosion potential and have either thick organic horizons or unconsolidated mineral soil (Cole 1987a). Sleeping and cooking areas can be separated; cooking can be done on highly durable sites (such as rock slabs) that might be uncomfortable sleeping places.
SAMPLE MESSAGES	"Avoid locating campsites in areas that have delicate plants." (33) "Choose a site on sandy terrain or the forest floor, rather than the lush, but delicate plant life of meadows, streambanks, fragile alpine tundra, and other areas that can be easily trampled or scarred." (6) "Camp on snow or gravel rather than on vegetation; or select a site which is covered by dry sedge rather than heather, huckleberry or other less-resilient plants." (76)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites. Well-established campsites in durable locations are less likely to experience excessive deterioration than those in fragile locations. The most common severe-impact problems related to site durability are erosion and exposure of highly compacted mineral soils; therefore, preferred sites include those with thick organic horizons and those in sand and gravel, with low erosion potential. (2) Proliferation of campsites. Durability is even more critical when selecting a previously unused site for camping. Durable sites can be camped on more frequently than sensitive sites before deterioration becomes obvious and additional users are attracted to the developing campsite. Vegetation loss is the most evident initial change on previously unused sites. Therefore, previously unused sites with a durable vegetation cover are preferred where it is not possible to select a site without vegetation.
IMPORTANCE	Moderate to high. This practice is extremely important on previously unused sites in places where use levels are not extremely low. It is among the most important means of avoiding the creation of new campsites. It is somewhat less critical either in very lightly used places or in places with well-established campsites.
CONTROVERSIAL ELEMENTS	The concept of using resistant sites is not disputed; what constitutes a durable site is controversial, however. Attempts to make broad generalizations, without recognizing differences between established and previously unused sites or between different environments, result in contradictory recommendations. Resolution of controversies will require additional research, as well as a willingness to recognize that this issue is complex.
KNOWLEDGE NEEDS	There is a sizable literature on site durability (see Cole 1987b and Kuss 1986 for an introduction). We need more information, however, for specific places and environments. This would permit the development of more specific recommendations such as those in sample message 76.
FREQUENCY OF RECOMMENDATION	Common. Many low-impact messages provide some do's and don'ts about durable places to camp. But there is little agreement on recommendations and less specificity than is desirable.
COSTS TO VISITORS	Low to moderate. The principal costs are the additional time required to search for a campsite that is resistant to impact, as well as desirable for other reasons, and forgoing camping on desirable sites that are fragile. For many visitors, these costs will be outweighed by the satisfaction of knowing that they have used their skills and knowledge to minimize impact. Moreover, many durable sites have characteristics that make them particularly desirable (for example, well-drained, rather than muddy or dusty).

PRACTICE 28—SELECT A CONCEALED CAMPSITE AWAY FROM TRAILS, OCCUPIED CAMPSITES, LAKES, AND OTHER WATER BODIES

DESCRIPTION

Locate your campsite where it is not likely to be observed by others walking or camping in the area. Locate it away from trails, occupied campsites, water bodies, and "beauty spots" that attract others. Concealed locations behind large boulders, in or behind clumps of trees, and on benches above lakes are ideal. In low-use places, this action is less important than selecting a durable campsite. In these places it may be preferable to select a durable open campsite instead of a more fragile forested site.

SAMPLE MESSAGES

"You will enjoy more solitude and be less conspicuous if you select a campsite away from the favorite spots. Locate your camp 200 feet or more from lakes, streams, meadows, and trails. Camping next to a busy trail or in full view of lakes, streams, and in meadows robs others of an unmarred scene and a feeling of solitude." (8)

"If other parties are close to where you want to camp, move on or choose your campsite so that terrain features ensure privacy. Trees, shrubs, or small hills will reduce noise substantially. Try to camp at least 200 feet away from water sources, trails, and 'beauty spots' to prevent water and visual pollution." (6)

PROBLEMS ADDRESSED AND RATIONALE

(1) Too many encounters. When selecting a campsite, it is important to locate a site where both ecological impacts and impacts on other campers are minimized. This action is primarily concerned with minimizing encounters between parties. By camping in places that are "out of the way," away from trails and other parties, and away from attractions, including lakes and other water bodies, contacts can be reduced (Echelberger and others 1983). They can also be reduced by selecting sites that are concealed by local topography and vegetation. (2) Animal harassment. In deserts, particularly, camping next to a waterhole can keep animals from water vital to their survival. (3) Water pollution. Arguments for locating campsites away from water bodies to avoid damaging fragile lakeshores and polluting water have intuitive appeal. There is little evidence, however, that lakeshores are particularly fragile (Cole 1982b) or that pollution from lakeshore camping is a serious problem (see, for example, Silverman and Erman 1979). There may be some places where camping close to water causes pronounced pollution. The primary justifiable rationale for asking people not to camp on lakeshores, however, is that this will tend to reduce encounters and preserve the esthetic qualities of lakeshores—a limited and highly valued resource (Cole 1981).

IMPORTANCE

Low to high. Importance varies with use levels and the nature of local topography and vegetation. In places where there are no other parties, this practice is not important (except where animals might be disturbed). In contrast, this practice is very important in destination areas with numerous parties. It can increase campsite solitude substantially, and campsite solitude is extremely important to many visitors (Manning 1986). It is also more important in environments with open vistas and few concealed sites.

CONTROVERSIAL ELEMENTS

There is little controversy about the recommendation. Some controversy exists about the rationale for recommendations not to camp on lakeshores. So far there is little definitive evidence that camping on lakeshores causes more serious or unique ecological impact problems than camping away from lakeshores. Unless this evidence can be found, it would be better to rely on social rationales that can be more easily justified.

KNOWLEDGE NEEDS

The value of this recommendation is based on the assumption that campers value campsite solitude more highly than they value being able to camp on traditional campsites close to trails and attractions such as lakes. This assumption is open to debate and could be tested. More research on water pollution adjacent to places where lakeshore campsites are located could resolve controversy over the underlying rationale for this recommendation.

FREQUENCY OF RECOMMENDATION

Very common. This is among the most common of recommendations.

COSTS TO VISITORS

Moderate. At first, costs could seem high because many campers will be forced to camp away from preferred campsites. Traditional campsites may have to be bypassed, with more time spent in campsite selection. But benefits in terms of campsite solitude should offset these costs, perhaps creating new norms for preferred campsite locations.

PRACTICE 29—WEAR SOFT-SOLED SHOES AROUND CAMP

DESCRIPTION	When you arrive at camp, take off lug-soled boots and put on soft-soled shoes such as tennis shoes or moccasins.
SAMPLE MESSAGE	"Wear sneakers or moccasins in and around the campsite. Heavy-soled shoes have a great impact on the ground cover. Besides, your feet deserve the rest." (90)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites and (2) proliferation of campsites. Wearing soft shoes around camp may reduce deterioration both of established and previously unused campsites, if these shoes have less impact on vegetation and soil.
IMPORTANCE	Low. All studies to date have found little difference in the impact caused by different types of shoes (Kuss 1983; Saunders and others 1980; Whittaker 1978). Although there may be differences in some situations, they are unlikely to be substantial.
CONTROVERSIAL ELEMENTS	Although there is no controversy, the common belief that soft shoes are less damaging than lug-soled boots is not supported by research. But because costs to visitors are low, there are no likely ecological side-effects, and there may be some situations where consequences are beneficial, the recommendation to wear soft shoes can be supported.
KNOWLEDGE NEEDS	More research on the effects of different shoe types might identify situations where types differ in their impact. It might also more precisely define the importance of this practice.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. Soft shoes add weight and take up space, but not much. Having a change of shoes also offers advantages of comfort and safety.

PRACTICE 30—MINIMIZE INTENTIONAL SITE ALTERATION AND THE BUILDING OF STRUCTURES

DESCRIPTION	Avoid intentionally altering the campsite and building structures. Activities to avoid include moving rocks and logs, digging up vegetation, digging ditches around tents, and building such structures as tables, chairs, and hitch rails. If you do some landscaping and construction, be prepared to dismantle and camouflage it (actions 33 and 36). Never leave wire and nails.
SAMPLE MESSAGES	“Campcraft (rock wind screens, wood construction, trench lines around tents, etc.) is not only unnecessary, but it is also extremely destructive. Pick a well-drained campsite and use a tent with waterproof floor or a waterproof groundcloth so trenching won’t be necessary.” (86) “Avoid trenching around your tent, cutting live branches, or pulling up plants to make a parklike campsite. If you do end up clearing the sleeping area of twigs or pinecones, scatter these items back over the campsite before you leave.” (6)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites and (2) proliferation of campsites. Engineering, landscaping, and construction of structures cause unnecessary impact to campsites, whether they are well established or virtually unused. These actions can cause further impact (such as where ditching causes accelerated erosion), they create eyesores and unnecessary evidence of human alteration, and on lightly used sites they can encourage increased use, which ultimately leads to campsite proliferation.
IMPORTANCE	Moderate. These impacts, while highly obtrusive, are generally not irreversible. This practice could, however, eliminate an entire category of unnecessary impacts.
CONTROVERSIAL ELEMENTS	There is some difference of opinion among users over the appropriateness of building facilities. While some users like to construct structures of various kinds, most wilderness users prefer primitive campsites (Stankey and Schreyer 1987); constructed facilities are major sources of visitor dissatisfaction (Lee 1975). There is little controversy, however, over the conclusion that these activities should be minimized in wilderness.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Very common.
COSTS TO VISITORS	Low. Landscaping and construction may offer some additional comfort and convenience, but they are unnecessary.

PRACTICE 31—AVOID TRAMPLING VEGETATION

DESCRIPTION	When walking around on or sitting in the campsite, note surviving clumps of vegetation and avoid disturbing them. Avoid trampling tree seedlings in particular. Walking routes and the location of tents or kitchen areas can be adjusted to make it easier to stay off surviving vegetation (see action 32 as well).
SAMPLE MESSAGE	"... watch where you walk to avoid crushing vegetation." "... try not to step on tree seedlings." (30)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites and (2) proliferation of campsites. Where vegetation is sparse, either naturally or as a result of previous impact, vegetation loss can be minimized by being careful to step between rather than on plants. Survival of tree seedlings is critical to the long-term maintenance of forested campsites. Tree seedlings are quickly eliminated by trampling; therefore, special attention must be given to not stepping on them.
IMPORTANCE	Moderate. Efforts to not step on vegetation can be helpful in many situations, but where use is heavy or vegetation is dense, benefits are limited. This practice is most important (1) on previously unused sites where the vegetation is sparse and not highly resistant and (2) on established sites where tree seedling survival is limited.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low. Some concentration is required at first, but soon watching where you step requires little thought. The location and nature of activities are unaffected.

PRACTICE 32—ON ESTABLISHED CAMPSITES, CONFINE TENTS AND ACTIVITIES TO ALREADY IMPACTED AREAS

DESCRIPTION	Locate tents and a central kitchen area in places that have already lost their vegetational cover. The general idea is to confine trampling, as much as possible, to places that have already been highly disturbed by trampling (fig. 2B).
SAMPLE MESSAGE	"When you camp at a well-marked site, you try to make most use of the ground that is already bare, already stamped by human presence; a little more traffic won't alter it further. When paths and pads are there, use them. But avoid doing anything to extend the barren area." (1)
PROBLEM ADDRESSED AND RATIONALE	Deterioration of established campsites. Expansion of zones of disturbance is the most common long-term deterioration problem on backcountry campsites (Cole 1986a). This practice seeks to avoid expansion by concentrating use on already impacted portions of the site. On-site concentration complements the strategy of selecting an already impacted site, as opposed to an undisturbed site.
IMPORTANCE	High. Well-impacted campsites are undesirable to many wilderness users. In popular places they are inevitable. Impact levels on established campsites should be kept to a minimum, however. Avoiding expansion is perhaps the most important means of limiting deterioration, and onsite concentration of activities is critical to avoiding expansion of impact.
CONTROVERSIAL ELEMENTS	On previously unused sites, the opposing strategy—dispersing tents and activities—is more appropriate (practice 34). Attempts to make simple generalizations about traffic flow and activity location on campsites that apply everywhere are inevitably contradictory. The general concept of concentrating use in already disturbed places and dispersing use in undisturbed places should not be controversial.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. Assuming that a large enough (practice 26) well-impacted (practice 23) campsite has been selected, it should be a simple matter to confine activities to already disturbed portions of the site. This is probably almost instinctive behavior.

PRACTICE 33—ON ESTABLISHED CAMPSITES, DISMANTLE ANY STRUCTURES YOU BUILT AND ANY OTHER INAPPROPRIATE STRUCTURES; LEAVE THE SITE CLEAN AND ATTRACTIVE

DESCRIPTION	Dismantle any structures that were built. (As noted in practice 30, such construction should generally be avoided.) Structures built by others should also be dismantled, if they are inappropriate and not likely to be immediately rebuilt. Leave a single firering (but dismantle any additional rings) and any agency-built structures. Primitive log seats should probably also be left, and there are situations where user-built stock facilities should be left. The basic philosophy is to keep facilities to a minimum, but to avoid having them rebuilt on different parts of the site, spreading impact around. This requires striking a balance between the ideal goal of having no "permanent" facilities and the practical value of confining the impact associated with a facility to a small area. It is also important to leave the site clean and attractive so that other parties will be attracted to the site, rather than use some less appropriate site.
SAMPLE MESSAGE	"When leaving camp, make sure that it is clean, attractive and will be appealing to the next group to use the area It is appropriate to . . . dismantle inappropriate user-built facilities, such as multiple firerings, constructed seats, tables, etc. However, properly-located and legal facilities, such as a single firering in many areas, should be left. Dismantling them will cause additional impact, because they will be rebuilt, with new rocks, and impact a new area." (30)
PROBLEM ADDRESSED AND RATIONALE	Deterioration of established campsites. The basic idea is to leave the campsite as attractive as possible so that other parties will want to camp on the site. This encourages concentration of use and impact. Therefore, it is important to (1) remove facilities that are considered inappropriate by others, but leave those that will certainly be rebuilt (primarily a rock firering and perhaps a sitting log) and (2) clean up the site, particularly pick up litter (practices 51 and 53) and clean up the firering (practice 49). Most visitors find a simple rock firering to be a desirable feature of an established campsite (Stankey and Schreyer 1987).
IMPORTANCE	Moderate. This practice effectively reduces impact, but those impacts are not irreversible.
CONTROVERSIAL ELEMENTS	Some people suggest that all facilities should be dismantled, regardless of the circumstances. This suggestion seems counterproductive where facilities will simply be rebuilt and impact a larger portion of the site. Stock facilities are particularly controversial. They are unnecessary, suggesting that they should be dismantled; however, the fact that they are frequently rebuilt suggests that it might be better to leave them. Perhaps dismantling of such facilities should be left to agency personnel.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low. The time spent dismantling facilities and cleaning up the site, the primary cost, should not be great and will be offset by having clean and attractive sites to camp on.

PRACTICE 34—ON PREVIOUSLY UNUSED SITES, DISPERSE TENTS AND ACTIVITIES

DESCRIPTION	Set tents up some distance from each other and from the central kitchen area. Stay off the site as much as possible and disperse your activities. Take alternate paths to water and minimize the number of trips. A portable water container makes this easier. Do everything possible to minimize the number of times that any place or path is trampled. This practice, the opposite of practice 32—the appropriate behavior on well-impacted sites—complements the strategy of selecting previously unused sites in remote places.
SAMPLE MESSAGES	“If you are at a pristine site, most especially if there is vegetation underfoot . . . try to avoid repeated traffic over any one piece of ground. In moving between kitchen and spring, or tent and toilet area, take a slightly different route each time, and try to walk on duff, rocks, and mineral soils. Try not to mill around too much in one place, as at the entrance of the tent or in the cooking area.” (1) “Arrange your site to avoid concentrating activities in the cooking area. Carry water to your site in large containers so fewer trips are needed. Further reduce your impact by choosing a different route each time you go for water.” (90)
PROBLEM ADDRESSED AND RATIONALE	Proliferation of campsites. To avoid creation of a campsite, it is important to minimize the number of times any piece of ground is trampled. Spreading out tents, activities, and traffic routes, along with selection of a previously unused site, helps realize this goal. Even a large party can avoid causing substantial impact if they locate their tents some distance from each other and avoid congregating in one place (unless that place is highly resistant—such as bare rock).
IMPORTANCE	Low to high. Where camping occurs on a virtually indestructable surface (such as bare rock, snow, or a beach), this practice is of little concern. It becomes increasingly important, however, as site durability decreases and as use levels increase.
CONTROVERSIAL ELEMENTS	On well-impacted sites, the opposing strategy—confining tents and activities to already impacted portions of the site—is more appropriate (practice 32). Attempts to make simple generalizations about traffic flow and activity location on campsites that apply everywhere are inevitably contradictory. The general concept of concentrating use in already disturbed places and dispersing use in undisturbed places should not be controversial.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. More attention needs to be paid to where you walk. This is part of the reason that using remote places and previously unused sites requires more care than using popular, well-impacted campsites and places. With time, this requires little thought, and this practice does not require significant changes in locations or behavior.

PRACTICE 35—ON PREVIOUSLY UNUSED SITES, KEEP LENGTHS OF STAY SHORT

DESCRIPTION	Minimize the amount of time spent on the site. In many situations, sites should not be camped on more than 1 night. Never stay so long that disturbance is pronounced.
SAMPLE MESSAGE	"Spend no more than a night or two at any site, to give plants a chance to recover." (86)
PROBLEM ADDRESSED AND RATIONALE	Proliferation of campsites. This practice, along with practices 24 (in remote locations, select a previously unused campsite) and 34 (spread out tents and activities), works to minimize the number of times any single piece of ground is trampled. This will limit deterioration and the likelihood that a campsite will develop.
IMPORTANCE	High. It is important that previously unused sites are not used for too many nights in a row. If they are, damage will be evident and further use is likely to be attracted to the site. Keeping lengths of stay to an absolute minimum may be less important, particularly where use levels are very low and sites are highly durable.
CONTROVERSIAL ELEMENTS	The concept is not controversial; however, there have been some inevitable contradictions in attempts to state exactly how many nights of use is acceptable. This maximum will vary with use frequency and site durability. Most low-impact materials suggest that lengths of stay should be limited on established campsites, as well as on previously unused sites. This is not necessary as long as other low-impact practices are followed (traffic is confined to devegetated places and site engineering and facility construction are avoided).
KNOWLEDGE NEEDS	More helpful information on appropriate lengths of stay could be provided if we had more research on deterioration rates of previously unused campsites. Such rates will vary with environmental characteristics, however, making a simple universally applicable limit an impossibility.
FREQUENCY OF RECOMMENDATION	Uncommon. Moreover, most recommendations have been applied to established campsites where this action is less important.
COSTS TO VISITORS	Moderate. This can require more frequent moving than desired. This is one of the costs of the extra care required to visit remote areas. Sometimes costs can be reduced by moving, but staying in the general area.

PRACTICE 36—ON PREVIOUSLY UNUSED SITES, CAMOUFLAGE ANY DISTURBANCE

DESCRIPTION	Make every effort to camouflage any inadvertent disturbance. Twigs, cones, and duff can be scattered on places where organic horizons have been scuffed up. Broken vegetation can be picked up and scattered elsewhere, while flattened vegetation can sometimes be “fluffed up.” Fire sites in particular should be carefully camouflaged (action 50).
SAMPLE MESSAGE	“Before leaving camp, naturalize the area. Replace rocks and wood used; scatter needles, leaves and twigs on the campsite.” (34)
PROBLEM ADDRESSED AND RATIONALE	Proliferation of campsites. Camouflaging disturbance is a way to avoid encouraging further use of the site. Any evidence that a place has been used as a campsite seems to attract repeat use. This practice is intended to minimize evidence of use.
IMPORTANCE	Moderate. Camouflaging disturbance is important; however, if other low-impact practices were followed, there should be little camouflaging required.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. Some time must be spent, but not much. This is another of the costs associated with use of remote places.

Campfires

PRACTICE 37—LIMIT THE USE OF CAMPFIRES

DESCRIPTION	Always question whether or not you really need or want a campfire. It is almost always better to cook on a stove, and esthetic fires are often not needed every night or can be limited to a short period of time. Work toward reducing the frequency and duration of campfires.
SAMPLE MESSAGES	"Fires should be used sparingly, as they are among the most serious visual impacts in the backcountry. Use of stoves is always preferable to building a campfire. Always carry a stove; use it for most if not all cooking; and only build a fire where it is safe and will not cause further damage or deplete wood supplies." (30) "If possible, avoid building fires. For cooking, a stove is much easier and is far more efficient. Proper equipment, clothing and technique will provide more warmth than a fire. Fires are inadvisable because they sterilize the soil and inhibit growth. They remove materials that continue the decomposition/rejuvenation process and can destroy ground cover. In addition, fires create an artificial barrier between you and the sights, sounds, and smells of the outdoor environment." (23)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites and (2) proliferation of campsites. The rationale behind this recommendation is to minimize the impacts associated with gathering firewood and having a campfire. Fewer and shorter fires, whether on well-impacted sites or on previously unused sites, will cause less impact. There will be less visual impact, less reduction of wood supplies, and less impact to the ground around an established fire site.
IMPORTANCE	Moderate. If all other low-impact recommendations on the use of campfires were followed, this recommendation would be unnecessary. This practice is most important (1) where proper fire location, construction, and cleanup practices are not followed and (2) in popular places, where firewood supplies have been depleted (places where fires would not be built if practice 38 was adhered to).
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	Nothing critical to the basic concept behind this recommendation. A better understanding of the significance of impacts associated with the gathering and burning of wood would improve our perspective on the importance of this action.
FREQUENCY OF RECOMMENDATION	Very common.
COSTS TO VISITORS	Low to moderate. As stated, costs are low. More emphatic statements about avoiding having campfires entirely are much more costly to those who enjoy campfires.

PRACTICE 38—AVOID FIRES WHERE FIREWOOD IS NOT PLENTIFUL

DESCRIPTION	Do not have a campfire in places where little dead and downed wood is available. Lack of firewood can reflect either low natural productivity (for example, close to and above timberline or in deserts) or depletion of wood supplies in popular camping areas. Either camp someplace where firewood is more plentiful or forgo a campfire.
SAMPLE MESSAGE	"You should use a campfire infrequently and only when there is abundant dead wood available on the ground. Be very critical about the necessity for campfires. In many areas, wood is being used faster than it grows. In overcamped areas or near timberline, choose an alternate campsite or use a portable stove." (6)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of campsites and (2) general disturbance of natural conditions. Gathering wood in places where it is not abundant upsets ecosystem functioning around campsites. Large decaying wood in particular plays an important and irreplaceable role in the ecosystem—in water and nutrient conservation and as a substrate for biological activity (Cole and Dalle-Molle 1982). Where gathering of firewood depletes all the downed wood, even large pieces, impact becomes severe. This is a particular problem at timberline and in arid environment, where growth rates are slow.
IMPORTANCE	Moderate. This practice is an effective way of minimizing the impacts associated with gathering firewood. These impacts are usually not particularly widespread, however.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Moderate. Campers in popular destination areas and in environments with low productivity may have to forgo campfires. In most cases, however, they retain the option of visiting places where campfires are less detrimental.

PRACTICE 39—DO NOT BUILD A FIRE WHERE FIRE DANGER IS HIGH

DESCRIPTION	Fire danger can be extremely high in certain places, at certain seasons, in particularly dry years, or when winds are high. Fires should not be built during these situations. If there is any question, visitors should check with managing agencies for fire danger or closures.
SAMPLE MESSAGE	"Avoid use of fires when fire hazard is high." (30)
PROBLEM ADDRESSED AND RATIONALE	General disturbance of natural conditions. Obviously, fires should not be built when there is a substantial risk that they could start a wildfire.
IMPORTANCE	High. A wildfire started by a careless camper is one of the more significant impacts of recreational use.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low. There are relatively few places and times when this should constrain options.

PRACTICE 40—BUILD FIRES ON MINERAL SOIL WHERE TREES, ROOTS, VEGETATION, OR ROCKS WILL NOT BE SCARRED

DESCRIPTION	Select a fire site where it is possible to build the fire on mineral soil, rather than on duff, vegetation, or rock. Usually this involves finding an established fire site or a place where mineral soil is exposed or underneath a thin layer of duff that can be removed. It is also possible, with care, to build a fire on a mound of mineral soil placed on rock (see action 45). The fire should also be far enough from trees, roots, overhanging branches, and large rocks so they are not blackened or harmed. Avoid building a fire in dense vegetation.
SAMPLE MESSAGE	"Never build a fire in deep, woody forest duff, on peat, or on humus. Never build one next to a log or tree, next to a clean standing rock, or on vegetation. Instead, find mineral soil of some sort." (1)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites and (2) proliferation of campsites. This action seeks to avoid long-term and unnecessary fire scars on rocks, trees, and vegetation. Scars on mineral soil, in contrast, can be scattered and/or covered. The action also seeks to avoid starting a wildfire through burning in duff. Any of these undesired scars can represent unnecessary impact on established campsites or leave long-term evidence of use on previously unused sites. Such evidence can encourage repeat use and the development of a new campsite.
IMPORTANCE	High. Creating a fire scar is perhaps the fastest way to cause long-term impact to a previously unused site. Therefore, building fires on mineral soil (along with careful fire construction and cleanup practices) is critical to avoiding campsite proliferation. It is also an effective means of avoiding unnecessary and unsightly impacts on established campsites.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. More time may be required to find or create an appropriate location for a fire.

PRACTICE 41—IN PLACES WITH WELL-IMPACTED CAMPSITES, BUILD FIRES IN EXISTING FIRERINGS OR ON FIRE SCARS

DESCRIPTION	When camping in an area that has well-impacted campsites and existing firerings, build campfires in an existing ring, or at least in a place that has already been scarred by fire. Do not build a campfire on a previously undisturbed spot. When selecting among several existing firerings, select one that will make it easy to concentrate onsite activities (practice 32).
SAMPLE MESSAGE	"[In heavily used areas] if fires are permitted, use an existing fire circle rather than build a new one." (8)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites. This is an additional aspect of the policy of concentrating use and impact on places that are already well impacted, in this case on a single spot on each campsite where fires have already been built. If this is not done, fire impacts are likely to spread around the site, leaving an unappealing and more highly impacted campsite. (2) Proliferation of campsites. This problem can be avoided by concentrating use and impact on campsites where fires have already been built. Otherwise, campfire impacts will spread to new sites that will likely deteriorate over time.
IMPORTANCE	High. Campfires are among the most common, visually obtrusive, and long lasting of impacts. This practice is critical to limiting the proliferation of campfire scars in popular destination areas. It is also important to keep established firerings clean and attractive (practice 49).
CONTROVERSIAL ELEMENTS	Attempts to make universally applicable rules about either always building fires in existing firerings or building fires on previously unused sites have been contradictory. Use of existing firerings is most appropriate in frequently used areas, while previous fire sites should be rehabilitated and avoided (practice 42) in remote places. The concept is to concentrate use and impact in popular places and to disperse use and impact in little-used places. The controversy results from attempting to develop a single simple rule.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Common.
COSTS TO VISITORS	Low. Existing firerings are the most convenient places to build fires anyway. If campers want to select their own fire site, they have the option of visiting appropriate low-use areas.

PRACTICE 42—IN PLACES WITHOUT WELL-IMPACTED CAMPSITES, DO NOT USE EXISTING FIRERINGS OR SCARS; DISMANTLE ANY RINGS

DESCRIPTION	When in an infrequently used area without well-developed campsites, dismantle and camouflage any firerings that you find. Do not use them and do not camp there. Select a site without obvious disturbance for camping and fire building.
SAMPLE MESSAGE	"If a fire ring shows signs of recovery, such as plant recolonization, you should disassemble the fire ring and camouflage the area so that future camping in the area will be discouraged." (3)
PROBLEM ADDRESSED AND RATIONALE	Proliferation of campsites. This practice complements practice 24 (in remote locations, select a previously unused campsite). A firering serves as evidence of previous impact. It should be avoided, and the fire evidence should be removed so that others will not be attracted to the site. Repetitive use of a lightly impacted site will cause deterioration (Cole 1987b).
IMPORTANCE	Moderate to high. This practice is particularly important where use levels are moderately high—almost to the level where it would be better to concentrate use on a few well-impacted campsites. It is always an important means of avoiding pronounced campfire impacts and the proliferation of campsites.
CONTROVERSIAL ELEMENTS	Some low-impact materials suggest that campfires should always be built in existing rings. This recommendation is appropriate in places with well-impacted sites (practice 41), but it results in unnecessarily impacted and obtrusive fire sites when applied in low-use places. The controversy results from attempting to develop a single universally applicable rule.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Moderate. This practice requires visitors in remote areas to take the extra time and care to build fires on a previously unused site. It is always easier to use an existing fire site. Visitors who want the ease of fire in an existing site have the option of visiting well-impacted places.

PRACTICE 43—GATHER FIREWOOD AWAY FROM CAMP; DISPERSE YOUR GATHERING

DESCRIPTION	Walk some distance from the immediate camp area to collect firewood. Gather a few pieces here and there, always leaving some wood on the ground. Do not take the last pieces of wood from any area.
SAMPLE MESSAGE	"Gather wood some distance from camp on existing sites and always leave some wood, so the area does not look denuded." (30)
PROBLEM ADDRESSED AND RATIONALE	Deterioration of established campsites. Dispersal of gathering and a willingness to search some distance from camp can avoid the common situation of an area totally devoid of down wood around frequently used campsites.
IMPORTANCE	Low to moderate. The ecological impact of concentrated firewood gathering may not be severe (Cole and Dalle-Molle 1982), as long as large woody debris is not collected (practice 44). But the esthetic effect is pronounced and can easily be avoided.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low. A little more time may be required to collect firewood. By not bothering to search in the picked-over area close to campsites, time is saved, however.

PRACTICE 44—USE ONLY DEAD AND DOWN FIREWOOD THAT YOU CAN BREAK BY HAND

DESCRIPTION	Select firewood from pieces that are dead and lying on the ground. Pieces should be small enough to break in your hands and fit within the fire site. Do not collect wood from standing trees, dead or alive, and do not collect or chop up large pieces of wood. There is no need for an ax or saw.
SAMPLE MESSAGE	"Remember when you gather wood that it must be both dead and down to be eligible. Rooted, rotten snags are not firewood: they are habitat and hunting territory for owls, woodpeckers, and a whole community of animals small and large. Don't use wood you can't break. Axe and hatchet are no part of the wilderness tool kit today." (1)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites and (2) general disturbance of natural conditions. Collection of wood that is not dead and down represents unnecessary disturbance of vegetation, which may be important for a variety of animals, particularly cavity-nesting birds. Collection of large pieces of down woody debris causes problems that do not result from the removal of small pieces of wood. Large woody debris plays an important and irreplaceable role in the ecosystem—in water and nutrient conservation, as a substrate for biological activity, and in other ways (Cole and Dalle-Molle 1982). The tree components which in the long term are most important to nutrient cycling are the leaves or needles and twigs (Weetman and Webber 1972), so removal of small pieces of wood causes little problem. Hacking of large downed wood and standing wood also causes pronounced esthetic impacts.
IMPORTANCE	Moderate. This practice would be effective in minimizing the impacts associated with the collection of firewood. These impacts are highly localized and probably not among the most critical.
CONTROVERSIAL ELEMENTS	Stock parties in particular tend to bring axes and saws to cut firewood. In fact, an ax is useful for stock parties to chop out trail obstacles. There may be some resistance to the idea of not chopping firewood, despite the fundamental ecological rationale for the recommendation.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Use only dead and down firewood is a very common recommendation. The recommendation to use small pieces that can be broken by hand is uncommon.
COSTS TO VISITORS	Low. Firewood collection should take no longer. Extra time spent in collection will be offset by time saved in chopping wood.

PRACTICE 45—ON PREVIOUSLY UNUSED FIRE SITES, BUILD FIRE IN A SHALLOW PIT OR ON A MOUND OF MINERAL SOIL

DESCRIPTION	Fires should be built either in a shallow pit in mineral soil or on a mound of mineral soil. Mound fires are an appropriate way to have a fire on rock. In neither case should a fire be built where vegetation is dense. For a mound fire, locate a source of sand or mineral soil that will not be disturbed by excavation and redeposition of material. Build the fire on top of a 6-inch-deep layer of mineral soil. For a pit fire, clear any duff or sparse vegetation; dig a shallow pit; and build the fire in this pit. See the example below and Hampton and Cole (1988) for more detail.
SAMPLE MESSAGES	"When looking for a potential fire site in a pristine area, . . . choose a surface of mineral soil, thin duff (less than 2-3 inches thick), sparse vegetation, or a flat rock. Never build a fire in thick duff because the danger of fire spreading is great. Avoid fires in dense vegetation because it is difficult to not damage the vegetation." "Fires can be built either on a mound or in a pit. Mound fires are preferable if an adequate supply of sand or mineral soil can be found without damaging the source area." "Mound fire: Spread a layer of soil about 6 inches deep on top of the ground surface, over an area larger than the fire will occupy. Build the fire on the soil. Mound fires are most likely to be built on mineral soil, duff, or rock. . . . [When cleaning up], scatter the soil and ash and camouflage the surface with mineral soil or litter and duff (whatever matches the surroundings). If the mound was built on a rock, rinse the rock off." "Pit fire: In mineral soil, simply dig a shallow pit several inches deep. Build the fire in the pit. Where there is a thin duff layer or sparse vegetation, clear the duff down to mineral soil from a circle several feet in diameter; build the fire in a shallow pit in the center of the circle of mineral soil [To clean up, scatter ash], fill [the pit] in, and camouflage the site." (30)
PROBLEM ADDRESSED AND RATIONALE	Proliferation of campsites. Campfire remnants and scars are one of the most obvious signs of human use in remote areas and on little-used sites. They provide unnecessary evidence of human presence and, by encouraging repeat use, contribute to the creation of new campsites. Proper campfire construction, along with careful cleanup on previously unused sites, can minimize these problems.
IMPORTANCE	High. Proliferation of fire scars and campsites in little-used places is one of the more serious unnecessary problems in wilderness. This practice, along with proper campfire cleanup and appropriate campsite selection and behavior, is critical to avoiding this problem. If these practices are followed, campsite impact can be virtually absent from the vast majority of the acreage of most wilderness and backcountry areas.
CONTROVERSIAL ELEMENTS	These specific practices are not controversial. Many educational brochures also describe a technique for building fire in a hole cut in dense vegetation. This technique has a high potential for causing damage and has been abandoned, due to poor success, by the National Outdoor Leadership School (NOLS) (which was largely responsible for developing the original technique). It is covered in the section on practices that can be counterproductive (refer to page 98). Its effectiveness has never been rigorously evaluated. Some areas have regulations that prohibit building fires outside of designated areas or in places where fires have never been built before.
KNOWLEDGE NEEDS	The effectiveness of these construction methods (and the more controversial method for dense vegetation) has never been rigorously evaluated. Evaluative research could improve our ability to precisely state construction specifications and preferred methods.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low to moderate. Proper construction of campfires on previously unused sites requires care and some time and effort. This is one of the costs of using remote sites.

PRACTICE 46—DO NOT RING A FIRE WITH ROCKS

DESCRIPTION	(This practice applies primarily to previously unused sites). Do not build a ring of rocks around the fire. Rocks do not increase fire safety. For cooking, use a stove, a grill with folding legs, or, as a last resort, two rocks to support a grill.
SAMPLE MESSAGE	"Resist the temptation to build a rock fire circle. You may want to use a small rock or two to support cooking pots, but a full circle is not needed and does not prevent fire from spreading." (8)
PROBLEM ADDRESSED AND RATIONALE	Proliferation of campsites. Blackened rocks are one of the obvious scars left by campfires. Minimizing or avoiding use of rocks limits this problem.
IMPORTANCE	Low to moderate. Provided that other low-impact practices are followed in little-used places, this practice is not critical. It is, however, an effective and easy way to avoid unnecessary impact. This practice is most important where multiple firerings are built on well-impacted sites and where fires are built on undisturbed sites close to well-impacted campsites; however, both of these situations should not exist if practices 23 (in popular locations, select a well-impacted campsite) and 41 (in places with well-impacted campsites, build fires in existing firerings or on fire scars) are followed and campers and managers leave a single clean firering on well-impacted sites (practice 49). Because these other practices are not always followed, and this one entails few costs, it should be encouraged.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. No change in practices is required.

PRACTICE 47—KEEP FIRES SMALL

DESCRIPTION	Campfires should be small. The area of the fire, size, and amount of firewood should all be minimized.
SAMPLE MESSAGE	"Build small fires—not large warming fires." (7)
PROBLEM ADDRESSED AND RATIONALE	(1) Deterioration of established campsites, (2) proliferation of campsites, and (3) general disturbance of natural conditions. The basic rationale is to minimize the consumption of firewood and the area impacted by campfires.
IMPORTANCE	Low to moderate. This practice increases in importance as demand for firewood increases and supplies of firewood decrease.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Common.
COSTS TO VISITORS	Low. Small campfires are generally at least as functional as large ones. Desires for large bonfires must be suppressed, particularly in popular places and places where firewood is scarce.

PRACTICE 48—BURN CHARCOAL TO ASH; SOAK ASHES; SCATTER EXCESS FIREWOOD

DESCRIPTION	Toward the end of the fire, stop adding large pieces of wood and concentrate on burning charcoal down to ash. When charcoal has burned to ash, soak the ashes to make certain the fire is out. Ashes should be cool enough to touch with your bare hand. Scatter any excess firewood away from the camp. Then, if you were using an existing fire site, leave the firering clean (practice 49); if you were using a previously unused site, remove all evidence of the fire (practice 50).
SAMPLE MESSAGES	"Stop adding fuel well before you wish to put the fire out. Keep pushing all half-burnt wood into the center of the fire until only white ash remains. Thoroughly soak the entire firepit with water." (9) "You should not have collected more wood than you needed, but if you have, scatter it also. Diffusion is a major strategy of minimum-impact camping; extra wood should be spread lightly so it will not be noticed." (3)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of existing campsites. Proper cleanup leaves existing campsites more attractive for the next party. (2) Proliferation of campsites. This practice is most important in avoiding site proliferation. Leaving a fire site clean on an established campsite encourages subsequent use; the next party is less likely to camp elsewhere and disturb another site. On previously unused sites, this practice is one of the first steps in removing evidence of use, thereby avoiding encouragement of further use and eventually the development of new campsites.
IMPORTANCE	Low to moderate, except that soaking is always important as a means of avoiding wildfire. This practice is less important on established campsites.
CONTROVERSIAL ELEMENTS	In some places it is a time-honored tradition to leave a pile of firewood for the next camper. On established sites this may be acceptable, although it is unnecessary and does run counter to the philosophy of leaving little evidence of your stay.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. Some time is required to let the fire burn down, but this is not a burden and no major behavioral changes are required.

PRACTICE 49—ON PREEXISTING FIRE SITES, LEAVE THE FIRERING CLEAN AND ATTRACTIVE; DISMANTLE EXTRA FIRERINGS

DESCRIPTION	When camping on a well-impacted campsite, campfires should be built where fires have been built before. A small, clean fire site should be left. If there was originally a ring of rocks, leave a ring of rocks. If the ring was overly large and built up, excess rocks should be scattered, away from the campsite. If it was clogged with charcoal and ash, this material should also be scattered away from the site. Scatter rocks, charcoal, and ash lightly in a number of places—to be as inconspicuous as possible. Other firerings on the site should be dismantled completely. Scatter rocks, charcoal, and ash away from the site and attempt to camouflage the fire scar. Any litter should be carried out.
SAMPLE MESSAGES	"If using a pre-existing fire site, leave a small clean firering to attract the next user. If large quantities of ash were generated by you or previous users, scatter it some distance from the campsite. Any excess blackened rocks—from an over-built firering or from multiple firerings—should be returned to their original locations, if possible, or scattered some distance from the camp." (30) "Fire rings have a habit of proliferating around camps. Destroy extra ones by spreading out the rocks, scattering the ashes and covering with soil or duff." (40)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of existing campsites and (2) litter. Overbuilt, sloppy firerings, extra rings, scattered fire debris, and litter represent significant esthetic impacts. This action seeks to avoid this unnecessary problem. Leaving a single clean ring will tend to confine the impacts associated with campfires by encouraging others to build campfires in that same place. (3) Proliferation of campsites. An attractive site, by encouraging repeat use, also helps avoid the creation of new campsites by users who would choose not to use a campsite littered with firerings, blackened rocks, charcoal, and ash.
IMPORTANCE	High. This is one of the more important practices on well-impacted campsites. Widespread campfire debris and litter are unnecessary impacts that are particularly obtrusive and displeasing to subsequent campers. This practice can eliminate those problems and make camping in frequently used, well-impacted destination areas more pleasant.
CONTROVERSIAL ELEMENTS	Some low-impact materials suggest that all firerings on campsites should be dismantled, regardless of circumstances. On frequently used sites, this frequently results in fire impacts spreading around a site as new firerings are built in different places. As a universal suggestion, dismantling all firerings is not recommended; it is appropriate in remote, little-used places (practice 50).
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. It does take some time to carefully clean out firerings and debris. Time spent will diminish, however, as others learn to behave properly. This time is merely the cost associated with being able to have a campfire.

PRACTICE 50—ON PREVIOUSLY UNUSED FIRE SITES, REMOVE ALL EVIDENCE OF THE FIRE

DESCRIPTION	After having a campfire in a place where fires have not been built before, remove all evidence of the fire. Either a pit or mound fire should have been built. With a pit, simply fill in the pit with excavated mineral soil and camouflage the disturbance with soil or duff—whatever will blend in with the surroundings. With a mound fire, return the ash and soil to its source or scatter it widely. If built on a rock, rinse the rock. Again, camouflage the site. All wood and charcoal should have been burned to ash; if it was not all burned, remove it from the ashes and scatter it widely. Rocks should not have been blackened, but if they were, scatter them widely. Refer to Hampton and Cole (1988) for more detail.
SAMPLE MESSAGE	“If you have been using a firepit, drown the ashes and coals, scatter all remaining ashes, and return most of the mineral soil you removed back to the hole. Now look at the surrounding ground cover, and camouflage the top of the firepit to match. Use duff, aspen leaves, pine cones, whatever it takes to restore the surface to its natural state. Always be careful not to overcamouflage. A big pile of duff is a sure giveaway that there is something underneath. Good camouflaging is an art that takes a subtle touch. If you have built a flat rock (mound) fire, scatter the ashes and return the mineral soil to where you got it. Rinse the rock with water, wash off any remaining residue of soil, and landscape the entire area.” (3)
PROBLEM ADDRESSED AND RATIONALE	Proliferation of campsites. Evidence of a campfire can encourage subsequent users to camp at the same spot. Where this happens, campsites develop rapidly. Removing evidence of campfires, along with proper campsite selection and behavior, eliminates this threat.
IMPORTANCE	High. Effective elimination of campfire evidence in remote places is critical to maintaining such places in a virtually undisturbed condition. It is one of the responsibilities that must be accepted when building a campfire in remote places.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low to moderate. This practice requires a commitment of time to mitigate the disturbance caused by campfires. Proper fire site selection and construction can minimize time requirements, however. For those who do not want to take the time, options include not having a campfire and visiting places with well-impacted campsites and established fire sites.

Waste Disposal and Sanitation

PRACTICE 51—PACK OUT NONORGANIC LITTER (OR BURN READILY BURNED LITTER)

DESCRIPTION

All nonorganic litter should be burned or packed out; it should not be buried or scattered. Paper products, including toilet paper, can usually be burned. Where fires are not permitted, paper products should be packed out, as should cans, bottles, plastic products, and anything else that cannot be completely burned. Special care must be taken to avoid leaving inconspicuous pieces of litter (such as "twist-ties") or the aluminum foil that lines paper products and will not burn.

SAMPLE MESSAGES

"You will want to pack out every bit of garbage that cannot be completely burned. Don't bury it." (7)

"The basic rule of waste disposal is to pack out what cannot be otherwise disposed of by careful meal planning. Only waste water and fish viscera should be scattered and burning of waste should be minimized." (30)

"Minimize the use of toilet paper. If it is used, either pack it out (ideally) or burn it as completely as possible and bury any remnants. Do not burn toilet paper if fire hazard is high or regulations prohibit it. Tampons should be packed out (unless you are in grizzly bear country) or burned in a very hot fire; they should never be buried." (30)

PROBLEM ADDRESSED AND RATIONALE

Litter. Removing all nonorganic waste products that are brought into the wilderness will eliminate litter problems.

IMPORTANCE

High. Litter is not a long-term ecological impact problem; however, it is one of the more serious problems in the opinion of wilderness users (Roggenbuck and others 1982; Stankey 1973). This practice, if faithfully applied by all users, would eliminate litter problems.

CONTROVERSIAL ELEMENTS

The concept of packing out what you pack in is generally accepted. The handling of toilet paper is controversial, however. Many land managers dislike the idea of burning it because this increases the risk of wildfire; users dislike the idea of packing it out. Burying toilet paper is the less-than-desirable compromise that is often suggested.

KNOWLEDGE NEEDS

None.

FREQUENCY OF RECOMMENDATION

Very common.

COSTS TO VISITORS

Low. All this practice requires is that visitors pack out what they pack in, minus what they eat and can burn. Only packing out toilet paper can be undesirable.

SPECIAL SITUATIONS

In grizzly bear country, odorous materials can attract bears. Do not pack out containers that hold odorous material. Through careful pretrip planning, odorous foods should be kept to a minimum and containers that are not burnable should be avoided.

PRACTICE 52—PICK UP OTHER PEOPLE'S LITTER

DESCRIPTION	In addition to packing out your own litter, pick up as much of that left by others as possible.
SAMPLE MESSAGE	"Pick up trash left by others and carry the "leave no trace" ethic the extra mile—a true "good turn" for all who enjoy wilderness and the backcountry." (8)
PROBLEM ADDRESSED AND RATIONALE	Litter. This practice will remove some of the litter problem created by unconscientious users.
IMPORTANCE	Low to moderate. This practice can help reduce litter problems, but deals with symptoms rather than the cause. It is less important than practice 51 (packing out your own litter).
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Common.
COSTS TO VISITORS	Low. Even relatively little effort and weight addition can be helpful.

PRACTICE 53—PACK OUT OR BURN ORGANIC GARBAGE (OR SCATTER FISH VISCERA)

DESCRIPTION	Small quantities of organic garbage (food scraps) can be burned in a hot fire. Large quantities are difficult to burn and should be packed out. Do not scatter or bury food scraps; they will attract animals. Fish viscera can be widely scattered, but should not be thrown back in lakes or streams. Packing them out or burning them is better, however.
SAMPLE MESSAGES	"Select low-waste foods and prepare them in quantities that will be eaten completely. If you do have leftover debris, however, pack it out with your other garbage." (23) "Litter and food scraps can be minimized with careful planning and preparation. Food can be carefully measured so leftovers are minimized. When food is left, it should be packaged up and either eaten later or packed out. Partial burning, which is likely to occur when food is burned at the end of a meal, is unacceptable. Fish viscera are generally a natural part of the ecosystem. They should be scattered widely, out of sight and away from campsites. In high-use areas and in bear country they should be scattered a long way from camps. Do not throw viscera back into lakes and streams (unless bear danger is high and viscera can be thrown into deep water); the cool temperatures in most mountain waters prevent rapid decomposition." (30)
PROBLEMS ADDRESSED AND RATIONALE	(1) Litter and (2) disturbance of feeding habits. Both of these problems can be avoided if waste is packed out or completely burned. Widespread scattering may make litter problems unobtrusive; however, it can alter the feeding habits of animals.
IMPORTANCE	Moderate. Organic wastes decompose more rapidly than nonorganic litter and are probably less of a problem in the opinion of wilderness users. This practice is an effective means of minimizing problems, however.
CONTROVERSIAL ELEMENTS	The pack-it-out, burning, and scattering options for disposal can all be found in the literature. Clearly, packing it out is the option most consistent with minimum-impact use; however, the other options are more convenient for users. The recommendations described above represent compromises between convenience and "doing the right thing."
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. In all cases, less must be packed out than was packed in.
SPECIAL SITUATIONS	In grizzly bear country, food scraps should not be packed out. Special care in planning is required. Leftovers that cannot be burned should be scattered a long way from camp.

PRACTICE 54—USE TOILETS IF PROVIDED

DESCRIPTION	When camped in an area where toilets are provided, use them. Do not practice the dispersed cathole method (practice 55).
SAMPLE MESSAGE	None found, although the practice is implied in most areas where toilets are provided.
PROBLEM ADDRESSED AND RATIONALE	Human waste. Toilets concentrate human waste in a single place. This should reduce the risk of accidental contamination.
IMPORTANCE	Moderate to high. In places where toilets are constructed, use levels are usually very high. In such places, use of toilets—assuming they are properly located and maintained—effectively minimizes the risk of contamination. The severity of the health risk associated with dispersed catholes is unclear, however. We do know that pathogens are capable of surviving in buried feces for years (Temple and others 1982).
CONTROVERSIAL ELEMENTS	The appropriateness of toilets in wilderness is questioned. Decisions about appropriateness involve tradeoffs between human health and esthetics and the provision of structures.
KNOWLEDGE NEEDS	A better understanding of fecal decomposition rates and the risks of contamination would provide a better basis for evaluating the importance of this practice and the situations in which provision of toilets are or are not needed.
FREQUENCY OF RECOMMENDATION	None.
COSTS TO VISITORS	Low. Many visitors dislike the use of toilets; others prefer using toilets (Stankey and Schreyer 1987). Those who dislike toilets can visit less popular places where toilets are not needed. Providing information on the location of toilets in the backcountry is important.

PRACTICE 55—DISPOSE OF HUMAN WASTE IN A PROPERLY LOCATED CATHOLE

DESCRIPTION	In an area without toilets, human waste should be disposed of in a place where it will not pollute waters and where other people will not find it. Catholes should be widely dispersed, as far from campsites, trails, lakes, and streams as possible. Waste should be buried in a small hole excavated in mineral soil, a place where disturbance will be minimal. Do not simply cover feces with a stone. A small trowel can be helpful. Do not build a latrine (refer to page 99).
SAMPLE MESSAGE	"For individuals, dig small latrines (cat-holes) in the top 6 to 8 inches of soil at least 200 feet from water, camp, and trails. Cover your latrine thoroughly with soil, rocks, needles, and twigs." (8)
PROBLEMS ADDRESSED AND RATIONALE	(1) Human waste and (2) water pollution. Where toilets are not provided, individuals must be responsible for depositing waste in a manner and place that minimize the risk that others will encounter the waste or that it will reach water supplies. These risks can be most effectively minimized by walking far from campsites, trails, and water bodies to seek a disposal site. Adequate burial adds further protection from risk of pollution or encountering waste. Contrary to popular belief, burial is not a means of increasing decomposition; it is primarily a means of slowing dispersal toward water and separating waste from other humans. The importance of widespread dispersal of waste disposal sites is suggested by recent research that reported survival of pathogenic indicators for a year or more (Temple and others 1982).
IMPORTANCE	Moderate to high. Importance varies with amount of use. This practice is of critical importance in regularly visited places. In remote, little-visited places, however, disposal practices can be more lax. In unused places, surface disposal is acceptable; this will increase decomposition rates and avoid the disturbance associated with excavating a hole. (Surface disposal should probably not be generally recommended.) Given the significance attached to problems of esthetics and human health, this practice is among the most important in regularly visited places. It becomes both increasingly important and increasingly difficult as use intensities increase.
CONTROVERSIAL ELEMENTS	Attempts to establish quantitative standards have resulted in inconsistent recommendations. Recommended appropriate distances from campsites, trails, and water range from 100 to 300 feet. Recommended depths for disposal range from 4 to 10 inches. These differences are not critical, although it would be best—for distance from campsites—to suggest that visitors go as far as possible. Other recommendations include use of group latrines and deposition on the surface. These practices are not generally recommended, although there are special situations where they might be appropriate.
KNOWLEDGE NEEDS	Rapid decomposition of waste reduces risk of contamination. We need to know more about environmental factors that promote rapid decomposition of feces. This would improve our ability to provide more specific recommendations about good disposal sites.
FREQUENCY OF RECOMMENDATION	Very common.
COSTS TO VISITORS	Moderate. This practice requires some time and care to walk far enough from camp and to excavate an adequate hole.
SPECIAL SITUATIONS	Certain environments offer unique opportunities for human waste disposal. Crevasses on glaciers can make good disposal sites. Otherwise, proper waste disposal on snow and ice is difficult. Selecting a site far from places that are used during any season becomes critical. Waste disposal below high tide offers an opportunity on low-use beaches. On rivers, equipment is available that permits all waste to be carried out in portable toilets (Hampton and Cole 1988). This is an extremely effective means of minimizing problems. Waste deposition on the surface may be appropriate in very lightly used areas where excavation of holes can cause long-term impact. Spreading the feces on a dry and exposed site will maximize exposure to sunlight and, therefore, decomposition. Finally, latrines may be necessary for long stays by large groups in popular areas. This situation should be avoided, however, because decomposition rates are extremely slow in latrines, and excavation by animals is a serious problem.

PRACTICE 56—USE BIODEGRADABLE SOAP IN SMALL AMOUNTS, IF AT ALL

DESCRIPTION	Minimize use of soap. Use small quantities of a biodegradable soap and keep soap out of water bodies (practice 57).
SAMPLE MESSAGES	“Minimize your use of soaps since even biodegradable soaps are pollutants.” (86) “The use of soaps or detergents containing phosphates must be avoided to prevent contamination of backcountry water sources and vegetation damage.” (9)
PROBLEMS ADDRESSED AND RATIONALE	(1) Water pollution. Pollution of water is avoided by keeping all soap, even biodegradable soap, out of water bodies. (2) General disturbance of natural conditions. Disturbance, most often on and around campsites, is minimized by using biodegradable soap in small quantities. Soap with phosphates adds nutrients to soils, which can lead to alteration of vegetation.
IMPORTANCE	Low to moderate. The significance of problems created by soap pollutants is poorly understood. As long as soaps are kept out of water bodies (practice 57), problems may not be substantial.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	Although it would not change the recommendation, a better understanding of the nature and significance of soap pollution would permit an evaluation of importance.
FREQUENCY OF RECOMMENDATION	Common.
COSTS TO VISITORS	Minimal.

PRACTICE 57—BATHE, WASH, AND DISPOSE OF WASTE WATER AWAY FROM WATER BODIES AND CAMPSITES

DESCRIPTION	Bathing in water bodies is acceptable if soap is not used. If soap is used, get wet; carry water in a pot to a place away from the water and campsites; soap and lather up; and rinse off. Dishes should also be washed away from water bodies and campsites so that soap, food scraps, and waste water do not pollute them.
SAMPLE MESSAGE	"All soap pollutes lakes and streams. If you bathe with soap, jump into the water first, then lather at least 100 feet from the water, and rinse the soap off with water carried in jugs or pots. This allows the biodegradable soap to break down and filter through soil before reaching any body of water. Clothes can be adequately cleaned by thoroughly rinsing. Soap is not necessary. Dishes should be washed away from water sources. Dishwashing is simple; don't use soap. If food sticks, fill the pan with cold water and let it soak several hours or overnight (except in grizzly bear country). Clean jars or narrow-mouthed containers by shaking pebbles and water inside them. Scrub the insides of pots with sand, gravel, pine cones, or a pine needle cluster." (6)
PROBLEMS ADDRESSED AND RATIONALE	(1) Water pollution. Soap and food scraps can pollute water bodies by contributing nutrients that had limited aquatic growth. Water clarity can be adversely affected and the food chain can be altered. (2) Deterioration of established campsites. In camp, food scraps can draw flies and be esthetically unattractive.
IMPORTANCE	Unknown, probably moderate. The susceptibility of water bodies to pollution and the significance of potential problems is poorly understood. Lakes in a heavily used lake basin in the Sierra Nevada have unusual chemistry and biota believed to reflect a history of heavy use and water pollution (Taylor and Erman 1979, 1980). Problems may be confined to water bodies with high susceptibility in places that are heavily used. This practice can alleviate problems even under these circumstances.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	Although it would not change the recommendation, a better understanding of the nature and significance of water pollution would permit a better evaluation of importance.
FREQUENCY OF RECOMMENDATION	Very common.
COSTS TO VISITORS	Moderate. This practice requires more time and energy than washing and bathing directly in water.
SPECIAL SITUATIONS	In grizzly bear country it is important to wash dishes immediately after use, in an area far from sleeping places. Where risk is very high, washing directly in water may be justified as a means of minimizing odors.

Additional Practices for Parties With Stock

PRACTICE 58—USE PROPERLY TRAINED STOCK

DESCRIPTION

Stock should be in good condition for mountain travel. Stock should be trained to methods of containment that will be used, as well as equipment. Stock should be fed weed-free food for several days before entry.

SAMPLE MESSAGE

“Animals conditioned to strenuous mountain travel are at home on the trail and accustomed to supplemental feeds and various methods of containment. Horses that react to strange looking ropes or corrals can cause damage or injure themselves. Introducing stock to hobbles, picket pins, hitch lines, and various temporary corrals in a familiar environment may avert a major calamity at some remote camp.” (19)

PROBLEMS ADDRESSED AND RATIONALE

(1) Deterioration of established trails, (2) deterioration of established campsites, (3) proliferation of campsites, and (4) deterioration of grazing areas. Properly trained stock can be managed more easily; therefore, it is more likely that such stock will be handled properly. Properly trained stock are more likely to stay on trails and to cause less damage around campsites and in grazing areas. They are less likely to need to be confined, a practice that commonly results in severe alteration.

IMPORTANCE

Moderate. This practice makes it easier to apply other low-impact stock practices.

CONTROVERSIAL ELEMENTS

None.

KNOWLEDGE NEEDS

None.

FREQUENCY OF RECOMMENDATION

Rare.

COSTS TO VISITORS

Low to moderate. Although this practice requires advanced planning and preparation, it will contribute greatly to a more enjoyable trip.

PRACTICE 59—CARRY APPROPRIATE EQUIPMENT

DESCRIPTION	Horses should be shod with flat plates or not at all. Other items to bring include supplemental feed, nosebags (for feed), hobbles, a hitch line with "tree-saver straps" (USDA FS 1981), and bug repellent and fringed eye guards to reduce aggravation caused by flies and mosquitoes. Carry an ax to chop out downed logs, but avoid using it to gather firewood (practice 44). Follow the recommendations on equipment for all wilderness users (practice 2). Otherwise, take as little equipment and as lightweight equipment as possible to minimize the number of stock.
SAMPLE MESSAGE	"Take only as much gear as you need for the trip. Use lightweight gear. Use picket lines or hobbles. Pack in processed grains and hay pellets where grass is scarce." (12)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established trails, (2) development of unwanted trails, (3) deterioration of established campsites, (4) proliferation of campsites, and (5) deterioration of grazing areas. Proper and lightweight equipment will minimize the inevitable "wear-and-tear" caused by packstock. Use of supplemental feed will reduce grazing impacts. Equipment designed to minimize the impact caused by confined stock is particularly important.
IMPORTANCE	Moderate to high. In places with substantial packstock use, stock impacts are severe except where special care is taken to limit those impacts. These suggestions make it easier to be gentle to the land.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Moderate to high. Many stock users have become accustomed to a style of wilderness use that includes large quantities of heavy equipment. This tradition needs to change and be replaced by use of lightweight equipment more similar to that used by the backpacker.

PRACTICE 60—MINIMIZE THE NUMBER OF STOCK

DESCRIPTION	Take as few head of stock as possible. Minimizing the amount and weight of equipment is critical to minimizing the number of stock.
SAMPLE MESSAGES	"Take the minimum number of stock to make your trip successful." (9)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established trails and (2) deterioration of established campsites. Reducing the number of stock can reduce damage to existing trails and campsites in some places. (3) Development of unwanted trails and (4) proliferation of campsites. Of more importance, large parties are more likely to create new trails and campsites if they travel off trail or use previously undisturbed campsites. (5) Deterioration of grazing areas and (6) competition with wildlife. Grazing areas will deteriorate more rapidly and severely when large numbers of stock graze. In places, this can result in competition with wildlife. (7) Visitor conflict. Visitor conflicts between stock and backpacker parties are also more serious where stock parties are large.
IMPORTANCE	High. The size of stock parties influences the severity of a number of problems. Particularly in little-used and off-trail places, it is critical that stock party size is minimized.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Moderate to high. This can require a substantial change in style of use. Many traditional comfort and convenience items would have to be left behind. Most of these can be replaced by lightweight equipment used by backpackers.

PRACTICE 61—STOCK SHOULD STAY ON ESTABLISHED TRAILS AS MUCH AS POSSIBLE

DESCRIPTION	Parties with stock should travel as much as possible on designated trails, rather than taking off-trail routes. When on trails, stock should be tied together (practice 63) and led single file along the main tread. They should not be allowed to spread out or to walk on parallel or developing trails.
SAMPLE MESSAGE	"Stay on designated trails." (33) "Keep your stock on the trail tread." (12)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of constructed trails and (2) development of undesired user-created trails. Trampling impacts of packstock are particularly severe because considerable weight is carried on a small bearing surface (Weaver and others 1979). Therefore, vegetation and soil damage occur rapidly where stock leave the trail. This is why it is best for stock to stay on constructed trails as much as possible. Where stock leave the main trail tread, trail widening and development of parallel trails are likely. Where stock travel off trail, new trails can be created rapidly.
IMPORTANCE	Moderate. This practice can be effective in minimizing trail deterioration problems caused by packstock use; however, severe trail problems are usually more a result of poor trail location and design than of type of use.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Moderate. Costs are minimal to most users—those who prefer trail travel. Those who enjoy off-trail travel will bear more cost, however. Off-trail travel with stock is acceptable if special care is taken (practice 6).
SPECIAL SITUATIONS	With careful planning, off-trail travel with stock is acceptable. The number of stock must be small, and parties should be prepared to practice low-impact techniques. Routes should be carefully selected for their durability.

PRACTICE 62—REMOVE TRAIL OBSTACLES INSTEAD OF SKIRTING THEM

DESCRIPTION	When encountering a trail obstacle, such as a fallen log, stock parties should remove it and make the main trail passable again. Do not leave the trail to skirt the obstacle. Notify the managing agency if the obstacle cannot be removed.
SAMPLE MESSAGE	“Trail obstacles are part of any wilderness journey. When possible riders clear trails to make travel easier for themselves and others. When a detour is necessary, local managers are notified so the trail can be cleared before an alternate route forms.” (19)
PROBLEM ADDRESSED AND RATIONALE	Deterioration of constructed trails. Where stock leave the trail to skirt an obstacle, the trail will widen or an alternate tread will develop. This deterioration can only be avoided by removing the obstacle and keeping stock on the main tread.
IMPORTANCE	Moderate. This is an effective way to eliminate one cause of trail deterioration. It is not one of the more critical trail problems, however.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Moderate. Clearing obstacles requires time and effort on the part of stock parties, although in few situations will obstacles be frequent enough to require a prohibitive effort.

PRACTICE 63—LEAD STOCK ON THE TRAIL, RATHER THAN LOOSE-HERD THEM

DESCRIPTION	Stock should be tied together and led down the trail. They should not be turned loose and herded down the trail.
SAMPLE MESSAGE	"On the trail pack stock should be led rather [than] loose-herded." (9)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of constructed trails. Loose stock will leave the constructed trail, widening it, creating parallel trails, and shortcutting switchbacks. Leading them on short strings will minimize these problems, as well as the risk of losing a load. (2) Visitor conflict. Leading stock will also cause less conflict with parties met on the trail.
IMPORTANCE	Low to moderate. Stock leaving the trail tread are a major cause of trail deterioration. This practice will reduce this source of trail problems.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. Leading stock is easier than herding them.

PRACTICE 64—TIE STOCK OFF TRAIL, ON A DURABLE SITE, WHEN TAKING A BREAK

DESCRIPTION	When it is time to take a break, move off the trail far enough so that other parties can pass unnoticed. Select a durable site for the break, tying stock in a place and manner that will not cause impact. Avoid tying stock to trees (practice 74).
SAMPLE MESSAGE	"At rest stops—even short ones—stock are tied well off the trail. It's courteous and minimizes trail wear. If it's a scenic overlook, historic site, or other popular stop, stock are kept out of the area." (19)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of constructed trails. Taking a rest stop adjacent to the trail is likely to cause trail widening and deterioration at that spot. This can be avoided by moving off trail to a durable spot. (2) Too many encounters and (3) visitor conflict. Moving off trail will also reduce the number of trail encounters and conflicts between stock and hiker parties.
IMPORTANCE	Low to moderate. Although this practice reduces problems, contrary behavior is not one of the more serious sources of problems.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low. This practice requires more time and care, but experiences are enhanced by getting away from the trail for breaks.

PRACTICE 65—AVOID PLACES THAT HAVE ALREADY BEEN HEAVILY GRAZED

DESCRIPTION	Places that have already been heavily grazed should not be grazed further. They can be used as camping areas if enough processed feed is available to avoid grazing. Otherwise, move to a camping area that has adequate forage.
SAMPLE MESSAGE	No straightforward statement of this recommendation was found. The following contains some of the idea: “Be certain meadows in the area will support the grazing needs of the livestock. Both water and grass supplies should be carefully examined. Frequently used areas are often exposed to heavy grazing through the season. Overgrazing contributes to a reduction in the active strength of the grasses, adds to the trodden-out appearance of the meadows, provides opportunities for unwanted weeds to grow and generally adds to the degradation of the area. The amount of feed available or the amount of feed packed in will determine the length of your stay.” (9) In some areas, overgrazed meadows have been closed to grazing.
PROBLEM ADDRESSED AND RATIONALE	Deterioration of grazing areas. Further grazing of meadows that have already been heavily grazed is likely to cause long-term deterioration. This practice should avoid that.
IMPORTANCE	High. This practice is critical to avoiding the degradation of grazing areas.
CONTROVERSIAL ELEMENTS	The concept is not controversial; however, there is probably little agreement on how much grazing meadows can sustain before further grazing should be avoided.
KNOWLEDGE NEEDS	We need more information on the effects of various levels of grazing on the condition of grazing areas. This would provide a more informed perspective on the point at which further grazing becomes extremely detrimental.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Moderate. Visitors may be unable to graze stock in preferred locations. This follows from the fact that those places that are most overgrazed are often those that are most preferred. The option to bring in feed (and still camp in the area) reduces costs.

PRACTICE 66—KEEP STOCK OFF CAMPSITES AS MUCH AS POSSIBLE

DESCRIPTION	Never confine or allow stock to roam on the campsite. They should be kept some distance away—where they will not foul the site. If necessary, bring them onto the campsite to be quickly loaded or unloaded. If they relieve themselves during this period, be careful to remove the manure.
SAMPLE MESSAGE	“Stock are never kept in camp. They are tied some distance away.” (19)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites and (2) visitor conflict. Stock can cause severe trampling damage if allowed on campsites (Cole 1983b). They also leave manure, which greatly reduces the desirability of the campsite to many visitors. These sources of impact are unnecessary if stock are kept away from the site.
IMPORTANCE	High. Stock cause severe ecological and esthetic impact to campsites. This practice effectively limits this problem.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. This practice requires some planning and coordination to load and unload stock quickly and move them off site. Behavior is not greatly constrained, however.

PRACTICE 67—KEEP LENGTHS OF STAY AT ONE PLACE SHORT

DESCRIPTION	Move to another campsite before forage is overgrazed and before places where stock are confined show excessive trampling damage. In fragile areas and during particularly vulnerable times of the year this may mean moving every day. In places with abundant forage and durable sites for confining stock, long stays are acceptable. Check with the managing agency about forage conditions.
SAMPLE MESSAGE	No examples of this precise recommendation were found, although some of the idea is captured in the following: “Avoid prolonged stock grazing in one area; it can have a serious impact on vegetation.” (82)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites, (2) proliferation of campsites, (3) deterioration of grazing areas, and (4) competition with wildlife. Grazing areas can sustain only a certain amount of grazing before long-term deterioration occurs (Strand 1979). Stock parties must move to another camp before this stage is reached. If the area is used frequently by other parties, or productivity is low, stays must be short to avoid deterioration and, in some places, competition with wildlife. Given the severe stresses caused by the trampling of stock, campsites can deteriorate rapidly unless stock are confined to highly durable sites. Particularly on previously unused or lightly used campsites, stays must be very short or highly impacted campsites will be created. Although less of a problem, long stays at established campsites can also cause excessive deterioration.
IMPORTANCE	High. Deterioration of grazing areas is one of the most widespread impacts in many wildernesses (Washburne and Cole 1983); stock impacts also are a major source of both excessive deterioration of campsites and the rapid proliferation of campsites. Although length of stay is probably less important than appropriate confinement of stock (see practices 71, 73, and 74 in particular), it is an important influence on amount of impact.
CONTROVERSIAL ELEMENTS	The general concept as stated here is not controversial. Any attempt to set quantitative limits on lengths of stay would be controversial because appropriate lengths of stay vary so greatly with such factors as previous impact, season, environmental conditions, and horse-handling practices.
KNOWLEDGE NEEDS	A better understanding of how much grazing different meadow types can sustain would help ascertain appropriate lengths of stay.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Moderate. This practice may require more frequent movement of camps than desired. This cost can be reduced by carefully planning to visit places that can support the lengths of stay desired. Also, by carrying supplemental feed and taking the time and care to confine stock properly, lengths of stay can be extended.

PRACTICE 68—WATER STOCK DOWNSTREAM FROM DRINKING SOURCES ON A DURABLE SPOT

DESCRIPTION	Pick a spot downstream from your camp and others in the vicinity to water your stock. Pick a spot that can handle the trampling, preferably a place with low banks that are hard and rocky or gravelly. Take stock to this place shortly after arriving in camp. Watering stock with a bucket can also reduce streambank impacts.
SAMPLE MESSAGES	"Horses should be watered downstream from the source of your drinking water and well away from the campsite area. When watering horses, avoid fragile streambanks and lake shore areas." (9) "Stock are led to water at a rocky spot where little bank damage will occur. Soft or marshy lake edges are avoided." (19)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of grazing areas. The banks of water bodies are often steep and moist. These characteristics make these sites particularly prone to disturbance. Damage to stream and lake banks can be minimized by watering stock in places where banks are not steep and where soils are dry and hard. (2) Water pollution. Recreational packstock are a source of bacterial contamination of drinking water. Therefore, it is important to keep them out of waters to be used for drinking.
IMPORTANCE	Moderate. This practice can be effective in minimizing health hazards created by packstock and with the breakdown of banks. These are not among the most serious and prevalent wilderness problems, however.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low. It may take additional time to show stock a durable place to water. But a major time commitment or shift in behavior is not required.

PRACTICE 69—CARRY AN APPROPRIATE AMOUNT OF WEED-FREE SUPPLEMENTAL FEED

DESCRIPTION	Bring some feed along so some of the grazing impact is reduced. This is particularly important when visiting either popular places or places where forage is limited. Feed should be weed free; processed feed avoids this problem. It is important to condition stock, before the trip, to eating small quantities of processed feed.
SAMPLE MESSAGES	"Plan on carrying supplemental feed for your stock. In many backcountry areas forage is limited and grazing may be restricted or unavailable. Inquire at the local Ranger Station about the conditions so that you will know how much supplemental feed to carry." (12) "Weed-free oats or pelletized feeds are preferable to hay, which is more bulky to pack. If hay is used it should be certified weed-free." (9)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of grazing areas and (2) competition with wildlife. Overgrazing causes grazing areas to deteriorate and can remove forage needed by wildlife. Supplemental feed can reduce the dependency on forage, thereby reducing the likelihood of meadow deterioration and competition with wildlife. Exotic plants and weeds are a common problem in grazing areas. Weeds can spread into wilderness in feed for stock. To avoid this problem, feed should be either weed free or processed.
IMPORTANCE	Low to high. It is always important to keep weeds out of feed; however, weeds will also enter the wilderness on the body and hooves of stock. So use of weed-free feed will be only a partial solution to the problem. The use of supplemental feed is not important where forage is abundant and use levels are low. It is extremely important where forage is sparse and/or where use levels are high.
CONTROVERSIAL ELEMENTS	Packing in supplemental feed can make it necessary to bring in more animals. Thus, there is a tradeoff between the increased damage caused by more animals and the reduced damage resulting from less reliance on forage. As trips increase in length, the advantages of bringing in feed decline.
KNOWLEDGE NEEDS	A better understanding of the relationship between amount of grazing and deterioration would contribute to more useful guidelines about where supplemental feed is needed and a better perspective on the importance of supplemental feed.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Moderate to high. This can require the added cost of supplemental feed and the need to take more animals into the wilderness. Use of supplemental feeds can remove some of the hassles associated with proper grazing practices and finding campsites with sufficient forage.
SPECIAL SITUATIONS	A number of wilderness areas require all feed to be packed in. A number also prohibit the use of hay or unprocessed feed.

PRACTICE 70—PLACE FEED AND SALT ON A TARP OR IN A FEEDBAG OR CONTAINER

DESCRIPTION	Place salt blocks on a tarp, a notched log, or some other container. Keep salt off the ground. By using processed feed, with salt added, there is no need for supplemental salt. Supplemental feed should be placed in a nosebag or on a tarp. Do not place directly on the ground.
SAMPLE MESSAGES	“When feeding hay or grains that have been packed in, lay the hay out on a pack tarp or sheet of plastic.” (9) “Supplemental feeds in cubes and pellets can be fed . . . in nose bags. [Salt blocks] are set out in a notched log or other container. This prevents rain from leaching salt into the soil, destroying vegetation, and attracting wildlife that paw up the ground.” (19)
PROBLEMS ADDRESSED AND RATIONALE	Deterioration of grazing areas. If feed or salt is placed directly on the ground, stock or wildlife are likely to paw up and unnecessarily disturb the ground.
IMPORTANCE	Low. This is not one of the more significant causes of impact to grazing and camping areas.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low. Nosebags and tarps are all that is needed.

PRACTICE 71—MINIMIZE CONFINEMENT OF STOCK WHEN GRAZING; MOVE PICKETED STOCK FREQUENTLY

DESCRIPTION	Let stock graze freely, using hobbles if they need to be restrained. Avoid confining stock while they graze. If they must be picketed, move picket pins frequently—every few hours. Use metal pins rather than pins made from wood found on the site.
SAMPLE MESSAGES	“Restrained animals can do considerable damage by pawing and trampling the vegetation. Hobbles are the best device for restraining stock. The animal can move enough to graze but is not confined as in picketing.” (9) “Once in camp, travelers allow their stock to graze. Because picketing can cause considerable plant and soil damage, most stock is hobbled. Visitors picket only enough horses to keep the others from straying. Since they know it is illegal and environmentally improper to cut green trees, visitors carry metal picket pins for moving the horses easily two or three times a day.” (35)
PROBLEM ADDRESSED AND RATIONALE	Deterioration of grazing areas. In addition to overgrazing of entire grazing areas, confinement of stock on part of a grazing area can cause substantial local deterioration. For this reason it is important to either allow horses to graze freely or, if they are picketed, to rotate stock frequently. This disperses grazing pressure and impact across a larger grazing area. Even with dispersal and rotation of grazing pressure, it is important not to overgraze the entire area by staying too long (practice 66).
IMPORTANCE	High. Careless confinement of stock is a primary source of impact in many places. Considerable damage can occur in relatively short periods of time. That is why confinement should be avoided as much as possible. When it cannot be avoided, it becomes necessary to invest considerable effort in frequently moving stock. Otherwise, serious deterioration will occur.
CONTROVERSIAL ELEMENTS	Some wilderness managers are more favorable toward picketing than others. This probably reflects their tradition of use. Meadow deterioration is likely to occur wherever stock is picketed, unless great care is exerted. Temporary corrals have also been suggested as a means of confining animals, particularly for long periods of time. This is likely to result in overgrazing of the corral area and, therefore, is not generally recommended.
KNOWLEDGE NEEDS	A better understanding of the effects of restraining stock in various ways for different periods of time would provide a better perspective on the importance of this recommendation. It would also provide more definitive guidelines on proper rotation frequency if using pickets.
FREQUENCY OF RECOMMENDATION	Rare (for minimizing confinement) to uncommon (for the need to frequently rotate picket pins).
COSTS TO VISITORS	Moderate to high. Costs are not substantial for well-trained stock and experienced stock handlers. Stock that are not well trained may run away if allowed to graze freely, and they may not handle hobbles well. If stock must be picketed, considerable time and effort must be invested in rotating animals before damage occurs.

PRACTICE 72—USE EXISTING HITCH RAILS AND CORRALS WHERE AVAILABLE

DESCRIPTION	In places where managing agencies have provided hitch rails or corrals for tying up stock, use these facilities.
SAMPLE MESSAGE	"Use existing camping and horse facilities when provided." (11)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites and (2) proliferation of campsites. Hitch rails and corrals concentrate the impact caused by the confinement of stock. Stock is concentrated not only on certain campsites but also on one spot on these campsites. Where such facilities are provided but not used, stock impacts spread to other places. This can result in both the proliferation of sites damaged by stock and excessive deterioration of individual sites.
IMPORTANCE	High. Although horse-holding facilities are uncommon in wilderness, it is important that they be used when provided by the managing agency. At camping areas that are popular with stock parties, this is an effective way of limiting stock damage to a small area. Not using facilities defeats this strategy and results in unnecessary disturbance.
CONTROVERSIAL ELEMENTS	Most wilderness visitors are opposed to the provision of stock facilities in wilderness (Stankey and Schreyer 1987). This may reflect an assumption that they are being provided for convenience rather than resource protection and therefore are not appropriate. What we know about the nature of packstock impact suggests that, in popular places, concentrating stock is the most effective means of limiting inevitable disturbance (Cole 1983b). While many object to this strategy of concentrating impact in "sacrifice areas," the concept of using facilities where they are provided is not controversial.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Rare.
COSTS TO VISITORS	Low. Most stock parties appreciate the convenience of using agency-built facilities.

PRACTICE 73—WHERE CONFINEMENT IS NECESSARY, USE A HITCH LINE ON A DURABLE SITE AWAY FROM WATER

DESCRIPTION	Stock should be allowed to run free (or with hobbles) as much as possible. If they must be tied up and confined, use a hitch line between two large trees. Use wide "tree-saver straps" (USDA FS 1981) to encircle the trees. Tie more than one horse to the line; this will tend to minimize idle pawing of the ground. Hobbling animals will also reduce pawing. Locate the hitch rail on a durable, hard site, preferably rocky or gravelly and without vegetation. It should be away from campsites (see practice 65) and from water. Never tie horses to trees for an extended period of time (see practice 74). Hitch rails and corrals are not necessary; they cause more disturbance than a hitch line.
SAMPLE MESSAGES	"Remember, any time stock is restrained, particularly if they are away from home and their special partners, they can cause considerable damage to trees, plants, and soil by pawing and tramping. If it is necessary to keep stock tied for any length of time, the following should be considered: (a) Use a rope hitch rail at least 200 feet from any water, trail, or campsite. (b) Select a site where they cannot tramp on tree roots and where damage to plants will be minimized. Rocky, hard ground is usually best. (c) If an animal is inclined to paw while tied, it can do considerable damage to the soil and plants. This type should be hobbled while tied. (d) If some horses are kept tied, while others are turned loose to graze at night or in the day-time, it is almost always best to keep two horses tied rather than one. Two will usually stand quieter." (18) "A hitch line is a good idea. Stock can be quickly tied, kept in order, and easily watched. Wide nylon "tree-saver straps" with quick-adjusting buckles are used for speed and convenience. Rope is run between the straps, tied with a quick-release knot, and pulled taut." (19)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites, (2) proliferation of campsites, and (3) water pollution. Confined stock can cause considerable damage to vegetation, soil, trees (if they are tied to trees), and water. The best alternative is to avoid confining stock. If they must be tied, it is important to select a location where disturbance will be minimized. Sites without vegetation and with a hard, rocky surface that cannot be churned up are best. It is also important to avoid disturbing campsites and to avoid contaminating water bodies. A hitch line is best because no native materials are used (as hitch rails and pole corrals do) and it minimizes the area disturbed; with corrals, a much larger area is disturbed.
IMPORTANCE	High. Disturbance caused by confined stock is a major source of impact on and around backcountry campsites. A few stock parties can cause substantial disturbance. Concentrating that impact on durable sites is the most effective means of limiting the problem.
CONTROVERSIAL ELEMENTS	Hitch rails, corrals, and trees are also used to confine stock. All of these practices cause more damage and are unnecessary.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. Attempts to avoid confinement entirely require more training of stock and higher risk of having stock stray. Using a hitch line in a proper location—as opposed to tying stock to trees or building a hitch rail or corral—is not much more difficult or time consuming.

PRACTICE 74—AVOID TYING STOCK TO TREES, PARTICULARLY SMALL TREES

DESCRIPTION	For breaks that last only a few minutes, it is acceptable to tie stock directly to trees—if they are larger than about 8 inches in diameter. Never tie stock to smaller trees and never tie stock to any tree for a long time. Use a hitch line between two trees instead (see practice 73).
SAMPLE MESSAGES	“To prevent tree damage, tie your stock to trees for only short rest periods.” (33) “When tying stock to trees the tree must be large enough to avoid rope damage to the bark. The diameter of the tie rope must also be large enough to avoid bark damage. Padding between the rope and the tree is recommended.” (9)
PROBLEMS ADDRESSED AND RATIONALE:	(1) Deterioration of established campsites, (2) proliferation of campsites, and (3) general disturbance of natural conditions. Stock tied to trees can girdle and kill the tree, particularly if it is a small tree. When stock are tied to trees for long periods, they excavate wells around the base of trees, exposing and trampling roots. This practice seeks to avoid this unnecessary disturbance by suggesting alternative less-damaging practices (see practice 73).
IMPORTANCE	High. Tree damage and root exposure resulting from stock tied to trees is a pervasive problem on campsites. Using a hitch line instead is a simple way to avoid this problem.
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Low. The hitch line with tree-saver straps is a simple alternative to tying stock directly to trees.

PRACTICE 75—RENOVATE PAWED-UP AREAS; SCATTER MANURE; REMOVE PICKET PINS AND EXCESS FEED AND SALT

DESCRIPTION	In addition to normal camp cleanup, several of the disturbances unique to stock parties must be dealt with. Wherever stock have been, it is important to scatter manure and smooth over any pawed-up areas. If picket pins were used, they should be removed. If salt and feed are left over, they should be packed out.
SAMPLE MESSAGE	"And when it's time to break camp nothing is left behind. Temporary hitch rails and corrals are dismantled, and manure piles are scattered to aid decomposition, discourage flies, and as a courtesy to others." (19)
PROBLEMS ADDRESSED AND RATIONALE	(1) Deterioration of established campsites and (2) proliferation of campsites. This practice is intended to make established campsites attractive to subsequent users and to remove all evidence of your stay on previously unused sites. (3) Deterioration of grazing areas. Leaving picket pins encourages the next party to picket their stock in the same place; this quickly leads to overgrazing.
IMPORTANCE	Moderate. This practice can reduce the impacts associated with stock use; however, it is less critical than the practices associated with proper confinement and restraint of stock (practices 71, 73, and 74).
CONTROVERSIAL ELEMENTS	None.
KNOWLEDGE NEEDS	None.
FREQUENCY OF RECOMMENDATION	Uncommon.
COSTS TO VISITORS	Moderate. This requires some time and energy on the part of stock parties. That requirement is small compared with the time generally required for handling stock and can be considered a responsibility that must be accepted for the privilege of taking stock into the backcountry.

PRACTICES THAT CAN BE COUNTERPRODUCTIVE

The following four commonly recommended practices should not be generally recommended. They are likely to have more negative consequences than positive benefits.

1. VISIT WILDERNESS DURING LESS POPULAR DAYS OF THE WEEK AND/OR SEASONS

DESCRIPTION

Most people visit the wilderness on weekends and, in most places, during summer. Spring, winter, and fall can be particularly popular seasons in the South. Plan trips so that they fall during weekdays and less popular seasons of the year.

PROBLEM ADDRESSED AND RATIONALE

Too many encounters. Solitude tends to decline as the number of encounters between parties increases. The number of encounters is also strongly influenced by the number of parties in the wilderness at one time. Because this number is highly concentrated during certain seasons and days of the week (Roggenbuck and Lucas 1987), the number of encounters at more popular times could be reduced by encouraging more parties to shift their visits to less popular times. This would constitute shifting use from weekends to weekdays and from popular to unpopular seasons (in mountainous areas, for example, from midsummer to other seasons).

NEGATIVE CONSEQUENCES

Shifting use to seasons other than summer may involve shifting it to seasons when trails, meadows, and animals are more vulnerable to damage. Thus, this practice may conflict with practices 4 (avoid trips where and when soils are wet and muddy) and 5 (avoid trips where and when animals are particularly vulnerable to disturbance). Shifting use to weekdays and less popular seasons also can have the negative consequence of increasing encounter levels at these times. It is not clear how to evaluate the overall costs and benefits of simultaneously decreasing encounter levels at popular times and increasing encounter levels at other times. Visitors that seek out low-use times and expect to see few people are particularly vulnerable to the increase in encounters that is likely to accompany temporal shifts in use.

FREQUENCY OF RECOMMENDATION

Uncommon.

CONCLUSION

General recommendations to visit during less popular times of the year appear to have more potential costs than benefits. Information about use levels at various times might be given to visitors to help them make better-informed decisions—but not to attempt to influence their decisions. Even when providing information, it is important to suggest caution about use when the environment is fragile (such as during early season snowmelt) or when animals are vulnerable to disturbance (such as during winter).

2. AVOID VISITING MORE POPULAR PLACES IN THE WILDERNESS

DESCRIPTION	When planning a trip, select trailheads, trails, and destination areas that are not heavily used. Avoid places that are popular and likely to be "crowded."
PROBLEMS ADDRESSED AND RATIONALE	(1) Too many encounters. Shifting use away from popular places should reduce the number of encounters in these places. If the shift is pronounced enough, opportunities for solitude should improve in popular places. (2) Deterioration of grazing areas. Reduced grazing of popular forage areas would reduce the prevalence and severity of overgrazing. (3) Human waste. Reduced use of popular places without toilets could reduce problems with accumulation of human waste. A number of other problems, such as trail and campsite deterioration and wildlife impacts, might be reduced in popular places by this practice; however, the practice would be relatively ineffective because there is only a weak relationship between these problems and amount of use.
NEGATIVE CONSEQUENCES	Visitor use that is shifted away from popular trails and destination areas will go elsewhere. This can result in the creation of problems in places that did not have problems before. Virtually all types of problems—trail and campsite deterioration and proliferation, litter, increased encounter levels, and wildlife impact problems—are likely to increase. Negative consequences in currently little-used places are likely to outweigh positive benefits in popular places. Both loss of solitude and increase in ecological impact are greater where use levels increase from low to moderate than where they increase a similar amount, but from moderate to high levels (Cole 1987b; Stankey 1973). This suggests that the increase in problems created by increased use of little-used places is likely to be much greater than the reduction of problems caused by decreased use of popular places. In addition, the number of places where new problems are likely to develop is likely to be greater than the number of places at which problems will be reduced. Moreover, the currently little-used places are the ones that come closest to meeting the ideals laid out in the Wilderness Act; their integrity should not be sacrificed in order to reduce problems elsewhere.
FREQUENCY OF RECOMMENDATION	Uncommon.
CONCLUSION	In most situations, general recommendations about visiting less popular places are likely to be counterproductive. It is not clear that this practice will alleviate problems substantially in popular places; there are more effective ways to deal with most problems (such as requiring supplemental feed for stock, providing toilets, and selecting "out-of-the-way" campsites). Moreover, it is likely that problems will be created in currently little-disturbed places. There are situations, however, where it is appropriate to divert use from specific overused places to identified alternative use locations (Roggenbuck and Berrier 1981; Thornburgh 1986). This could be particularly useful in avoiding wildlife impacts—by advising people to stay away from or to not camp in certain critical habitats or places (such as in meadows in general or at a specific critical meadow).

3. BUILD FIRE IN A HOLE CUT IN SOD

DESCRIPTION

Build a campfire in dense vegetation by digging a pit, through the sod, down to mineral soil. Remove the plants in as large a block as possible and place them and the soil some distance from the pit. Dig the pit as deep as the plants' roots and keep the pit sides as vertical as possible. Make the pit large enough to avoid burning the surroundings. Patting mineral soil around the perimeter of the pit and keeping the perimeter moist can also help avoid scorching. After having the fire and cleaning out ashes, replace the soil and sod, making sure there are no air pockets. Water the site and remove evidence of disturbance.

PROBLEM ADDRESSED AND RATIONALE

Proliferation of campsites. This practice is a means of building a campfire in dense vegetation, with minimal disturbance. Where disturbance is minimized, the probability of creating a new campsite is reduced.

NEGATIVE CONSEQUENCES

Without question, this practice is the best way to minimize campfire impacts in areas of dense vegetation. The probability of the practice being ineffective and leaving a fire scar is high, however. Vegetation can be severely injured while being moved, it can dry out while being stored, and it can fail to grow after being replaced. Campfires should be built in a place without dense vegetation or they should not be built at all.

FREQUENCY OF RECOMMENDATION

Uncommon.

CONCLUSION

This practice was advanced as a way to minimize campfire impacts in places with dense vegetation. The National Outdoor Leadership School, which was involved in the initial development of this procedure, no longer uses the technique. Reexamination of old fires revealed frequent lack of success. The simple solution to the problem of avoiding impact is to not camp on dense vegetation on nights when a campfire is desired.

4. DISPOSE OF HUMAN WASTE IN A LATRINE

DESCRIPTION	Dispose of human waste in a single latrine excavated to handle the human waste of the entire party.
PROBLEM ADDRESSED AND RATIONALE	Human waste. Latrines are basically informal toilets established to concentrate waste in places where use is heavy and adequate dispersal of catholes is difficult.
NEGATIVE CONSEQUENCES	The difference between a latrine and a toilet is that each group digs its own latrine. In popular camping areas, proliferation of latrines becomes as much of a problem as proliferation of catholes. Moreover, the concentration of human waste in a latrine dramatically slows decomposition rates and attracts animals that dig up the latrine. The result is that latrines create more of a health hazard than individual catholes.
FREQUENCY OF RECOMMENDATION	Uncommon.
CONCLUSION	Latrines are generally recommended for large parties in popular camping places. Ideally, toilets should be provided in places where latrines seem like a good idea. Where toilets are not provided, widespread dispersal of catholes (people may have to walk a long way from camp) is preferable to a latrine. The only other options are to go with a smaller group or to stay away from very popular camping areas. With few exceptions, digging a latrine will increase the health hazard.

PRACTICES THAT ARE APPROPRIATE ONLY IN CERTAIN SITUATIONS

The following eight commonly recommended practices are appropriate in certain situations, but are inappropriate elsewhere. In each case, readers are referred to a recommended practice that describes situations where the practice is not appropriate.

1. **SELECT AN ESTABLISHED CAMPSITE.** This practice is appropriate in popular places with well-impacted campsites; it is not desirable in little-used places (see practice 24).
2. **SELECT AN UNUSED CAMPSITE.** This practice is appropriate in little-used places; it is inappropriate in popular places with well-impacted campsites (see practice 23).
3. **DO NOT CAMP ON HEAVILY USED CAMPSITES.** This practice is appropriate in little-used places; heavily used campsites should be used in popular locations (see practice 23).
4. **DISPERSE ACTIVITIES ON CAMPSITES.** This practice is appropriate when camping on previously unused sites in little-used places; it is not appropriate when camping on established, well-impacted campsites (see practice 32).
5. **CONCENTRATE ACTIVITIES ON CAMPSITES.** This practice is appropriate when camping on established, well-impacted campsites; it is not appropriate when camping on unused sites (see practice 34).
6. **BUILD FIRE IN AN EXISTING FIRERING.** This practice is appropriate when camping in popular locations with well-impacted campsites; it is inappropriate when camping in little-used places (see practice 42).
7. **AVOID BUILDING FIRE IN AN EXISTING FIRERING.** This practice is appropriate when camping in little-used places; it is inappropriate when camping in popular places with well-impacted campsites and established fire sites (see practice 41).
8. **DISMANTLE ALL FIRERINGS.** This practice is appropriate in little-used places and on little-impacted sites; it is inappropriate on established campsites that are likely to be used by other parties (see practice 49).

DEVELOPING LOW-IMPACT MESSAGES

The preceding section described each recommended practice individually. When putting together a low-impact message, it will be more effective to group individual practices and to weave discussions of rationale into statements of recommended practices. This makes it easier to convey the way of thinking and the ethic that is the ultimate goal of low-impact education.

Considerable creativity and writing skill are required at this stage. One example of an attempt to convey this way of thinking is the 1986 revision of the National Outdoor Leadership School's (NOLS) Conservation Practices (see appendix C). This revision was a cooperative effort between NOLS and the author to develop a set of recommended practices and rationale that incorporates the best available information. Other examples can be found in books—such as Hampton and Cole (1988) and Hart (1977)—and journal articles—such as Curtis (1982) and Wallace and DeBell (1982).

Tailoring the Message to Different Environments

The recommendations described in this report are general ones that apply across a range of different environments. Often, specific information is available about different environments that can make recommendations more effective. For example, in deserts, sand washes are among the most durable surfaces, while soils crusted with cryptogams (moss, lichen, algae, and fungus) are among the most fragile. At high altitudes snowfield turfs are durable, while heaths are quite fragile. The specificity of recommendations can be increased by developing different messages for different environments. In addition, the importance of various practices differs between environments. For example, campfire practices designed to avoid excessive use of firewood are particularly important in environments with low wood productivity,

Tailoring the Message to Different User Groups

such as timberline forests or deserts. Certain environments also offer unique opportunities for minimizing impact. For example, on coastlines, the effects of fires built below high tide will be removed by periodic tides. Low-impact guidelines for (1) deserts, (2) high altitude and high latitude areas, (3) travel on snow and ice, and (4) coastline areas have been developed for use in conjunction with the general NOLS Conservation Practices. These guidelines are presented in appendix D as examples of how general practices might be modified in certain environments. Similar guidelines might be developed for other environments, such as swamps or eastern forests.

Different types of users also present particular challenges and offer unique opportunities for minimizing impact. Stock users, for example, must be much more cautious than backpackers if they are to keep impact to low levels. Rafters and stock users, because they can carry specialized equipment, have the opportunity to reduce their impact to extremely low levels. Low-impact messages should be tailored to take advantage of these differences. There is no reason to burden backpackers with information about low-impact stock or raft use. Special considerations for some important user groups follow. Similar guidelines might be developed for other user groups, such as day hikers, anglers, and hunters.

Stock Users—Parties traveling with stock are particularly prone to causing problems with (1) deterioration of constructed trails, (2) creation of new trails, (3) deterioration of established campsites, (4) creation of new campsites, (5) visitor conflict, (6) deterioration of grazing areas, and (7) competition with wildlife. This potential reflects the greater bearing weight of stock, the tendency for shod hooves to churn up soil, the trampling damage associated with confining stock, and the consumption of forage by grazing stock. Key elements to low-impact stock use are care in grazing and in confining stock. It is also preferable for stock parties to keep to constructed trails and substantially impacted camping areas (which are able to tolerate use by stock parties without further deterioration), except where they are prepared to be especially careful. Practices specific to parties with stock were described in detail in a previous section.

Boaters—Rafters, and to a lesser extent kayakers and canoers, can carry fire pans (to shield the soil from campfire impacts), charcoal briquets (to avoid having to collect firewood), portable toilets (for removing human waste), and containers (to carry out ash and charcoal from campfires). Boaters often can also minimize their impact by camping below the annual high water line. These environments are often quite resistant, and much of the impact that does occur is removed by yearly floods. For these reasons, boaters should generally cause less impact than other users (if they take advantage of these opportunities).

Large Parties—Large parties are particularly prone to causing problems with (1) enlargement of established campsites, (2) creation of new trails, (3) creation of new campsites, and (4) visitor conflict. Practices 26 (select a site that is large enough to accommodate your party) and 32 (confine tents and activities to already impacted areas) are critical to avoiding campsite enlargement. Advance planning to identify places with sufficiently large campsites is needed. The three latter problems can be avoided by breaking the party up into smaller groups for traveling and camping. These smaller groups can spread out. On trails, this will reduce the conflict that results when large parties are encountered. Off trails, smaller groups are less likely to create a new trail, particularly if they spread out when walking (practice 19). At little-used camping areas, groups should stay separate, except to meet on some durable spot. This separation, along with spreading out tents and activities (practice 34), should reduce the likelihood of new campsites developing.

Parties Planning To Have Fires—Parties planning to have wood fires must be more cautious than those that do not. All of the practices in the section on campfires (practices 37-50) apply only to these users. Such parties must use particular caution when camping in little-used places because it is so important to camouflage any disturbance (practice 36). It is easy, when having a campfire, to leave a long-lasting scar. Such evidence tends to attract subsequent use, a tendency that often results ultimately in the creation of new campsites.

Parties Traveling Cross Country—Established trails are designed to accommodate use with minimal problem; well-impacted campsites function in the same way. Parties that choose to travel cross country and camp in little-used places accept special responsibilities for low-impact use (practice 6). Undisturbed places can experience long-term damage very quickly. Large parties, parties with stock, and parties planning to build campfires must be particularly careful in such places. Much more knowledge and decision-making ability are

Tailoring the Message to Different Audiences and Media

required to select cross-country routes (practice 21) and campsites (practice 27) that can be used without leaving evidence of your passage. More care is also needed to spread out when hiking (practice 19) and camping (practice 34). Lengths of stay on campsites must also be short (practice 35).

Backcountry travel and campsite selection and behavior techniques differ so greatly between trail users and cross-country hikers that separate materials might be worked up for each type.

It should be obvious that there is a large amount of information on low-impact use that must be communicated to visitors. The information in the NOLS Conservation Practices (appendix C) takes 10 single-spaced pages. Clearly, all of this information cannot be communicated to users with signs or even by information specialists at trailheads. Pamphlets, books, video demonstrations, workshops, and ranger contacts are all needed. We need to (1) decide which media are most effective for which messages, (2) identify the most effective media for different audiences, and (3) ultimately get all messages across effectively to all users. Messages need not only to *communicate*, but also to *motivate* visitors to adopt recommendations.

Unfortunately, information on how to communicate and motivate visitors is limited. A variety of educational media have been employed, but effectiveness has seldom been rigorously evaluated. Moreover, there has been little attempt to apply existing theory to this problem. A major research effort is needed to develop effective means of instilling a low-impact ethic.

Despite the importance of the topic, I will not attempt to summarize what is known about how to communicate with backcountry users. A major report, comparable in length and detail to this one, is warranted. Interested readers are referred to several articles that describe educational programs (Bradley 1979; Hart 1980) and a comprehensive review of alternative communication methods (Martin and Taylor 1981). Other worthwhile sources include Fazio's (1979) and Roggenbuck and Berrier's (1981) work evaluating the effectiveness of communication techniques, and Dustin's (1985) attempt to bring psychological theory to bear on the question of how to instill a wilderness ethic.

RESEARCH GAPS

In the "knowledge needs" category under each practice, a number of research gaps were identified. These gaps are listed below, along with brief descriptions. They are listed in an approximate order of priority, starting with those that will most improve the application of practices.

1. *The durability of different environments.* We need to evaluate the durability of different environments as places for off-trail hiking, low-impact campsites, campfire sites, and holding stock. This is a broad topic. A fair amount is already known (Cole 1987b; Kuss 1986), and we will never have all the answers; however, it is important to continually increase our knowledge. This topic is assigned highest priority because this is knowledge that should be used continually by backcountry users and it is capable of substantially reducing impact.

2. *Harassment and disturbance of animals.* We need to learn how serious animal disturbance is. We need to learn which species are affected, where and when disturbance occurs, and how behavioral alteration can reduce problems. This is a broad topic about which very little is known (see Boyle and Samson 1983 for an annotated bibliography). Although we do not know enough to be certain, it is likely that adoption of disturbance-avoiding behavior could reduce impact substantially.

3. *Impacts of packstock on grazing areas.* We need to learn more about the effects of grazing and trampling on meadows and grasslands. We need to understand the effect of differences in the amount, timing, frequency, and location of grazing. This would be useful in developing better guidelines for avoiding overgrazing, recommended maximum lengths of stay, and the need for supplemental feed. This topic is a broad one about which little is known.

4. *Water pollution problems.* We need to know more about the nature, severity, and causes of recreation-related water pollution. To what extent does camping close to lakes and other water bodies cause problems? Is soap or fecal contamination of waters a common problem? We know very little about recreational impacts on water in wilderness (see Herrmann and Williams 1987 for a review). Research results may not change recommended practices, but it is critical to evaluating the importance of practices taken to avoid problems.

5. *Visitor preferences for campsite attributes.* We need to know more about the attributes that visitors seek when selecting a campsite. Tradeoffs between attributes are often required. Recommendations that visitors seek campsites away from lakeshores are based on an assumption that visitors are willing to give up camping by a lake for more solitude away from the lake and the opportunity to visit less disturbed lakeshores. Is this assumption, and others that we make about visitor preferences, valid? We know a fair amount about certain visitor attitudes and preferences (Stankey and Schreyer 1987), but we know little about how they make tradeoffs. This knowledge is important to recommendations related to behavior intended primarily to maintain quality visitor experiences.

6. *Sources of visitor conflict.* We need to know more about behaviors that result in conflict between parties. We know that certain visitors object to large parties, parties with stock, and parties with pets. The prevalence of these sentiments and means of mitigating conflict should be explored. The importance of other sources of conflict—shooting guns, competitive events, and so on—should also be examined.

7. *Relationship between quality of experience (visitor satisfaction) and frequency of encounters.* Although frequently studied, this relationship remains poorly understood. The aspect of this relationship most relevant to low-impact practices is whether or not the positive benefits of fewer encounters in popular places and at popular times exceed the negative consequences of more frequent encounters elsewhere and at other times. These changes are likely results of attempting to shift use away from popular places and times.

8. *Relationships between campsite impact and use frequency, length of stay, and party size.* We need to learn, for different environments, how much use sites can support before concentrating camping on a few well-impacted campsites becomes a more effective strategy than dispersing use among many undisturbed sites. Related to this is need for a better understanding of how rapidly impact is caused by parties of various sizes. This would be useful in recommending more specific length-of-stay and party size limits. Much is already known at a general level about these relationships (see Cole 1987b for a review). More quantification is needed for specific vegetation types. While this is likely to improve specificity, the basic concepts presented in the practices should be relatively unaffected by results.

9. *Seasonal variation in vulnerability.* We need to learn, for different environments, for different parameters (such as soil and animals), and for different sources of impact (such as stock and hikers), how vulnerability varies seasonally. We also need to learn how much variation there is in seasonal differences from year to year. We need to learn how to evaluate and predict vulnerability so visitors can vary their routes and/or behavior to account for seasonal differences. We have some general knowledge about seasonal vulnerability (such as that soils are particularly vulnerable during spring snowmelt), but more specific information is needed.

10. *Campfire impacts and the effectiveness of alternative campfire construction techniques.* A better understanding of the nature and significance of the impacts associated with collecting firewood and burning it in campfires would help in evaluating the importance of campfire practices and deciding where particular care is needed (Cole and Dalle-Molle 1982). Tests of the effectiveness of various campfire construction techniques could improve recommendations about how to build low-impact campfires.

11. *Fecal decomposition rates.* We need a better understanding of how rapidly feces and pathogenic organisms decompose and how decomposition rates can be maximized. Certain microsites might prove to be better sites for decomposition than others. A better understanding of decomposition rates might indicate where toilets are needed and how widespread the dispersal of catholes must be. Some limited research suggests that we have not shown enough concern about disposal of human waste (Temple and others 1982).

12. *How type of sole influences amount of impact.* It is widely assumed that lug-soled boots cause more damage than soft-soled boots, particularly on campsites. No studies have succeeded in demonstrating a substantial difference between sole types. Although a relatively minor point, further research might corroborate the general recommendation to wear soft-soled shoes around camp.

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APPENDIX A . LIST OF RECOMMENDED PRACTICES

I. TRIP PREPARATION

A. Clothes and Equipment

1. Choose clothing and equipment colors that blend with surroundings
2. Carry appropriate equipment

B. Party Size

3. Keep party size small

C. Where and When to Visit the Backcountry

4. Avoid trips where and when soils are wet and muddy
5. Avoid trips where and when animals are particularly vulnerable to disturbance
6. Avoid off-trail travel unless prepared to use extra care

II. GENERAL CONDUCT

A. Pets

7. Keep pets under restraint or leave them at home

B. Noise Levels

8. Be quiet in the wilderness

C. Disturbance of Natural and Cultural Features

9. Minimize disturbance of natural features
10. Do not disturb cultural artifacts or archaeological sites

D. Disturbance of Animals

11. Avoid harassment of animals
12. Do not feed animals
13. Protect food from animals

III. BACKCOUNTRY TRAVEL

A. Practices When Traveling on Existing Trails

14. Avoid walking on closed trails and/or developing user-created trails
15. Walk single file and keep to the main tread
16. Do not shortcut switchbacks
17. Take trailside breaks off trail on a durable site
18. Step off the trail, downslope, when encountering a stock party

B. Practices When Traveling Off Trail

19. Spread out when walking off trail
20. Do not mark cross-country routes
21. Choose a cross-country route that crosses durable surfaces
22. Use caution when ascending or descending steep slopes

IV. CAMPSITE SELECTION AND BEHAVIOR

A. Guidelines for Campsite Selection

23. In popular locations, select a well-impacted campsite
24. In remote locations, select a previously unused campsite
25. Never camp on a lightly impacted campsite
26. Select a site that is large enough to accommodate your party
27. Select a durable site
28. Select a concealed campsite away from trails, occupied campsites, lakes, and other water bodies

B. General Campsite Behavior

29. Wear soft-soled shoes around camp
30. Minimize intentional site alteration and the building of structures
31. Avoid trampling vegetation

C. Campsite Behavior on Well-Established Campsites

- 32. On established campsites, confine tents and activities to already impacted areas
- 33. On established campsites, dismantle any structures you built and any other inappropriate structures; leave the site clean and attractive

D. Campsite Behavior on Previously Unused Sites

- 34. On previously unused sites, disperse tents and activities
- 35. On previously unused sites, keep lengths of stay short
- 36. On previously unused sites, camouflage any disturbance

V. CAMPFIRES

A. Places Where Campfires Are or Are Not Appropriate

- 37. Limit the use of campfires
- 38. Avoid fires where firewood is not plentiful
- 39. Do not build a fire where fire danger is high
- 40. Build fires on mineral soil where trees, roots, vegetation, or rocks will not be scarred
- 41. In places with well-impacted campsites, build fires in existing firerings or on fire scars
- 42. In places without well-impacted campsites, do not use existing firerings or scars; dismantle any rings

B. Firewood Gathering

- 43. Gather firewood away from camp; disperse your gathering
- 44. Use only dead and down firewood that you can break by hand

C. Fire Site Construction on Previously Unused Sites

- 45. On previously unused fire sites, build fire in a shallow pit or on a mound of mineral soil
- 46. Do not ring a fire with rocks

D. Campfire Use and Cleanup

- 47. Keep fires small
- 48. Burn charcoal to ash; soak ashes; scatter excess firewood
- 49. On preexisting fire sites, leave the firering clean and attractive; dismantle extra firerings
- 50. On previously unused fire sites, remove all evidence of the fire

VI. WASTE DISPOSAL AND SANITATION

A. Disposal of Litter and Organic Wastes

- 51. Pack out nonorganic litter (or burn readily burned litter)
- 52. Pick up other people's litter
- 53. Pack out or burn organic garbage (or scatter fish viscera)

B. Disposal of Human Waste

- 54. Use toilets if provided
- 55. Dispose of human waste in a properly located cathole

C. Bathing and Washing

- 56. Use biodegradable soap in small amounts, if at all
- 57. Bathe, wash, and dispose of waste water away from water bodies and campsites

VII. ADDITIONAL PRACTICES FOR PARTIES WITH STOCK

A. Equipment and Trip Preparation

- 58. Use properly trained stock
- 59. Carry appropriate equipment
- 60. Minimize the number of stock

- B. Practices When Traveling on Existing Trails
 - 61. Stock should stay on established trails as much as possible
 - 62. Remove trail obstacles instead of skirting them
 - 63. Lead stock on the trail, rather than loose-herd them
 - 64. Tie stock off trail, on a durable site, when taking a break
- C. Campsite Selection
 - 65. Avoid places that have already been heavily grazed
- D. Campsite Behavior
 - 66. Keep stock off campsites as much as possible
 - 67. Keep lengths of stay at one place short
- E. Watering, Feeding, and Grazing Stock
 - 68. Water stock downstream from drinking sources on a durable spot
 - 69. Carry an appropriate amount of weed-free supplemental feed
 - 70. Place feed and salt on a tarp or in a feedbag or container
 - 71. Minimize confinement of stock when grazing; move picketed stock frequently
- F. Confining Stock
 - 72. Use existing hitch rails and corrals where available
 - 73. Where confinement is necessary, use a hitch line on a durable site away from water
 - 74. Avoid tying stock to trees, particularly small trees
- G. Cleanup
 - 75. Renovate pawed-up areas; scatter manure; remove picket pins and excess feed and salt

APPENDIX B: SOURCE MATERIALS ON LOW-IMPACT PRACTICES

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APPENDIX C: NOLS CONSERVATION PRACTICES

If we are to maintain the ecological integrity and quality experiences that backcountry provides, it is imperative that every visitor strives to minimize his/her impact both on the land and on other visitors. Otherwise management of backcountry will become increasingly dominated by rules, regulations, and restriction of access and use. The National Outdoor Leadership School has pioneered the teaching and development of practical conservation techniques, designed to minimize impact, since 1965.

We recommend the following practices as a guide to minimizing the impact of your backcountry visits. This guide represents a synthesis of our observations and experience with human impact in the backcountry, as well as the results of research on recreational impact and its causes. Under each major topic, we briefly discuss factors to consider when making judgements about how to minimize impact and the rationale behind recommended practices. These sections are followed by a list of specific practices.

NOLS welcomes comments and suggestions for further modifications to these conservation practices. Before traveling into the backcountry, we recommend that you check with local officials of the Forest Service, Park Service, Fish and Wildlife Service, Bureau of Land Management, or other managing agency for advice and regulations specific to the area.

Minimum impact backcountry use is an ethic and way of thinking. It depends more on attitude and awareness than on rules and regulations. Conservation practices must be flexible and tempered by judgement and experience. Consider the variables of each place—soil, vegetation, wildlife, moisture level, the amount and type of use the area receives and the overall effect of prior use—then use these observations to determine which recommended practices to apply. Minimize your impact on the land and on other visitors, but be sure to enjoy your visit as well.

A. BACKCOUNTRY TRAVEL

When traveling in the backcountry, care is required to minimize disturbance of both other visitors and the environment. Disturbance of other visitors is minimized when contacts are infrequent, party size is small, and behavior is considered appropriate by others. Impacts on wildlife, soil and vegetation can be minimized by walking on constructed trails that are already highly disturbed and, in many cases, have been designed to accommodate heavy use. Unfortunately, use of existing trails increases contact with other visitors. Consider the trade-off between social and ecological impacts when deciding whether to travel by trail or cross country. The impacts associated with cross country travel are minimized when group size is small, routes are carefully selected to avoid fragile terrain and critical wildlife habitat and special care is taken to avoid disturbance.

Specific practices are as follows:

1. Travel quietly in the backcountry, whether hiking by trail or cross country. You will be more aware of your environment, wildlife will be less disturbed, and other visitors will appreciate the solitude.
2. Brightly colored clothes and equipment have limited advantages in the backcountry, despite their great appearance in store windows. To minimize the likelihood that others will see you and your camp, attempt to wear and carry earth colored clothes and equipment, particularly tents.

3. If you are camping with a large group, hike in groups of no more than 4-6 people. Four is an optimum number, especially for cross country travel, because in case of sickness or injury one person can stay with the victim while two people go for help. A group of four is small enough to minimize impact on other visitors and on the environment when traveling cross country. Use judgement in breaking your group into smaller units to minimize impacts and maximize individual enjoyment and self-reliance.
4. If possible, visit the backcountry during seasons or days of the week when use levels are low. This should be tempered with a concern for avoiding travel when the environment is particularly fragile (for example, during snowmelt when trails are muddy). Similarly, by visiting places that receive little use, contact with others will be minimized. Again, this should be tempered by a concern for avoiding disturbance of such little-used and little-impacted places. Large groups can disturb these places rapidly.
5. Pick up all of your litter and any of that left by others that you can. On the way out—when your pack is light—try to pick up a little extra.
6. Allow others a sense of discovery by leaving rocks, plants and other objects of interest as you found them. Enjoy an occasional edible plant, but be careful not to deplete the surrounding vegetation or to disturb plants that are either rare or do not reproduce in abundance (such as many edible lilies).
7. Respect the needs of birds and other animals for undisturbed territory. When tracking wildlife for a photograph or a closer look, stay downwind, avoid sudden movement, and never chase or charge any animal. Avoiding disturbance is particularly important at birthing or nesting sites and at watering or feeding grounds, especially during times of year, such as winter, when animals are already stressed. Find out as much as you can, before entering the area about species, places and times when disturbance is likely. Some animals may be quite curious, but resist the temptation to feed them. Even in low-use areas, feeding wildlife can alter feeding habits, migration patterns and reproduction levels, ultimately resulting in unnatural behavior, population structure and species composition.
8. When following existing trails, walk single-file on the designated path. Walking outside the tread, to walk abreast or to avoid rocks or mud, breaks down the trail edge and widens the trail. It can also lead to the development of multiple trails. As with muddy stretches, snowbanks should be crossed, rather than skirted, to avoid creation of additional paths. Shortcutting switchbacks causes erosion and gullying. If a trail is impassable, walk on hard surfaces (such as rock, sand or snow) as much as possible and notify the agency officials responsible for that area.
9. When taking a break along the trail, move off the trail some distance to a durable stopping place. Here you can enjoy more natural surroundings and other parties can pass by without contact. Durable stopping places include rock outcrops, sand, other non-vegetated places and sites with durable vegetation, such as dry grasslands.
10. When you meet a stock party on the trail, allow them plenty of room, as stock are frightened easily. The entire party should move off to the same side of the trail, if possible the downhill side, and stand quietly until the stock party passes. Sometimes it helps to talk, in a low voice to the first rider, so the horses have advance notice of your presence.

11. Cross country travel is acceptable if groups are small (no larger than 4-6) and fragile areas can be avoided. Cross country travel is undesirable where user-created trail systems are developing, in wet places, on steep and unstable slopes, on crusted desert soils and in places where wildlife disturbance is likely. It is most desirable on rock, sand, snow and ice or stable non-vegetated surfaces.
12. When traveling cross-country it is generally best to spread out rather than have everyone follow the same route. This will minimize the amount of trampling any place receives and avoid the creation of undesired trails. In some places it is not practical to spread out; avoid such routes if other groups are likely to follow in your footsteps and particularly if incipient paths are developing. In extremely fragile places, such as on cryptogam soils, it is best to walk single-file so only one trail is created. Cross-country travel should be avoided in such fragile places.
13. Do not blaze trees, build cairns or leave messages in the dirt. Such markers may be confusing and they detract from other visitor's sense of discovery.
14. In steep terrain it is least damaging to ascend or descend on rock outcrops or snow. On soil-covered surfaces it is less damaging to ascend than to descend steep slopes. If slopes are so steep that it is necessary to dig toes and heels into the soil to get a grip, some other route should be located, if possible. Spreading out can also reduce damage. When descending loose scree slopes, move slowly and cautiously. Rapid descents can move sizeable quantities of scree downslope. This erosion is undesirable and should be minimized.
15. If traveling with pets (this is prohibited in many National Park Service areas and discouraged in many other areas), keep them under restraint. They should never be allowed to chase wildlife or harass other users and barking should be discouraged. Pets should be left at home.

B. CAMPSITE SELECTION AND USE

Selecting an appropriate campsite is probably the most difficult and perhaps the most important aspect of low impact backcountry use. It requires the greatest use of judgement and information and often involves making trade-offs between minimizing ecological or social impacts. A decision about where to camp should be based on information about the level and type of use in the area, the fragility of vegetation and soil, the likelihood of wildlife disturbance, an assessment of previous impacts and your party's potential to cause or avoid impact.

In selecting a campsite, the objective is to choose one that will not be damaged by your stay. Generally it is best to camp either (1) on apparently undisturbed sites (if your stay will cause little impact and, therefore, not encourage subsequent use by other parties) or (2) on sites that are so highly impacted that further use will cause no additional impact. Lightly impacted sites—those that have obviously been used but with a substantial amount of vegetation surviving on-site—should always be avoided; such sites will deteriorate rapidly with further use, while if unused they should recover rapidly.

When selecting an undisturbed site, choose one that either has no vegetation or a durable vegetation cover. When selecting a high impact site, choose one that is concealed and, if possible, in thick forest duff (the dark layer of decomposing leaves, needles and twigs that lies on top of the lighter, grittier mineral soil). On such sites, little vegetation can survive use, but exposure of mineral soil will be less pronounced on sites with thick organic horizons. If mineral soil exposure is minimal, soil compaction and erosion will also be minimized. Other considerations when selecting a site include camping away from critical wildlife habitat, particularly water holes, away from trails and other campers and, in popular areas, away from "beauty spots" and lakes and streams.

Appropriate camping behavior depends upon whether a pristine or a high impact site has been selected. On pristine sites it is best to spread out tents, avoid repetitive traffic routes and move camp every night. The objective is to minimize the number of times any part of the site is trampled. On high impact sites, tents should be concentrated on already impacted areas, as should traffic routes, and multi-day stays are acceptable. The objective is to confine impact to places that have already been impacted and avoid enlargement of the site.

Specific practices of, first, site selection and then camping behavior are as follows:

1. Obey any regulations in the area related to campsite selection. Select either a pristine site or a high impact one. A pristine site is one that shows no evidence of previous use. A high impact site is one on which vegetation has been removed from an area large enough to accommodate your group. Avoid selecting a pristine site in popular areas or a high impact site in an infrequently used area. Select a high impact site for large groups, multi-day stays or when you want to build a fire (if there is abundant firewood in the area). Allow enough time and energy to select an appropriate site.
2. Selection and use of pristine sites
 - a. Select a site, well away from high impact areas, that shows no evidence of previous use and is unlikely to be used after you leave. Durability of the ground surface is the most important consideration in determining exactly where to set up tents and the "kitchen". Non-vegetated areas, such as slickrock, rock outcrops, gravel bars, beaches and snow, are best. Forest duff is acceptable if it is possible to not crush any plants or seedlings (forest-floor vegetation is highly fragile). Grassy areas and dry meadows can also make good pristine campsites. They are quite resistant and capable of recovering rapidly from the effects of one night of low-impact use. When deciding whether or not to camp in a meadow, consider whether you will impact other users or wildlife. Places to avoid, if possible, include vegetated forest-floors, sites with low-growing shrubs (particularly those at or above timberline), moist areas, and crusted desert soils.
 - b. In setting up camp, disperse tent sites and the "kitchen" on durable sites. Wear "soft" shoes around camp. Minimize activity around the kitchen and places where packs are stashed and watch where you walk to avoid crushing vegetation. Take alternate paths to water and minimize the number of trips to water by carrying water containers. Avoid using the same general area for more than one night. Dispersal of sites, traffic routes and activities and short stays are particularly important for large groups, which must be especially careful not to disturb the site. When leaving, camouflage the area by covering any scuffed-up places with duff or other native materials (see under Fires and Stoves for more).
3. Selection and use of high impact sites
 - a. Select a site that has already lost most of its vegetation cover. If possible, avoid those with obvious soil erosion and with root exposure and mutilations on most trees, as well as those that have coalesced into large campgrounds. Such sites are poorly located and/or have been used improperly in the past; they should probably be permanently closed to use. In very popular areas, however, use levels are so high that it is best to use these severely impacted sites. If possible, choose screened, forested sites, with thick organic horizons. Otherwise choose sites that naturally lack vegetation—those that are gravelly, sandy or have exposed mineral soil. Avoid camping in meadows and the zone between forest and snow. The visual impact of campsite deterioration is severe in

these particularly scenic areas. Avoid camping close to water sources, trails, other campers and "beauty spots". The choicest camping spots are often prime locations for other people's enjoyment of the area, so take a little extra time to seek out a more "out-of-the-way" site.

- b. In setting up camp, do not sprawl out. Set up tents and the "kitchen" in places that have already been impacted, with well-developed paths between tents and the "kitchen". Avoid enlarging the site and try not to step on tree seedlings. When leaving camp, make sure that it is clean, attractive and will be appealing to the next group to use the area.
4. On all sites, leave the area as you found it. Do not dig trenches for tents, cut standing trees or branches or pull up plants or embedded rocks to make a pleasant camp. If you clear the sleeping area of surface rocks, twigs or pinecones, replace these items before leaving. On high impact sites, it is appropriate to clean up the site and dismantle inappropriate user-built facilities, such as multiple firerings, constructed seats, tables, etc. However, properly-located and legal facilities, such as a single firering in many areas, should be left. Dismantling them will cause additional impact, because they will be rebuilt, with new rocks, and impact a new area.
5. A backcountry camp should be organized. If you have laundry to dry or equipment to air out, make sure these items are not in sight of other campers or hikers, especially around lakeshores or in open meadows. Make sure your food is protected from animals. This is especially important in bear country.

C. FIRES AND STOVES

Fires should be used sparingly, as they are among the most serious visual impacts in the backcountry. They can also sterilize the soil locally and collection of firewood can scar live trees and snags and deplete large decaying wood in the soil. Large decaying wood plays an important and irreplaceable role in the ecosystem—in water and nutrient conservation and as a substrate for biological activity; smaller pieces of wood are less critical. Fires can also escape and burn large areas. Avoid use of fires when fire hazard is high. Finally, many areas have regulations that control the use of fire; be certain to know and respect regulations.

Use of stoves is always preferable to building a campfire. Always carry a stove; use it for most if not all cooking; and only build a fire where it is safe and will not cause further damage or deplete wood supplies. Campfires are acceptable at high impact sites in existing firerings or places where fires have been built—but only if there is abundant dead wood on the ground. Fires should be avoided in popular areas in the desert or near timberline, because wood regenerates so slowly in these places. On pristine sites, fires are less desirable. Although firewood may be abundant, fires on undisturbed sites can damage soil and vegetation, as can concentrated trampling around the fire. In popular areas there is no excuse for building a fire where one has never been built before. In remote places, impact can be minimized if fires are carefully constructed on sandy sites or sites with abundant mineral soil, or below the high water line along water courses or on the coast. With special care fires can also be built on rocks or in dense vegetation (see below for further description of techniques), but use of these latter techniques should be minimized.

When building a campfire on a pristine site, care must be taken in locating the fire, constructing it, selecting and burning wood, avoiding trampling around the fire and in cleanup. When building fires in existing rings on high impact sites, only care in selecting and burning wood and a moderate amount of cleanup is necessary.

Specific fire-building practices are as follows:

1. Locate campfires where they are safe, damage will be minimal and cleanup and camouflaging of the site will be easiest.
 - a. Always build fires far from tents, trees, branches, root systems and large rocks that might be damaged by sparks and heat or blackened by smoke.
 - b. When looking for a potential fire site in a pristine area, the usual types of surfaces to choose between are vegetation, rock, duff (the dark surface layer of decomposing leaves, needles and twigs) and bare mineral soil (the lighter and grittier soil layers beneath the duff). In order of preference, choose a surface of mineral soil, thin duff (less than 2-3 inches thick), sparse vegetation, or a flat rock. Never build a fire in thick duff because the danger of fire spreading is great. Avoid fires in dense vegetation because it is difficult to not damage the vegetation.
 - c. On a previously-used site where fires have been built in several places, select the fire scar that is most pronounced and/or is in the best location (in terms of the criteria in a and b above). If you can, cleanup all other firerings and scars (see Practice 4b below). This cleanup will more than compensate for the effect of another fire on the site.
2. Construction. Fires can be built either on a mound or in a pit. Mound fires are preferable if an adequate supply of sand or mineral soil can be found without damaging the source area. Regardless of fire type or location, avoid blackening rocks by cooking on a stove, using a grill with folding legs, or hanging pots from a dead branch.
 - a. **Mound fire:** Spread a layer of soil about 6 inches deep on top of the ground surface, over an area larger than the fire will occupy. Build the fire on the soil. Mound fires are most likely to be built on mineral soil, duff or rock.
 - b. **Pit fire:** In mineral soil, simply dig a shallow pit, several inches deep. Build the fire in the pit. Where there is a thin duff layer or sparse vegetation, clear the duff down to mineral soil from a circle several feet in diameter; build the fire in a shallow pit in the center of the circle of mineral soil. If a fire absolutely must be built in dense vegetation, dig a pit down to mineral soil and as deep as the plant's roots, if possible. Keep the pit sides as vertical as possible. Make sure it is not so deep that air circulation is hindered. Remove the plants and soil in as large a block as possible and place them neatly some distance from the pit. Make sure the pit is large enough to avoid burning the adjacent vegetation. This can also be prevented by patting mineral soil around the firepit perimeter and by keeping the perimeter moist. The removed sod should also be kept moist.
3. Select firewood from small diameter wood lying loose on the ground. If wood is not small and dry enough to break by hand it should not be used. Do not bring saws or axes. Gather wood some distance from camp on existing sites and always leave some wood, so the area does not look denuded. Collect only enough wood for a small fire; do not stockpile. Avoid burning food scraps and plastic. Complete combustion is difficult, wastes wood and transfers large quantities of heat into the soil; incomplete combustion makes cleanup difficult.
4. Cleanup
 - a. At least 30 minutes before finishing with the fire, begin to burn remaining wood and charcoal to ash. Heap coals and unburned pieces of wood where the heat is greatest and keep adding very small pieces of

wood until only white ash remains. Soak ash with water and crush any charcoal remnants to powder. Scatter any excess firewood away from the site.

- b. If using a pre-existing fire site, leave a small clean firering to attract the next user. If large quantities of ash were generated by you or previous users, scatter it some distance from the campsite. Any excess blackened rocks—from an over-built firering or from multiple firerings—should be returned to their original locations, if possible, or scattered some distance from the camp.
- c. If using a pristine site, scatter ash widely. If using a mound fire, scatter the soil and ash and camouflage the surface with mineral soil or litter and duff (whatever matches the surroundings). If the mound was built on a rock, rinse the rock off. If using a pit, fill it in and camouflage the site. For pits in dense vegetation, make sure there are no air pockets underneath or around sod blocks to cause drying of roots or subsequent settling of the soil. Water the site well to help recovery and landscape the area.

D. SANITATION

Proper disposal of human waste is difficult, particularly in heavily used areas where toilets are not provided. Only footprints are more difficult not to leave in the backcountry. The most important objectives when deciding on how to dispose of waste are (1) to minimize the chance that other people will find it, (2) to minimize the chance that waters will be polluted and (3) to maximize the rate of decomposition. In the past, objectives 1 and 2 have been met by recommending burial of feces in catholes or latrines (for large groups) well away from water bodies. The oft-stated contention has been that decomposition by soil organisms would be rapid. Unfortunately, recent research has found that this is not always the case. In the Rocky Mountains, pathogenic organisms survived in buried feces for a year or more. Moreover, survival was little affected by either depth of burial or the type of site where the feces was buried. It is still generally best to deposit feces in catholes, but the slow decomposition rate emphasizes the need to disperse catholes widely and far from water, campsites and other frequently used places.

Decomposition is most rapid when feces is left at the surface in the open sunlight. It is least rapid when concentrated (as in a latrine) or when deposited in soils that are cold, sterile or wet. Therefore, in remote places where there is little chance that others will find your feces, it may be desirable to leave it at the surface. In more popular places, it will be necessary to bury feces in catholes or, as a last resort (for large groups) to concentrate it in latrines. Considerable judgement must be exercised to determine if surface deposition is acceptable and whether to use a latrine or individual catholes.

Urination is less of a problem. It has little direct effect on vegetation or soil. It does attract salt-craving wildlife, however, and they can defoliate plants and dig up soil. Therefore, it is best to urinate on rocks and in places where urine is unlikely to attract wildlife.

The primary consideration with washing yourself or your clothes is to avoid contamination of water supplies.

Specific practices are as follows:

1. Only leave feces on the surface in low use areas, well away from trails, campsites and both perennial and seasonal water bodies. Choose a dry, open exposure that is unlikely to be walked over. Scattering and smearing the feces around will maximize exposure to the sunlight. Surface disposal is most desirable above timberline where digging holes or moving rocks can cause long-lasting impact.

2. In most situations, catholes are the preferred method of disposal. Choose a level spot and dig a hole, about 6 inches deep, in the organic soil horizon, where organisms are most abundant. Avoid wet areas and go at least 200 feet from trails, campsites and water bodies.
3. Latrines may be necessary for long stays by large groups in popular areas. Locate the latrine away from trails, camps and water bodies, on a well-drained forested site with thick organic horizons. Build it when you first arrive in camp and make sure that everyone knows where it is. Latrines should be at least 12 inches deep to minimize the chance that they will be dug up by animals or exposed by other people. After each usage, feces should be covered with soil and compressed with foot or shovel. This encourages decomposition. Fill in the latrine once it gets within about 4 inches of being full.
4. Minimize the use of toilet paper. If it is used, either pack it out (ideally) or burn it as completely as possible and bury any remnants. Do not burn toilet paper if fire hazard is high or if regulations prohibit it. Tampons should be packed out (unless you are in grizzly bear country) or burned in a very hot fire; they should never be buried.
5. It is best to urinate away from trails, campsites and water bodies. Areas with thick organic horizons and bare rock are the best sites.
6. Soap must not enter lakes or streams, so it is best to minimize its use. If bathing with soap is necessary, get wet; lather up on shore far from water; and rinse off far from water bodies with water carried in a pot. This procedure allows the biodegradable soap to break down and filter through the soil before reaching any body of water. Clothes can be cleaned by thorough rinsing. Soap is not necessary and residual soap can cause skin irritation. Avoid even rinsing in small water bodies.

E. WASTE DISPOSAL

The basic rule of waste disposal is to pack out what cannot be avoided by careful meal planning. Only waste water and fish viscera should be scattered and burning of waste should be minimized. Scattering of food remnants will attract wildlife and can alter feeding habits, migration patterns and reproduction levels. Although these effects are unlikely to be serious in remote places, it is always best to pack out scraps. Burial is ineffective because animals will dig up waste.

Specific practices are as follows:

1. Waste water, from washing dishes or excess cooking water, should be drained off either in the corner of a fire pit or away from water bodies and campsites (to prevent attracting flies). If there are large quantities of water, pour it into a sump hole or disperse it widely. Pick up food scraps and pack them out with excess food and other litter.
2. Litter and food scraps can be minimized with careful preparation. Food can be packaged in plastic bags, instead of cans, bottles or tin foil. Food can be carefully measured, so leftovers are minimized. When food is left, it should be packaged up and either eaten later or packed out. Partial burning, which is likely to occur when food is burned at the end of a meal, is unacceptable.
3. Fish viscera are generally a natural part of the ecosystem. They should be scattered widely, out of sight and away from campsites. In high use areas and in bear country they should be scattered a long way from camps. Do not throw viscera back into lakes and streams (unless bear danger is high and viscera can be thrown into deep water); the cool temperatures in most mountain waters prevent rapid decomposition.

APPENDIX D: NOLS REGIONAL GUIDELINES

1. DESERT CONSERVATION PRACTICES

Many desert environments appear largely sterile and lifeless, but this is deceiving. Most desert landscapes consist of dispersed islands of life and fertility in a matrix of largely barren rock and mineral soil. These fertile islands of vegetation, animals, decaying organic matter and structured soils develop beneath shrub and tree clumps. Although they may occupy only 10-20% of the ground surface, over centuries they become as structured, fertile and diverse as many humid environments. When these islands of vegetation and soil are disturbed, the results of centuries of biological cycling are destroyed and centuries will pass before recovery is complete.

Plant growth in deserts is limited by short supplies of water, a deficiency that is manifested in low resilience, the most unique characteristic of desert environments, relevant to conservation practices. Desert environments vary greatly in their ability to resist impact—some like cryptogamic soil are extremely fragile while others like sandy washes and slickrock are highly resistant; but all desert environments, except for those around water, recover very slowly once impact does occur. Because impacts are so long-lasting it is particularly important, in deserts, either to use an area in such a way that you leave no visual evidence of your visit (and do not disturb the fertile islands) or to use trails and campsites that are already highly impacted.

Riparian strips and areas around water holes contrast strikingly with other desert environments. In effect they are localized non-desert environments superimposed on the arid landscape. Riparian zones can often recover rapidly following disturbance; but their richer vegetation and soils can also be rapidly disturbed and these environments provide focal points for both wild animals and human visitors. Water is critical to the survival of wildlife and the enjoyment of visitors. Therefore, special attention must be paid to avoiding pollution of water sources and disturbance of the flora and fauna that depend on them, particularly where they are sparse.

Where water sources are sparse, social impact problems are aggravated by the tendency for all parties in any area to be attracted to and camp near the same water supply. Thus crowding problems can be unusually pronounced in desert environments.

Low resilience is one manifestation of the low productivity of deserts that results from a limited amount of water. Another manifestation is a slow rate of wood production. Therefore downed wood used for firewood is replaced very slowly. This makes deserts the least appropriate environment for fires, along with high altitude and high latitude environments.

Most desert environments can be used with relatively little impact, because resistant sites are usually abundant. The keys to low-impact are (1) to either confine activities to resistant surfaces or, where this is not possible or use is heavy, to travel on existing trails and camp on high impact sites, (2) to avoid disturbance of areas around water and not camp near water where supplies are scarce, and (3) to minimize use of wood for fires.

Backcountry travel

Practices are the same as the general practices, but several are particularly important and some of the details are unique to deserts. Because any scars you leave will be slow to heal, you accept a more profound responsibility when you choose to travel cross-country. Only travel cross-country where there are no established trails, there are durable routes on slickrock, along dry washes, or on non-vegetated ground (without cryptogam crusts), and you can be sure you will leave no evidence of your passage to attract others.

Cryptogam crusts are a particular concern. These crusts consist of free-living blue-green algae, fungi, lichens and mosses in a matrix of soil, that form conspicuous black pedestaled surfaces. These crusts have many functions. They increase soil stability, reducing the potential for both wind and water erosion; they increase the ability of soils to absorb rainfall and promote water conservation; they fix nitrogen and act as a nutrient reservoir for higher plants;

and they provide a preferred substrate for the germination and growth of plants. Unfortunately, just a few people walking across a crust will destroy the crust and leave a trail that will attract others. In cryptogam areas, stay on established trails or, if there is no alternative, have everyone follow in the same footprints and leave the area as soon as possible. (Note that having everyone follow in the same footsteps off established trails is the opposite of the general practice of spreading out when traveling cross-country—a practice that should be adhered to when crossing less fragile desert terrain).

Campsite selection and use

Practices are similar to the general practices. But particular responsibility is accepted when a pristine site is camped on, because any damage you cause will be there for a long time. With care, however, substantial impact can be avoided because there are many highly resistant environments in the desert (slickrock, dry washes, beaches, and even open ground between shrubs, if there is no cryptogamic crust). On all but the most resistant pristine sites, err on the side of caution by keeping group size down, keeping stays short and dispersing activities widely. Select a high impact site in popular areas and where you cannot be certain that you can leave a site with no evidence of your stay.

Avoid camping next to water unless you are in an area where water is abundant. This will minimize encounters with other parties that are drawn to the water source. More importantly, it will allow wary wildlife access to the water they need to survive and avoid harassment of the many animals that live in the rich environment the water supports. Camping close to water is probably more appealing in the desert than in any other environment, but this is where it is most critical to forego that luxury.

Fires and stoves

Practices are similar to the general practices. However, one quality of deserts makes fires particularly harmful there, while another provides opportunities to minimize fire impacts. The low productivity of deserts is reflected in slow replacement of wood burned in fires. Consequently, fires should be avoided except where there is an oft-replenished supply of driftwood (driftwood supplies are not replenished on many dam-controlled rivers) or where use levels are low. Even under these conditions fire should be minimized.

The prevalence of mineral soil makes it relatively simple to build a fire in such a way that you leave little trace when you leave. The very best sites are in the unconsolidated sands of a dry wash, where floods will eventually remove any evidence you do leave.

Sanitation

Practices are identical to those in the general practices. If you ignore the advice not to camp near scarce water sources, it is important to disperse widely and far from the water before depositing human waste in a cat-hole. Otherwise you may pollute the water supply and, in popular areas, risk either contracting or spreading diseases, due to excessive deposition of feces within a small area.

Waste disposal

Practices are identical to those in the general practices. If you ignore the advice not to camp near scarce water sources, extreme caution must be taken not to pollute water supplies with soap or other wastes.

2. HIGH ALTITUDE AND HIGH LATITUDE CONSERVATION PRACTICES

The common denominator of high altitude and high latitude environments is their low mean annual temperature and short, cool growing season. This confines growth to short and prostrate plants and limits productivity severely. Most plants adapt to these conditions by having most of their biomass underground. Consequently, there are many places where aboveground vegetation is sparse and mineral soil, rock and snow is abundant. Although annual productivity is low, places long-free from disturbance may be covered with luxuriant vegetation and may have well-developed soils rich in organic matter—vegetation and soil that has developed over centuries. Environmental heterogeneity, particularly in high altitude environments, is extremely high.

This greater heterogeneity at high altitudes is one of the primary differences between arctic and alpine environments. Alpine environments, depending upon local topography, can have longer and warmer growing seasons or they can be colder and less predictable than the arctic; there frequently is more late-lying snow. Another difference is the prevalence and importance of permafrost in many arctic landscapes.

The most unique characteristic of both of these environments is their low productivity, which makes recovery following disturbance extremely slow. Low resilience, along with a lack of firewood, makes these environments similar, as far as backcountry low-impact use is concerned, to deserts. Special caution must be taken to not disturb places that have not already been disturbed and fires should not be built except in emergencies.

Another similarity with deserts is the abundance of bare mineral soil, gravel and rock, particularly in alpine environments. This provides numerous resistant surfaces to use as routes when travelling cross-country or as pristine campsites. Also dense meadow turfs (tundra), with soil bound by the fibrous root masses of grasses and sedges, make quite resistant surfaces, as long as use levels are relatively low. Thus there are numerous means of minimizing impact as long as use levels are not high. Where use levels are high, however, it is important to stick to established trails and campsites, because resilience is so low.

A primary concern in arctic areas is to avoid heavy use of areas with permafrost with a high ice content. Loss of vegetation in such places will cause "thermokarst"—melting of the upper part of the permafrost, followed by subsidence and erosion of the soil. Loss of soil is catastrophic; we do not know how long it takes to replace an arctic soil but it must certainly be calculated in terms of thousands or tens of thousands of years. Try to confine travel to coarse-grained soils or bedrock and follow ridgetops or streambeds, avoiding wet areas with organic soils that are common in lower-lying areas.

Another feature to take advantage of are the many environments that experience frequent natural disturbance. Examples include large, braided glacial streams, caribou trails and slopes subject to solifluction. Any disturbance of such places will be removed in time by natural disturbances.

The "fragility" of high altitude and latitude environments, as with deserts, is more in how long scars last than in their ability to resist scarring. However, in some situations disturbance can be rapid and catastrophic, such as where lichen mats are destroyed or thermokarsting occurs. The keys to low-impact are (1) to either confine activities to resistant surfaces or, where this is not possible or use is heavy, to travel on existing trails and camp on high impact sites and (2) to minimize use of wood for fires.

Backcountry travel

Practices are not different from general practices, but it is particularly important to travel on established trails, except where use levels are low and you can be certain that you will leave no trace of your passage. Leaving no trace is not difficult where there is abundant bedrock, ice and snow. Meadow turfs and open tundra are also durable surfaces, although here you should spread out. In arctic tundra, the openness of vegetation and terrain makes it a simple matter to spread out and the prevalence of caribou trails provides numerous routes that have already been naturally disturbed. However, where soils are water-saturated or easily-displaced, particularly on steep slopes, or where vegetation is fragile, as in heath communities, you will leave evidence of your passage and, if enough other people follow in your footsteps, new and unwanted trails will develop. These are particularly unsightly at high altitudes and latitudes, where visibility is so high. Traveling in small groups and avoiding places where previous use is evident is important.

When following established trails, it is particularly important not to contribute to the development of braided or ever-widening trails. This is a common problem in these environments where trails cross mud holes or late-lying snowbanks, situations that can be widespread during early season (a good reason to avoid travel at this time). Stay in the trail tread and cross snowbanks directly or walk far from the trail, preferably on a hard surface.

Finally, because visibility is so great, it is particularly important to minimize your effect on other parties by avoiding brightly-colored equipment.

Campsite selection and use

As with backcountry travel, practices are not different from general practices, but the consequences of inappropriate behavior are particularly serious because impacts are so visually obtrusive and long-lasting. More responsibility must be accepted when not camping on a site that has already been highly impacted. This means selection of a resistant, undisturbed site, small groups, dispersal of activities, short stays, minimal disturbance of the site and camouflaging of any impact you do cause. The most resistant surfaces are on snow, ice, rock, gravel or unconsolidated mineral soil, such as along arctic rivers with large fluctuations in volume. If you must use vegetated surfaces, thick turfs of grass and sedge are quite resistant, while krummholz (prostrate trees near timberline), lichen-rich and heather communities are very fragile. Another recommended location is on small level areas below active solifluction lobes. Because these lobes are moving slowly downhill, they will eventually override the campsite and eliminate all traces of human disturbance. A common situation at high latitudes is to set up tents on dry tundra and a cooking area closeby in a gravelly stream bed. Impact should be minimal as long as care is taken to avoid the creation of trails between tent and cooking areas. This can be a particular problem where the area between tent and cooking areas is steep and wet. It is always important not to move rocks and stones—to create level campsites or build windscreens. Often vegetation can only get established in the protection of rocks, so their disturbance creates a permanent barren feature.

When using an established camp, it is particularly important to camp out-of-sight, due to the visual impact of other groups in the open landscape, and to avoid enlargement of the site and proliferation of user-built trails in the area.

Fires and stoves

Always use stoves at or above timberline, except in emergency situations, even where occasional patches of trees occur. Wood production is too low to support fires and the visual impact of fire scars is particularly pronounced in these open landscapes. The only exception is on streamside gravel bars in places where wood is relatively abundant and use levels are low.

Sanitation

Practices are similar to general practices, although this is the environment where surface disposal is most appropriate and group latrines are least appropriate. Soil and vegetation disturbance resulting from excavation of cat-holes will not recover rapidly and buried feces will decompose very slowly in the cold and sterile soil. These problems can be avoided if feces is deposited on the surface. Decomposition will be most rapid if the deposition site is in direct sunlight and exposure is increased by smearing the feces. However, surface disposal is only appropriate where there is no chance that other people will encounter it. This means it is important to seek out dispersed and isolated spots. It also provides an impetus to visit little-used places, when you are prepared to accept the responsibilities associated with off-trail hiking and camping.

In more popular places there is just no alternative to the use of cat-holes. Group latrines should be avoided at all costs, however, because such a concentration of waste simply will not decompose. It will be dug up by animals. This does not apply to existing latrines, which should always be used if available.

An option on glaciers is to make a latrine next to a deep crevasse, preferably one with relatively straight sides. With a shovel, feces can then be tossed to the bottom of the crevasse.

Waste disposal

Practices are similar to general practices, except that sump holes should never be excavated. Either use a naturally-occurring hole or disperse waste water widely.

3. CONSERVATION PRACTICES ON SNOW AND ICE

The presence of a thick mantle of snow or ice on the ground both offers unique opportunities for minimizing impact and presents unique challenges. The difficulties and hazards of cold place particular stresses on both wildlife and human visitors. Without special care this can result in serious impact that might not occur during warmer seasons or in less extreme environments.

A thick cover of snow shelters vegetation and soil from the normally inevitable impacts of trampling. Ice is also only ephemerally affected by trampling. Since trampling impacts are often the most serious unavoidable results of backcountry use, impacts caused by travel on snow or ice can quite easily be less pronounced than those at other seasons. However, as the snow mantle thins (either in early or late winter or in places where snow cover is less continuous), or as you leave the edge of an ice mass, the vulnerability of vegetation and soil increases to the point where they are much more easily disturbed than under snow-free summer conditions. This results primarily from the fragility of soils saturated with snow-melt waters. Such soils can become highly compacted and muddy and they are often easily displaced. Plants pressed into muddy soils have little chance of survival and plants growing in wet coarse soils are easily uprooted; plants can also be particularly vulnerable if they become brittle in fall or if they are just beginning to translocate nutrients from underground perennial tissues to aerial growing points in spring.

Probably the most important aspect of low-impact winter use is the need to minimize disturbance of wildlife. (This is less of a concern during travel on ice in other seasons.) Like humans, wildlife find winter a particularly challenging and stressful season. Unlike humans they do not have sleeping bags and tents to conserve heat and energy and they cannot bring their own food; they must scrounge for it under deep snow or in windswept areas. Finally, the large animals cannot travel on top of the snow, as humans do; they must plow through the snow, utilizing tremendous stores of energy when they must travel long distances. Given these problems, the most common winter strategy is to conserve energy by lowering activity levels—not moving rapidly or great distances unless absolutely necessary. Flight from recreationists and even an increased heartbeat associated with fright defeat this survival strategy. Energy consumption increases, so more food is required; but more energy is needed to seek out food and if food is scarce or there are large numbers of competing animals, some animals may not survive or the stress they undergo may reduce their reproductive capacity. Therefore it is critical in winter to stay far enough from wildlife to not induce flight or even cause fear.

Another unique characteristic of winter is that downed wood is covered by snow. Along with the difficulty of disguising fire remnants in winter, this makes fire a poor choice in winter.

Finally, proper disposal of human waste is extremely difficult, because it can be hard to dig down through the snow to the soil or to dig a cat-hole in frozen soil. This is probably the most difficult aspect of low-impact winter use. In popular areas for either summer or winter use, few acceptable solutions are available. Proper disposal on ice is even more problematic.

Backcountry travel

The primary concern with travel is minimizing impacts on wildlife. As long as the snow is deep, impact to vegetation and soil is minimal and except in a very few places use levels are so low that there need be little concern for other visitors. Consequently, many of the general guidelines can be relaxed. Bright clothes are more acceptable and can be desirable from a safety standpoint. Large groups are more acceptable and can be desirable from a wildlife impact perspective. Limited research suggests that frequent encounters with small groups are more disturbing than infrequent encounters with large groups. So it is probably best to keep groups close together and avoid dispersal of people or smaller groups in places that wildlife use for refuge. There is also little reason to be concerned about where you travel (other than to avoid wildlife disturbance). Cross-country and trail travel are equally acceptable and there is no need to worry about resistance of the ground. Perhaps the major

consideration, beyond wildlife, is that visiting places that are infrequently used during any season will make disposal of human waste and even having fires less problematic. In contrast to travel on solid ground, which is often quite fragile, dispersal of use and visitation of little-used places is always preferred on snow and ice.

On popular mountaineering routes, concern for minimizing your impact on other parties is required. Party sizes should be smaller and travel at less popular times is encouraged.

Campsite selection and use

As with the travel guidelines, the lack of trampling impact to soil and vegetation permits many guidelines to be relaxed. The most important considerations are to select a site where you will not disturb wildlife or pollute water supplies and where you can dispose of human waste properly. This can be accomplished by camping well away from trails and bodies of water—both those that are open in winter and those that will be running in spring or summer, as well as places that wildlife frequent.

There need be little concern for whether the site selected is pristine or highly impacted, for the resistance of the ground, for whether you concentrate or disperse tent sites and traffic routes, for size of the group or for length of stay—as long as wildlife is not disturbed and human waste can be disposed of properly.

There is some controversy about whether or not snow structures you build should be left standing. Although leaving them can provide comfort and even safety for you or others, this practice provides an unnecessary reminder that others have been here before and negates the principle of leaving pristine areas as they were found. Therefore, we suggest that such structures be removed unless there is a high likelihood that you will return on the same trip and you are in an area that is infrequently visited in winter.

Fires and stoves

There are several compelling reasons for not building fires in winter. Dead and downed wood that is dry is essentially non-existent, so the temptation will be to tear off lower branches or mutilate standing snags. Moreover, it is extremely difficult to properly dispose of the remains of a fire built in snow. Therefore, fires are not recommended except in an emergency. However, in remote areas that are seldom used during any season occasional small fires are acceptable, if care is taken to not disfigure trees when collecting firewood and some attempt is made to disperse charcoal and ash.

Sanitation

Practices are similar to those in the general practices, but it can be difficult to use the cathole technique properly. Given this difficulty, it is best to travel and camp in places that are seldom visited in summer. In such places, human waste can be deposited on the snow or ice in an out-of-the-way place, far from drainages. Decomposition will not occur after the feces is covered with snow and snowmelt waters will probably spread any pathogens, so it is critical that your disposal site is far from water (so it can break up and disperse) and in a place where human contact is unlikely. If you can dig a cathole in the ground, however, that is preferable.

In popular areas, the only solution is to try to emulate summer practices and make the effort to use catholes. If it is too difficult for everyone to dig their own personal holes, it may be necessary to construct a group latrine.

When travelling on glaciers, human waste can be deposited in crevasses. Although we do not know much about this practice, it is probable that feces will be ground up and pathogens will be dispersed before significant contamination occurs. As always, concentration of large quantities of waste in one area, particularly if it is frequently used by others, demands particular caution and should be avoided, if possible.

Kick snow over urination holes, unless in conditions (heavy current snowfall or no other winter users) where they will not be seen.

Waste disposal

Most practices are similar to the general practices. Waste water should be concentrated in one or a few holes and covered with snow when camp is broken. Extra care must be taken not to litter since it is so easy to lose items in the snow. Give special attention to plastic bags and wrappers and to candle wax. Candle wax should be caught in a cup and packed out.

4. COASTLINE CONSERVATION PRACTICES

The most unique and common characteristics of coastlines are the intertidal zone, the area between low and high tides that is strongly affected by incoming seas twice a day, and sporadic higher beach deposits that often extend inland for short distances, having been deposited by major storms or transported by winds. The intertidal zone can be either quite fragile (e.g. rocky tidepools that support an abundant flora and fauna) or extremely resistant (e.g. cobble, gravel or sand beaches). Intertidal and higher beach deposits are usually resistant because they consist almost entirely of unconsolidated mineral soil. Vegetation, organic matter and soil development are minimal; consequently there is little for human use to disturb. However, where vegetation has become established and, particularly, where embryonic dunes are forming, human impact can be significant. Loss of vegetation can cause accelerated wind erosion, greatly altering the morphology of the beach and, particularly, sand dunes.

In the intertidal zone, much of the evidence of human disturbance is removed by incoming tides twice a day and some inland areas are "cleansed" after major storms. Therefore, these resistant environments are also highly resilient. Most impacts that do occur are removed, depending upon their location, either daily or yearly. There are exceptions, however. Impacts beyond the zone disturbed by tides and major storms are similar to those that occur elsewhere. And, as mentioned earlier, certain environments within the intertidal zone and higher beaches are quite fragile and subject to long-term disturbance. Because much of the coast is particularly resistant and resilient, while some places are quite fragile, it is particularly important to concentrate activities on resistant beaches and particularly where tides or storms will cover evidence of human use.

The vast quantity of water in the ocean, along with the transporting effects of tides and currents, also provides a unique opportunity for dispersion and dilution of certain waste products that cannot be disposed of properly (other than to carry them out) in other environments. Most wastes that are not carried out are better deposited in the ocean than on land. However, because the abundant flora and fauna of tidepools are inundated by ocean waters, it is critical that concentrated dosages of pollutants are kept away from tidepools and camping areas.

Although the relative abundance of resistant and resilient substrates and the ease of dispersing certain wastes in the ocean make coastlines relatively durable environments, certain problems are aggravated by the fact that use is concentrated along a narrow coastal strip. On popular routes, certain campsites are used over and over again and often by quite large groups. This contributes to localized problems with human waste disposal and trampling impacts beyond the beaches and intertidal zone, where vegetation and soils are better developed.

Generally, coastal zones should be the easiest environment for the recreationist to use responsibly. The overall keys to low-impact use of coastlines are to (1) concentrate activities on resistant substrates just above and below high tide lines, (2) avoid damage to tidepools and disturbance of wildlife, and (3) minimize sanitation problems by choosing less popular campsites, disposing of human waste in the ocean where possible and dispersing human waste widely on land where this is not possible.

Backcountry travel

Practices are the same as for the general practices, although some are particularly important here and some of the details are unique to coastlines. Because impacts to trails are minimal and campsite damage is limited by the resistance of available substrates, particular attention can be paid to minimizing

impact on other groups. Thus it is particularly worthwhile to travel during lightly used days and seasons and to select lightly used routes where this is possible.

The abundance of wildlife and edible foods should not lead to complacency. Wildlife disturbance should be avoided; give nesting birds and marine mammals a wide berth and take particular care not to damage tidepools. The eggs and young (up to 4-6 weeks) of brown pelican are vulnerable to predation, particularly by gulls and ravens, when your intrusion scares adults off nests. Gulls have even been known to follow humans and then eat eggs or young when adults flee. So be careful to avoid disturbing pelicans during nesting season. Disturbance of ospreys should also be minimized during nesting season. Edible foods, particularly shellfish, should not be overharvested. This may mean only harvesting in places that are not frequently visited. Finally, when spearfishing, take care to minimize the chance of maiming fish.

Campsite selection and use

Most practices are the same as for the general practices. The major difference is that use of relatively undisturbed sites is particularly appropriate on coastlines, even where use is heavy. This follows from the fact that sand, gravel and cobble beach substrates without soil development or vegetation are so abundant. These environments are little disturbed by use and evidence of use is usually removed quickly by high tides or large storms. They can be used repeatedly and for long periods, even by large groups, with little adverse impact.

Where resistant beach substrates are abundant there should be no need to choose a high impact site, regardless of how popular an area is. Merely select a resistant site on sand, gravel or cobbles for kitchen and sleeping areas. There is also no need to worry about either concentrating or dispersing tent sites or traffic routes as long as activities are confined to resistant substrates.

Where beach deposits are scarce or small, however, more care is needed. If beaches are small, confine as many activities as possible, including those associated with the kitchen, to the beach and set up sleeping areas further inland. When it is necessary to camp off the beach, follow the general guidelines for campsite selection and use and, in Baja California, the modifications for desert environments. There, dry washes are preferable locations to higher ground with more vegetation and better-developed soils and high impact sites should be used in popular areas. Avoid creating trail systems between tent and kitchen areas.

Fires and stoves

Practices are the same as for the general practices. As with campsite impacts, it is particularly easy to leave essentially no trace of fire impacts if fires are built on beaches below the high tide line. Such a fire is built on unconsolidated mineral soil where it will have little effect. Once all wood and charcoal is burned down to ash, ashes and rocks are thrown into the ocean, and excess firewood is scattered on land, the high tide will eliminate residual evidence of the fire.

If fires cannot be built on the beach, below the high tide, the need for a fire should be carefully evaluated. If necessary follow the general guidelines for fires and stoves and, in Baja California, the modifications for deserts.

The presence of driftwood makes firewood often—but not always—particularly abundant. Driftwood, particularly what has been milled or otherwise altered by humans, should be collected before using wood from further inland. Again, carefully consider the need for a fire if there is little driftwood or if use is sufficiently high to seriously deplete existing driftwood supplies.

Sanitation

The major difference from general practices is addition of the possibility of urinating and depositing feces directly in the ocean. It is a simple matter to urinate below the high tide line—away from the tide pool areas—where the ocean will quickly dilute the urine. Away from campsites, feces can be deposited on a rock and hurled into the ocean. Shells and flat rocks are abundant alternatives to toilet paper. An untried technique with considerable potential, particularly when using popular campsites, is to line an ammo box with paper (it must be biodegradable), have all party members deposit their feces in the lined ammo box and then deposit the paper and feces in the deep ocean on the next travel day. Where neither of these options are feasible follow the general guidelines for sanitation.

Waste disposal

The major difference from general practices is that certain wastes can be deposited directly in the ocean with little adverse effect. Fish viscera are generally a natural part of the ecosystem. Deposited below the high tide line—but away from camps—they will be scavenged by birds or eaten by fish. Away from popular campsites, it is probably less harmful to use biodegradable soaps directly in the ocean than to pour it onto the land—although this is a poor practice where large groups repeatedly use the same site or in areas of rich tidepool life. It is always best to minimize use of soaps and not deposit sizeable quantities in any single place.

Finally, in Baja California, cans can be deposited in the deep ocean after paper has been removed and the ends have been cut off. While such littering appears to run counter to the wildland ethic, the alternative in Baja is frequently that garbage is dumped alongside roads in the desert, an environment much less capable of degrading cans than the ocean depths. This practice is not generally recommended in places where litter that is packed out is likely to end up in a legitimate garbage dump.

Cole, David N. 1989. Low-impact recreational practices for wilderness and backcountry. Gen. Tech. Rep. INT-265. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 131 p.

Describes low-impact practices that can contribute to minimizing problems resulting from recreational use of wilderness and backcountry. Each practice is described and information is provided on such subjects as rationale for the practice, importance, and costs to visitors. Practices that may be counter-productive are described, as are important research gaps.

KEYWORDS: no trace, minimum impact, recreation, visitor behavior



The Intermountain Research Station provides scientific knowledge and technology to improve management, protection, and use of the forests and rangelands of the Intermountain West. Research is designed to meet the needs of National Forest managers, Federal and State agencies, industry, academic institutions, public and private organizations, and individuals. Results of research are made available through publications, symposia, workshops, training sessions, and personal contacts.

The Intermountain Research Station territory includes Montana, Idaho, Utah, Nevada, and western Wyoming. Eighty-five percent of the lands in the Station area, about 231 million acres, are classified as forest or rangeland. They include grasslands, deserts, shrublands, alpine areas, and forests. They provide fiber for forest industries, minerals and fossil fuels for energy and industrial development, water for domestic and industrial consumption, forage for livestock and wildlife, and recreation opportunities for millions of visitors.

Several Station units conduct research in additional western States, or have missions that are national or international in scope.

Station laboratories are located in:

Boise, Idaho

Bozeman, Montana (in cooperation with Montana State University)

Logan, Utah (in cooperation with Utah State University)

Missoula, Montana (in cooperation with the University of Montana)

Moscow, Idaho (in cooperation with the University of Idaho)

Ogden, Utah

Provo, Utah (in cooperation with Brigham Young University)

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