

# Wilderness Party Size Regulations: Implications for Management and a Decisionmaking Framework

Christopher Monz  
Joseph Roggenbuck  
David Cole  
Richard Brame  
Andrew Yoder

---

**Abstract**—Arriving at appropriate limits on the size of groups in wilderness remains a difficult and often controversial management challenge. This paper presents a review of the state of knowledge regarding group size from an ecological impact and visitor experience standpoint, a survey of wilderness managers regarding the current status of group size regulations and a proposed management decisionmaking framework for group size.

---

Almost every wilderness visitor enjoys the outdoors in a group of some size—the vast majority of visitors do not travel solo. Therefore, management decisions about limiting group size can affect many public land constituents and enthusiasts.

Limiting party size is an established and accepted visitor management technique used in wilderness. Current trends suggest that more managers are adopting party size restrictions and that the maximum allowable group size is getting smaller. In one of the first surveys of wilderness managers, Fish and Bury (1981) found that 46% of all Forest Service and 43% of all National Park Service wilderness managers had limited maximum group size. Washburne and Cole (1983) found that 48% of all wilderness managers had placed a limit on group size and that the percentage of Forest Service wilderness areas with such limits had increased to 58%. Marion and others (1993) surveyed National Park Service wilderness and backcountry managers in the early 1990s and reported that 62% required groups to limit their size.

Initially, group size limits were established to limit the social and ecological impacts resulting from a few very large groups. These large groups (of 50 or more visitors, for example) were typically not common, but also not uncommon in some wilderness areas. Fish and Bury (1981) reported

a typical group size limit of 20 people plus 50 pack animals. Washburne and Cole (1983) found limits ranging from 5 to 60 persons with a median of 15; the most common limit was 25. Lime (1972) reported that the group size limit in the Boundary Waters Canoe Area Wilderness (BWCAW) in 1971 was 15 people per party; he also speculated about what types of visitors would be most affected if group size limits were reduced to 12, 10 or even 8. Now, some 25 years later, allowable size has been lowered to nine in the BWCAW, with a controversial proposal to further reduce maximum size down to seven persons. Cole and others (1987) have noted that party size limits larger than about 10 would likely have little social or ecological consequence. Given this and the apparent perception that larger parties have disproportionately high impacts, managers throughout the National Wilderness Preservation System (NWPS) have moved toward more stringent group size restrictions.

To begin to answer these questions, we initiated this project with several goals: 1) to examine the current literature on the ecological and social consequences of group size limits; 2) to conduct an examination of the current management status of group size limits in the National Wilderness Preservation System; and 3) to review the possible management options and visitor practices in order to develop a decisionmaking framework for adopting group size limits. Minimizing ecological and social impacts, while of fundamental importance, is just one goal of wilderness management. Optimizing this goal may conflict with other important goals, such as pursuing equity in decisions about access and avoiding the exclusion of organized groups that provide important societal benefits. We believe that careful, conscious and explicit decisions about how best to compromise between these alternative goals and additional research are critical to the process of setting defensible use limits.

## The Influence of Group Size on Ecological Impacts

---

There have been very few empirical studies of the influence of group size on either the areal extent or intensity of ecological impact. The only study we found to directly manipulate group size and measure a response was a study of per capita firewood consumption. Davilla (1979) found that Sierra Club groups of 20-25 people burned less than one-half the firewood per person per fire than other groups of about

---

In: Cole, David N.; McCool, Stephen F.; Borrie, William T.; O'Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 4: Wilderness visitors, experiences, and visitor management; 1999 May 23–27; Missoula, MT. Proceedings RMRS-P-15-VOL-4. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Christopher Monz is Research Scientist, National Outdoor Leadership School and Natural Resource Recreation and Tourism Department, Colorado State University. Joseph Roggenbuck is Professor, Natural Resource Recreation, Department of Forestry, Virginia Tech. David Cole is Research Biologist, Aldo Leopold Wilderness Research Institute. Richard Brame is Outreach Manager, National Outdoor Leadership School. Andrew Yoder is Graduate Research Assistant, Department of Forestry, Virginia Tech.

four visitors. A Sierra Club group of 41 burned only one-half as much firewood per person as a group of 20-25. The large groups burned more total wood than small groups; they just burned less per capita per fire. However, since large groups are more likely to have more fires than small groups (Christensen and Cole, this volume), actual per capita firewood consumption might not be less in larger groups. Therefore, this is hardly a compelling argument in favor of fewer large groups rather than more small groups.

The next category of research results might be termed suggestive. In these studies, the effects of different group sizes were not directly compared, but research findings suggest why either larger or smaller groups might be more damaging in different situations. In a study of nordic skiing impacts on elk and moose, Ferguson and Keith (1982) found that animals were startled at the passage of the first skier but it was irrelevant how many additional skiers passed by thereafter. This suggests that a few large groups would have less impact than many small groups, since there would be fewer skier-wildlife interactions overall. Wildlife disturbance may be the primary impact for which a few large groups are less disturbing than more small groups.

The research generalization with the most important implications for group size is the curvilinear relationship between use and amount of impact, first described as an important principle by Cole (1981, 1987) in syntheses of research findings that began with the work of Frissell and Duncan (1965). This relationship indicates that differences in amount of use can cause great differences in amount of impact to vegetation and soils, but only when use and impact levels are low. Where use and pre-existing impact levels are high, even large differences in amount of use have little effect on amount of impact. The primary implication of this finding to group size is that the adverse effects of larger groups can increase as amount of use and prior impact decrease— but only in certain circumstances. In relatively undisturbed places, intense, concentrated use by a large group can cause substantial impact, while a small group exhibiting the same behavior over a similar square area might cause little significant impact to the soil and plant communities. There are, however, many variables that can alter the above scenario, such as a group's level of minimum-impact behavior, use of dispersal strategies while traveling and in camp, relative durability of the vegetation and soils of campsites, etc.

Numerous studies have also found that horses have more potential than hikers to cause both accelerated erosion (DeLuca and others 1998) and vegetation damage (Cole and Spildie 1998). This suggests that size limits are particularly important for groups with horses and mules, particularly in less-disturbed portions of wilderness.

Finally, one can draw some common-sense conclusions about group size effects. The primary such observation—based particularly on the curvilinear use-impact relationship—is that large groups are not likely to increase either the area or magnitude of impact if the already impacted places where they walk and camp are large enough to accommodate them. Conversely, large groups will have much more impact than numerous small groups if already impacted sites are not large enough to accommodate large groups.

These research results and common-sense conclusions, particularly the use-impact relationship, suggest several

generalizations. First, large groups may tend to cause more impact than small groups, and few large groups are more likely to cause more soil and vegetation impact than many small groups. However, this generalization is most valid in remote, lightly impacted portions of wilderness under certain circumstances, as described previously. In places with impacted sites large or numerous enough to accommodate a large group within the already impacted area, group size limits are considerably less useful.

Second, group size limits decrease in value as the size limit increases. The common group size limits, in the range of 15 to 25 people or stock, is likely to have little effect on ecological impacts. If these groups do not employ strict minimum-impact techniques, they will need to find—or will create—very large impacted areas while camping and will cause observable impact in trail-less areas while hiking. This is particularly true when groups travel with horses and mules. Horses cause more and different impact than hikers, so if the goal is to reduce ecological impact, group size limits should be lower for horse groups than hiking groups, and horses should be counted as if they were group members.

It should be stressed, however, that not all groups are equal. We are convinced that a large group of conscientious, experienced people, even with horses, can cause little impact, even less than a small group of people who are unconcerned or unknowledgeable (although this is difficult to test experimentally). Specifically, large groups can mitigate the effects of their size on soils and vegetation by 1) breaking into small groups to travel and camp, 2) camping in areas with large impacted sites and confining their activities to already impacted places, and 3) meeting infrequently as a large group and only on a durable site, such as a large rock.

## **The Influence of Large Groups on Wilderness Experiences**

Considerable research has examined the impact of large groups upon visitor experiences in wilderness. Wilderness visitors generally say that encountering large groups reduces the feeling of wilderness. Stankey (1973 and 1980) and Towler (1977) asked visitors to six different western wilderness or backcountry areas whether seeing large groups reduce the feelings that one is in wilderness, and more than two-thirds said it did. An exception to this finding was the Boundary Waters Canoe Area Wilderness, where 54% agreed with the statement.

## **Support for Party Size Limits**

Today there is generally high support for party size limits, but there is considerable variation across time of study and type of wilderness use group. As time has passed, more and more wilderness areas have adopted group size restrictions, and with these limits has come greater support for them. Stankey (1973) first measured wilderness visitors' support for party size limits and found that 62% of canoeists in the Boundary Waters Canoe Area Wilderness and about 70% of Bridger Wilderness visitors supported such limits.

About 75% of hikers in wilderness today support group size limits. For example, 76% of Desolation Wilderness

visitors, 79% of John Muir hikers, 85% of Sequoia-Kings Canyon hikers, and 71% of overnight hikers of the Lewis Fork and Little Wilson Creek Wildernesses indicated support for limits (Cole and others 1995; Roggenbuck and others 1994; Watson and others 1993).

Some have speculated that the reason most wilderness visitors generally support group size limits is that they bear none of the costs associated with this regulation (Cole 1995). Since most wilderness user groups include two, three, or four persons and most established size limits are much higher, these limits leave the majority of visitors unaffected.

## Are Large Groups a Problem in Wilderness?

In those wildernesses where visitors have been queried, only about 20% to 30% say seeing large groups was at least a slight problem and very few say it substantially detracted from the experience. For example, 19% and 23% of day and overnight visitors at Three Sisters, Mt. Jefferson, and Mt. Washington wilderness areas, respectively, reported that seeing large groups was a problem (Cronn and others 1992). In the Great Smoky Mountains backcountry, 25% said the size of groups they encountered detracted from their experience. However, in another study in the Smokies, only 1% of backcountry visitors said that the size of hiking groups met along the trails greatly detracted from or ruined their experience. The large group issue ranked last on a list of 32 potential experience detractors (Renfro and others 1990). In the Teton Wilderness, 29% reported that large groups lowered the quality of their experience, but 12% said such groups added to their enjoyment (Grayson 1990).

In a 1971 study of use and users at Superstition Wilderness in Arizona, Lewis found a more serious party size problem. About 69% of all respondents noticed very large groups. About 28% found this annoying, and 22% said it seriously interfered with their enjoyment. Roggenbuck and others (1979) reported that the number of Linville Gorge, Shining Rock, and Joyce Kilmer/Slickrock Wilderness visitors who felt that encountering large groups was a problem equaled 35%, 47%, and 33%, respectively. By 1990, the percentage of Shining Rock visitors who felt that meeting large groups was a problem dropped to 41% (Roggenbuck and Stubbs 1991). Lime (1991) found that 33% of Boundary Waters Canoe Area Wilderness visitors felt that encountering large groups was a problem on their trip.

Another way to assess the severity of the "large group problem" on wilderness experiences is to determine how it ranks against lists of other potential problems. These studies have generally found group size to be among the lowest ranked problems. For example, Hall and Shelby (1994) found that Eagle Cap Wilderness visitors ranked "large groups seen" as 17<sup>th</sup> on their list of 19 impacts to experience quality. Cronn and others (1992) reported that encountering large groups ranked 7<sup>th</sup> to 10<sup>th</sup> of 16 possible impacts to experiences in Three Sisters, Mt. Jefferson, and Mt. Washington Wildernesses. Roggenbuck and others (1993) found that visitors to Cohutta, Caney Creek, Upland Island, and Rattlesnake Wilderness ranked the number of large groups seen as 12<sup>th</sup>, 15<sup>th</sup>, 12<sup>th</sup>, and 12<sup>th</sup> in severity out of 19 social and ecological influences on the quality of experiences (in

this study, the influences could be positive or negative.). Roggenbuck and others (1982) reported the top ten perceived problems out of 42 listed for Linville Gorge, Shining Rock, and Joyce Kilmer/Slickrock, and encountering excessively large groups was not on the list of top 10 problems in any area.

Visitors of two wilderness areas in the high country at Mount Rogers National Recreation Area in Virginia differed in their evaluation of people seen in large groups by their own group type. For day hikers, backpackers, horseback riders, and hunters, the problem was ranked 16<sup>th</sup>, 14<sup>th</sup>, 28<sup>th</sup>, and 16<sup>th</sup> out of 36 potential problems listed on the survey (Roggenbuck and others 1994). Watson and others (1993) asked hikers and stock users at John Muir, Sequoia-Kings Canyon, and the Charles C. Deam Wildernesses to evaluate the severity of 23 problems, including seeing too many large groups. The group size problem tied for 13<sup>th</sup>, 12<sup>th</sup>, and 11<sup>th</sup> in ranking by hikers to the three areas, respectively. The stock users rated all problems as less serious, but they ranked too many large groups as 9<sup>th</sup>, 6<sup>th</sup>, and 9<sup>th</sup> in importance among their overall problem lists. Finally, about 16% of backpackers in the Great Smokey National Park indicated that the size of horse groups met along trails greatly detracted from or ruined their experience. These encounters ranked 3<sup>rd</sup> in importance out of 32 listed potential problems, indicating that large horse groups may be a much greater visitor experience impact in the Smokies than at other wilderness/backcountry studied (Renfro and others 1979).

## Apparent Benefits and Costs of Party Size Limits to Wilderness Experiences

From the standpoint of impact on experiences, we believe that the current group size limits in place in most areas do have some benefits for protecting wilderness experiences. Seeing very large groups, for example, more than 20 people in a group, does bother many wilderness visitors. Such groups once existed in wilderness, although they were always a minority. Now, in part because of group size limits, they are very rare. But research also shows that encountering many other use, user, and impact variables in wilderness is more bothersome than group size issues. Also, we are not at all sure that seeing people in one large group has a more negative impact on experiences than seeing the same number of people in several small parties. Stankey (1973) did report such a negative effect of large groups in his historic study of the visitors at the Boundary Waters Canoe Area Wilderness and other western wilderness/backcountry areas. However, in that study, Stankey compared an encounter with a hypothetical group of 30 or more persons to seeing 10 groups of three people. But few of his respondents had encountered groups of this size in the wilderness; few such large groups existed. In addition, humans are not very adept at judging their response to hypothetical situations. For example, Manning and Ciali (1980) studied the relationship between hypothetical encounters with varying numbers of other recreationists and levels of satisfaction and found a drop in satisfaction as the number of encounters increased. However, when they assessed the same relationship between *actual* encounters and satisfaction, ratings of satisfaction stayed about the same across all the levels of density.

## Current Status in Management

In order to understand the role that group size limits are currently playing in management of the NWPS, we surveyed wilderness managers in an effort to answer the following questions:

- 1) What is the percentage of all wilderness areas in the National Wilderness Preservation System that currently have group size limits, and what is the maximum allowable size?
- 2) What justifications do managers give for their group size limits?
- 3) Do wilderness managers have plans to alter their group size regulations, and if so, why and how?

## Methods

A questionnaire was mailed to the managers of all 624 areas in the NWPS. A few wildernesses are managed by more than one agency; in these cases, we mailed each agency manager a survey. Approximately one month after the initial mailing, we sent nonrespondents a second survey and again urged them to respond. Through this procedure, we obtained an overall response rate of 81%, with a range of 75% for the U.S. Forest Service to 96% for the U.S. Fish & Wildlife Service.

## Results

**Maximum Allowable Group Size**—Overall, about 52% of wilderness areas have established some type of group size limit (table 1). This varies greatly by agency, however. Only 11% and 17% of the Fish and Wildlife Service and the Bureau of Land Management areas, respectively, limit group size. About 68% and 73% of National Park Service and U.S. Forest Service areas, respectively, do so. Only 10 areas (1.9%) are closed or inaccessible, and eight of these are managed by the Fish & Wildlife Service. These differences likely reflect the differing recreational use levels and management philosophy/objectives of the four agencies.

Those areas with a group size limit on people (201 wildernesses) vary greatly in the specific number allowed (table 2). Responses ranged from 6 to 60, with a median of 12 and a mode of 10. Horse and packstock limits (108 wildernesses) varied almost as much, ranging from 5 to 35, with a median of 15 and a mode of 25. Heartbeat limits (57 wildernesses), a maximum allowed combination of people, horses, and

sometimes dogs did not vary quite as greatly, ranging from 8 to 25, with a median of 15 and a mode of 25.

The four wilderness agencies show little difference in their maximum allowable group size for people, but do differ considerably in their prescriptions for horses (table 2). The Bureau of Land Management and the U.S. Forest Service have median group size limits for horses at 15 and 25, respectively, with the limit for the National Park Service at 11 and the only response from Fish & Wildlife Service at 10.

Only 18 areas, about 7% of areas with size limits, put separate limits on outdoor experience or educational groups. Although the sample size is small, the median of 12 people per group for educational groups is the same as that for groups overall.

**Reasons for Group Size Limits**—Respondents were presented with seven reasons for establishing group size limits. These were environmental impact, conflict between groups, conflict within groups, facility/site constraints, overall high use of the area, public complaints/pressure and consistency with neighboring wilderness areas. Area managers could check as many of these reasons as they desired, and there was opportunity to provide open-ended responses. Because of this, the percent of reasons listed in table 3 will total more than 100%.

Not surprisingly, environmental impact was the most frequently listed reason for establishing group size limits. About 81% of all area managers listed this reason. Quite surprisingly, the second most frequently selected reason, at 50%, was “to be consistent with neighboring wilderness areas.” About 40% of all area managers cited “conflict between groups,” “facility/site constraints” (that is, size of parking lot at trailhead), and “overall high use of area.” Managers seemed to most frequently base their decisions on their own perceptions of resource or social impacts; only 24% said that “public complaints/pressure” was a reason for their group size limit. Finally, less than 6% (14 areas) of all respondents said their limit was based on conflicts *within* groups. In one sense, this is not surprising, since neither managers nor researchers have focused on within-group dynamics. On the other hand, we know that such dynamics profoundly affect the experiences of all groups in wilderness, especially the learning and growth outcomes of educational groups. Thus, managers may be unknowingly affecting experiences in wilderness in profound ways, for better or for worse, with their group size limits.

**Plans to Change Group Size Limits**—Over 77 percent of wilderness areas do not plan to make any revisions to their

**Table 1**—Wilderness area group size limits by management agency.<sup>1</sup>

Agency	No limits		Limits—same		Limits—different		Closed		Total N
	N	%	N	%	N	%	N	%	
BLM	99	82.5	13	10.8	7	5.8	1	0.8	120
USFS	82	27.4	209	69.9	8	2.7	0	0.0	299
USF&WS	52	77.6	5	7.5	2	3.0	8	11.9	67
NPS	11	28.9	20	52.6	6	15.8	1	2.6	38
Total	244	46.6	247	47.1	23	4.4	10	1.9	524

<sup>1</sup>It is possible for the area to have no group size limits (No Limits), to have the same limits for all users (Limits—Same), to have different limits for different user types (Limits—Different), or to be closed or inaccessible to the public (Closed).

**Table 2**—Breakdown of wilderness area group size limits for people, horses and/or packstock, and heartbeats by agency.

Agency	Number of people			Number of horses and/or packstock			Number of heartbeats <sup>1</sup>		
	N	Median	Mode	N	Median	Mode	N	Median	Mode
BLM	12	15	15	10	25	25	0		
USFS	166	12	10	85	15	15	56	15	25
USF&WS	5	15	15	1	—	10	0		
NPS	18	12	12	12	11	5,8,12, 15,20	1		16
Total	201	12	10	108	15	25	57	15	25

<sup>1</sup>Number of Heartbeats is often applied to groups with packstock as a count of the total group size, horses and humans. (Note: blanks indicate no or insufficient data to calculate a number.)

**Table 3**—Reasons for establishing group size limits by agency.<sup>1</sup>

Agency	N	Environ. impact		Conflict between groups		Conflict within groups		Facility/site constraint		Overall high use of area		Public complaint/pressure		To be consistent with neighbors	
		n	%	n	%	n	%	n	%	n	%	n	%	N	%
BLM	19	10	53	5	26	2	10	2	11	3	16	1	5	12	63
USFS	202	167	83	98	49	9	5	82	40	91	45	48	24	111	55
USF&WS	6	5	83	3	50	0	0	5	83	2	33	3	50	1	17
NPS	27	24	88	14	52	3	11	11	41	11	41	8	30	4	15
Total	254	206	81	120	47	14	6	100	39	107	42	60	24	128	50

<sup>1</sup>Percentages are rounded to the nearest whole number.

current group size regulations within the next five years. About 17% of areas plan to change or create limits over this time period. An additional six percent are unsure of their plans and are waiting for a round of public involvement and research before they decide what to do. Of those planning to make a change, most thought they would lower the group size limit. Only four areas indicated they might increase the allowable group size, and no areas said they planned to eliminate their group size limits. Twenty-six areas without a current group size limit said they planned to establish a limit in the future.

## Discussion

Washburne and Cole (1983) found that 48% of all wilderness areas, regardless of agency, had placed a limit on group size. Our findings suggest about 51% of all areas currently have such a limit. This suggests little overall change over a 16-year period.

A very different picture emerges when change across time within agency is examined. For example, in 1981, Fish and Bury found that 46% of all USFS wilderness managers had limited group size. This increased to 58% in the 1983 Washburne and Cole study. Our data suggest that 73% of USFS wilderness areas currently have a group size regulation. Similarly, Marion and others (1993) reported that about 62% of all NPS wilderness and backcountry areas had group size limits in 1993. We found that 68% of NPS wildernesses currently have group size limits. Some of our higher agency percentages might be explained by our lack of

a census of all areas: Presumably, those areas without group size limits would be less likely to return their group-size-limit survey than those with limits. Nevertheless, we believe that there is an increasing trend toward enacting group size limits within the USFS and the NPS. The reason that the trend for all areas is essentially flat is likely because of the inclusion of many BLM areas and some F&WS areas into the NWPS in the late 1980's and into the 1990's; most of these areas have no group size limits.

In wilderness areas with limits, the trend appears to be toward reducing maximum allowable group size, at least for people. Cole and others (1987) summarized past studies and found that party size limits ranged from 5 to 60. The most common limit was 25. Limits on packstock ranged from 5 to 50, but the most common limit was 20. Our data, summarized across all agencies, suggest that the most common group size limit for people is 10; the median is 12. For horses and packstock, the most common limit is 25, but the median is 15.

Our respondents agreed with Cole (1989) and Cole and others (1987) in listing environmental impacts very frequently and conflicts between groups quite frequently as reasons for adopting group size regulations. However, other frequent reasons given for group size limit seem somewhat more problematic. For example, about half of all areas with limits reported that they did so at least in part to be consistent with neighboring wildernesses. This is in some respects admirable; it seems wise to present consistent minimum impact messages and management regulations to the public. But not all areas, or zones of areas, have similar

susceptibility to impact. This also suggests that the wilderness manager may not have carefully evaluated the benefits and costs of group size limits in his or her area.

Managers in our study frequently mentioned conflict between groups as a reason for group size limits, while far fewer mentioned public complaints/pressure as a reason for adopting limitations. We assume that managerial concerns about conflicts from encountering large groups are based on prescriptions contained in the minimum-impact literature (such as Cole 1989, Cole and others 1987), rather than on reports from their visitors. While such prescriptions and rationale do merit management consideration, these approaches are often not grounded in empirical research.

## A Decisionmaking Framework \_\_\_\_\_

Investigations into the development of a “carrying capacity” for wilderness concluded that while measurements of biophysical and social conditions are invaluable aids in decisionmaking, they cannot be the sole determinants for management decisions (Stankey and others 1990). Careful, value-based decisions must often be made in defining visitor limits and for management actions. The subsequent development of planning frameworks such as Limits of Acceptable Change (LAC) (Stankey and others 1985) and Visitor Impact Management (VIM) (Graefe and others 1990) are based on this premise and, to date, represent the most effective efforts to maintain a high standard of resource and social conditions. We believe that the management of group size can benefit from a similar process—a clear decisionmaking framework (figure 1). This suggestion is not made to diminish the importance of additional research into the many social and biophysical aspects of group size, but rather represents a parallel effort to move forward with thoughtful management on this important issue.

The Wilderness Act mandates that wilderness areas “... should be administered for the use and enjoyment of the American people in such a manner that will leave them unimpaired as wilderness, and so as to provide for the protection of these areas.” The act goes on to specify that wilderness areas should provide “outstanding opportunities for solitude or a primitive and unconfined type of recreation.” This dual mandate is the challenge of the wilderness manager—to provide for visitor access and simultaneously preserve and protect resources and social conditions. The degree of conflict in these dual mandates depends on many factors, many of which are area-specific. Total amount of visitation, season of use, visitor use patterns, types of activities, availability of resistant substrates for campsites and geographic features to name a few, can play a role in the degree of compromise required for meeting competing stakeholder demands. Moreover, managing visitors is even more difficult given the range of legitimate uses, such as commercial outfitting, educational groups, etc., that at times appear to conflict with the private individual visitor. Despite the fact that guided and educational groups represent a small proportion of the total use in wilderness (Morton, personal communication), they can serve broad societal needs.

Given these challenges, the proposed decisionmaking framework approaches this issue from a broad, hypothetical perspective to examine what alternatives might be available to the wilderness manager. Step one in the framework presents three possible management positions: 1) little or no compromise on protection (of social conditions and resources); 2) free and open access for recreation as the priority; and 3) a compromise between the two. There are costs and benefits associated with each of these positions. For example, with no compromise on protection, total use levels would be low, and use would be restricted to small groups (for example, four to six persons). The benefit, of course, would be a high degree of wilderness protection. The cost would be elimination of or reduced access for many. Visitors who prefer a large group would be affected; in particular, services such as guided outings and educational experiences would likely be eliminated or reduced. The opposite position, free and open access, would allow for use of wilderness free from regulation, but at the cost of a high potential for resource and experience impact.

Some sort of compromise between these two extremes is likely to be the preferred option. Step two in the process addresses this situation by offering three possible options, all of which assume some degree of compromise. These are: 1) Emphasize resource and experience protection; 2) emphasize offering wilderness access to the broadest range of wilderness visitors; and 3) find a middle ground between the two. If the desire is to emphasize resource/experience protection, lower group size limits would be sought. Moderate limits would be desirable for the middle ground and higher limits for an emphasis on providing access to the wilderness.

Regardless of the decision made in step two, step three involves deciding whether 1) to impose a uniform limit across the entire wilderness area, or 2) to employ a spatial/temporal zoning approach to develop two or more group size limits across the area. This step also involves setting the group size limits for the remainder of the process for both the uniform limit and zoning options. If there is zoning, several use limits must be set. Different places and portions of the wilderness must be allocated to each zone and the associated group size limit. In making these decisions, consider 1) the proportion of the wilderness in each group size class, and 2) developing specific criteria for allocation to each group size zone. For example, areas where larger groups are allowed should have a high resource tolerance for large groups and a low probability that large groups would impact the experience of other visitors; this would be accomplished through geographic or temporal separation. In the uniform limit option, important considerations are the extent to which protection and access should be balanced and the equity of the single limit for all types of legitimate uses.

Step four considers whether certain groups should be given exemptions, and be allowed to travel in a larger group. Some factors to consider would be whether the sponsoring organization and/or leaders of the group can clearly demonstrate a high level of minimum-impact proficiency, the ability of the agency to regulate and monitor the group’s activities and the value and importance of the service being

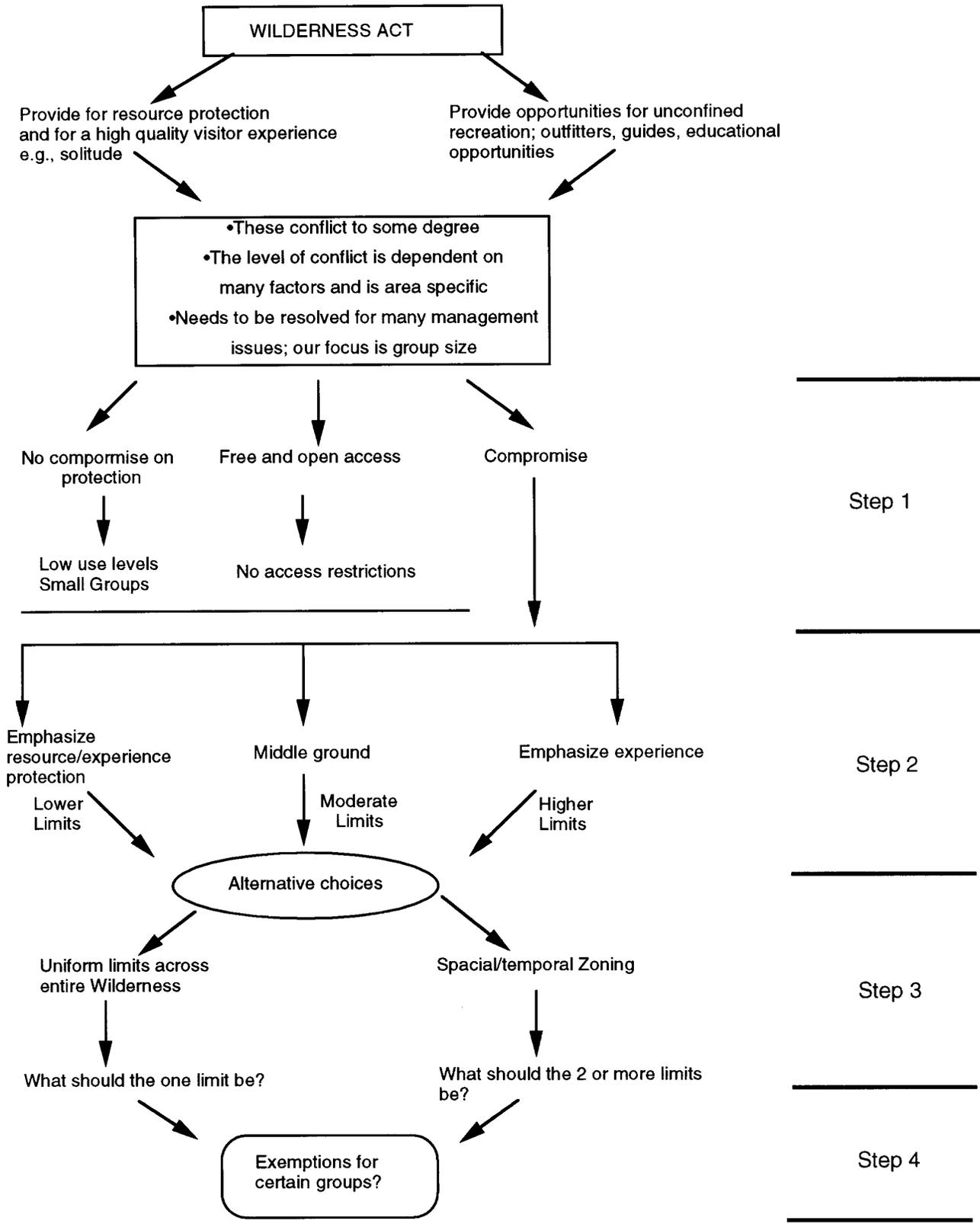


Figure 1—A conceptual model for making group-size decisions.

provided. Moreover, in many cases, larger, organized groups can conduct service projects that further wilderness management goals.

## Conclusions

Limiting group size is a common management approach with the overall goal of limiting ecological and visitor experience impacts. Currently, however, it is not clear how successful this approach has been in limiting impacts, with the exception of eliminating very large groups and their associated impacts. Within current limits, management of factors such as visitor behavior, overall visitor numbers, geographic and temporal separation of groups and site size and durability may be more effective in minimizing impacts than limiting group size.

It is essential that management decisions that limit the size of groups in wilderness be evaluated from a broad cost-and-benefit standpoint. While further research on the ecological and visitor experience implications of groups size remains important, careful and explicit decisions about how best to compromise between the costs and benefits of group size limits are critical to the process of setting a defensible group size.

## Acknowledgments

The ideas in this paper were originally presented in a dialogue session at the Wilderness Science Conference, Missoula, MT, in May 1999. We thank the many participants in that session for their suggestions and lively discussion. We also thank the reviewers of this manuscript for many helpful suggestions.

## References

Christensen, N. A.; Cole, D. N. In press. Leave-no-trace practices: behaviors and preferences of wilderness visitors regarding use of cookstoves and camping away from lakes. In: Cole, David N.; McCool, Stephen F., eds. Proceedings: wilderness science in a time of change. 1999 May 23-27; Missoula, MT. Proc. RMRS-P-000. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Cole, David N. 1981. Managing ecological impacts at wilderness campsites: an evaluation of techniques. *Journal of Forestry*. 79: 86-89.

Cole, David N. 1987. Research on soil and vegetation in wilderness: a state-of-knowledge review. In: Lucas, Robert C., comp. Proceedings—National wilderness research conference: issues, state-of-knowledge, future directions; 1985 July 23-26; Fort Collins, CO. General Technical Report INT-220. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 135-177.

Cole, D.N.; Petersen, M.E. and. Lucas, R.L. 1987. Managing wilderness recreation use: common problems and potential solutions. Ogden, UT. USDA Forest Service, General Technical Report INT-230. 60 pp.

Cole, D.N. 1989. Low-impact recreational practices for wilderness and backcountry. Ogden, UT. USDA Forest Service, General Technical Report INT-265. 131 pp.

Cole, D. N. 1995. Group size limits—can they work? *LNT Master Network*. 10: 3, 15.

Cole, D. N.; Watson, A. E.; Roggenbuck, J. W. 1995. Trends in wilderness visitors and visits: Boundary Waters Canoe Area, Shining Rock, and Desolation Wildernesses. Ogden, UT: U.S.

Department of Agriculture, Forest Service, Intermountain Research Station. Research Paper INT-RP-483. 38 p.

Cole, D.N.; Spildie, D.R. 1998. Hiker, horse and llama trampling effects on native vegetation in Montana, USA. *Journal of Environmental Management*. 53: 61-71.

Cronn, R.; Watson, A. E.; Cole, D. N. 1992. Three Sisters, Mt. Jefferson, and Mt. Washington Wilderness: a survey of Oregon wilderness visitors. Unpublished report. Missoula, MT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 94 p.

Davilla, Bill. 1979. Firewood production, use and availability in the High Sierra. In: Stanley, J.T., Jr.; Harvey, H.T.; Hartesveldt, R.J., eds. A report on the wilderness impact study. San Francisco, CA: Sierra Club, Outing Committee: 94-128.

DeLuca, T.H.; Patterson, W.A.; Freimund, W.A.; Cole, D.N. 1998. Influence of llamas, horses, and hikers on soil erosion from established recreation trails in western Montana, USA. *Environmental Management*. 22: 255-262.

Ferguson, Michael A.D.; Keith, Lloyd, B. 1982. Influence of nordic skiing on distribution of moose and elk in Elk Island National Park, Alberta. *Canadian Field-Naturalist*. 96: 69-78.

Fish, C.B. ; Bury, R.L. 1981. Wilderness visitor management: diversity and agency policies. *Journal of Forestry*, 79: 608-612.

Frissell, S.S., Jr.; Duncan, D.P. 1965. Campsite preference and deterioration in the Quetico-Superior canoe country. *Journal of Forestry*. 65: 256-160.

Graefe, A. R.; Kuss, F.R.; Vaske, J. J. 1990. Visitor impact management, Vol. 2, The planning framework. National Parks and Conservation Association: Washington, DC. 105 pp.

Grayson, M. C. 1990. A survey of visitor characteristics, preferences, and attitudes toward management in the Teton Wilderness area. Buffalo, WY: U.S. Department of Agriculture, Forest Service, Bridger-Teton National Forest, Buffalo Ranger District.

Hall, T. E.; Shelby, B. 1994. Eagle Cap Wilderness: Recreational use and impacts. Report to Eagle Cap Ranger District, Wallowa-Whitman National Forest. Oregon State University, Corvallis, Oregon.

Lime, D.W. 1972. Large groups in the Boundary Waters Canoe Area—their numbers, characteristics and impacts. USDA Forest Service Research Note NC- 142. 4 pp.

Lime, D. W. 1991. Procedures to monitor social conditions in the Boundary Waters Canoe Area Wilderness following the Limits of Acceptable Change (LAC) Planning Framework. Final report to Superior National Forest, USDA Forest Service. St. Paul, MN: Department of Forest Resources, University of Minnesota. 56 p.

Manning, R. E.; Ciali, C.P. 1980. Recreation density and user satisfaction : a further exploration of the satisfaction model. *Journal of Leisure Research*. 12(4): 329-345.

Marion, J. L.; Roggenbuck, J. W.; Manning; R. E. 1993. Problems and practices in backcountry recreation management: a survey of National Park Service managers. Denver, CO. USDI National Park Service, Natural Resources Publication Office, Natural Resources Report NPS/NRVT/NRR-93/12. 48 pp.

Morton, S. USDA Forest Service, Region 1, Missoula, MT.

Renfro, J. R.; Peine, J. D.; VanCleave, R. L.; Overton, D. J.; Absher, J. D. 1990. Backpacker use patterns at Great Smoky Mountains National Park. National Park Service—Southeast Region Research/Resources Management Report. Gatlinburg, TN: Uplands Field Research Laboratory, Great Smoky Mountains National Park. 87 p.

Roggenbuck, J. W.; Timm, W. N.; Watson, A. E. 1979. Visitor perception of the recreation carrying capacity of three wilderness areas in North Carolina. Unpublished report. Blacksburg, VA: Department of Forestry, Virginia Tech. 303 p.

Roggenbuck, J. W.; Watson, A. E.; Stankey, G. H. 1982. Wilderness management in the Southern Appalachians. *Southern Journal of Applied Forestry*. 6(3): 147-152.

Roggenbuck, J.W.; Stubbs, C.J. 1991. Changes in wilderness visits, visitors, problems and preferences at Shining Rock Wilderness: 1978 and 1990. Unpublished report. Blacksburg, VA: Department of Forestry, Virginia Tech. 162 p.

Roggenbuck, J. W.; Williams, D. R.; Watson, A. E. 1993. Defining acceptable conditions in wilderness. *Environmental Management*. 17(2): 187-197

Roggenbuck, J. W.; Widner, C. J.; Williams, D. R. 1994. Mount Rogers NRA high country use and user management: 1992-1993.

- Unpublished report. Blacksburg, VA: Department of Forestry, Virginia Tech. 341 p.
- Stankey, G. H. 1973. Visitor perceptions of wilderness recreation carrying capacity. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. Research Paper INT-142. 61 p.
- Stankey, G. H.; Cole D. N.; Lucas R. C.; Peterson M. E.; Frissel S. S. 1985. The Limits of Acceptable Change (LAC) system for wilderness planning. USDA Forest Service, Intermountain Forest Experiment Station General Technical Report INT-176. Ogden, UT 37 pp.
- Stankey, G. H. 1980. A comparison of carrying capacity perceptions among visitors in two wildernesses. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. Research Paper INT-242. 34 p.
- Stankey, G. H.; McCool, S. F.; and Stokes; G. L. 1990. Managing for appropriate Wilderness conditions: the carrying capacity issue. In: Hendee, J. C.; Stankey, G. H. and Lucas, R.C. Wilderness Management. North American Press, Golden, CO. 546 pp.
- Towler, W. L. 1977. Hiker perception of wilderness: a study of the social carrying capacity of the Grand Canyon. Arizona Review. 26: 1-10.
- Washburne, R.F. and D. N. Cole. 1983. Problems and practices in wilderness management: a survey of managers. Ogden, UT. USDA Forest Service, Research Paper INT-304. 56 pp.
- Watson, A. E.; Niccolucci, M. J.; Williams, D. R. 1993. Hikers and recreational stock users: predicting and managing recreation conflicts in three wildernesses. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. Research Paper INT-468. 35 p.