

# Opportunities for Solitude in the Boundary Waters Canoe Area Wilderness

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**ABSTRACT.** Recreation visitors to the Boundary Waters Canoe Area Wilderness in Minnesota were surveyed to examine the effects of a Forest Service proposal to reduce the number of entrance permits in hopes of increasing opportunities for solitude and reducing resource damage. Results suggest that: (1) reducing recreation-use limits will benefit a portion of the overnight visitors who reported difficulty finding an unoccupied campsite; (2) solitude opportunities can be meaningfully described by comparing visitor encounter levels with visitor tolerance for encounters; and (3) the least number of daily encounters rather than the average number may be the most useful evaluation criteria in determining if solitude opportunities exist. Furthermore, while minimal opportunities for solitude must be provided to meet the mandate of the Wilderness Act, understanding visitor preferences can help determine the quality of wilderness recreation opportunities. *North. J. Appl. For.* 12(1): 12-18.

Assuring opportunities for solitude is a challenge to wilderness managers. The Wilderness Act of 1964 (P.L. 88-577) includes "outstanding opportunities for solitude" among the list of characteristics that define a wilderness. The largest challenge managers face might be to obtain agreement on an acceptable way of determining whether adequate opportunities for solitude exist. Some dictionary definitions of solitude are: alone, seclusion, in a secluded place, shut off from others, isolated, state of being alone, remote from habitation, and in a lonely, unfrequented place. In wilderness, however, very few people actually travel alone. In the early years of wilderness recreation research, increases in visitor density or intergroup encounter levels within a wilderness were assumed to reduce the quality of visitor experiences (Graefe et al. 1984). While such a relationship appears to exist, research found that individual expectations and preferences also influence how visitors respond to encounter levels (Shelby et al. 1983). Recreationists have reported increased crowding not only when they encountered more visitors, but when the number of encounters exceeded their expectations or preferences. Sometimes solitude may be lost when encounters or visitor densities are relatively low, simply because expectations for solitude are high. Alternatively, where use levels are particularly high, visitors may consider the opportunities for solitude to be acceptable, so long as they have accurate expectations about visitor density.

This paper examines the relationship between visitor reports of use densities, density preferences, density tolerances, and density expectations at the Boundary Waters Canoe Area Wilderness in Minnesota. This information will

allow us to determine the ability of current visitors to achieve desired personal solitude opportunity objectives in a heavily used wilderness.

## The Boundary Waters Canoe Area Wilderness (BWCAW)

Less than 2% of the National Wilderness Preservation System is located east of the Mississippi River and north of Arkansas, Tennessee, and Virginia. The BWCAW in Minnesota is by far the largest wilderness in that region, even though it is far removed from the majority of the region's population.

The Boundary Waters Canoe Area (BWCA) entered the National Wilderness Preservation System in 1964, but with many nonwilderness characteristics. With passage of additional legislation in 1978, the BWCAW grew to more than one million acres. The majority of wilderness recreation users come from Minnesota (65%), mostly from the Twin Cities area (Minneapolis and St. Paul).

Most users of the BWCAW paddle canoes, though motorized access is allowed at 10 of the 74 designated entry points; hikers account for only about 1% of the use. All overnight use requires permits. In 1991, 26,400 overnight permits were issued. An estimate of total day use, combined with the overnight total, produced an estimated total of 1.5 million recreation visitor days (RVDs) of use. One RVD is equal to 12 hr of onsite recreation participation. This is the highest total use for any unit in the National Wilderness Preservation System.

An entry point quota system is in place from May 1 through September 30 to enhance solitude opportunities and limit resource impact by limiting campsite occupancy in defined travel zones. The objective is to maintain occupation of campsites at less than 85% of available sites in some zones and at less than 67% in others. A maximum of 382 overnight group permits can be issued for entry each day, though the total of 26,400 permits issued for all of 1991 equals only about 46% of the total possible use between May and September. As in most wildernesses, use peaks on weekends and during good weather, leading to variation in visitor densities and in the number of permits actually claimed.

The established capacities are a function of the number of designated campsites in the travel zones where campers can stay only in designated sites (93% of the area). In the zone where campers do not have to stay in designated sites, the capacity is related to the number of user-established campsites. By far the majority of use occurs in zones with designated sites. Other restrictions on use are intended to help reduce impacts to the lake system and improve opportunities for solitude. Group size is limited to 10 people, fire grates are provided at designated campsites, no cans or bottles are allowed, and pit toilets have been constructed at most campsites to reduce the chance of water pollution.

The Superior National Forest proposed reducing entry point quotas to improve solitude opportunities and reduce resource impacts. The proposed changes in quotas would have less than 67% of the campsites occupied on any one night in all travel zones, on the assumption solitude will increase and resource damage will decrease with lower occupancy. This change would result in a reduction in total overnight permits available each day from 382 to 276. The research reported here offers an opportunity to examine the need for these proposed reductions through analysis of visitor perceptions of solitude opportunities currently existing in the BWCAW. It further offers an opportunity to demonstrate a method of evaluating the effect future changes in the quota system might have on solitude opportunities. This research does not address the potential for limiting entry permits to reduce resource impacts.

## Methods

A survey to assess characteristics and preferences of overnight BWCAW visitors was conducted in 1991. The sample, which consisted of visitors who had obtained the required entry permit, was taken at selected entry points in proportion to permit distribution at that entry point during the previous year (1990). Since the number of permits available for each entry point varied substantially, and it was not feasible to sample every single entry point, the entrances were stratified based on the number of permits issued annually. The distribution of the 1991 sample across four strata was similar to the 1991 permit distribution (Table 1). Twenty-three percent of the 1991 sample entered through the BWCAW's two most heavily used entry points, comparable to the 22% of the total number of 1991 permits issued at these points. The second tier of entry points (6) contributed about

**Table 1. Sample and permit distribution across entry points at the Boundary Waters Canoe Area Wilderness in 1991.**

Entry use level <sup>a</sup>	Proportion of sample	Proportion of permits issued (%)	Proposed reduction in quota
Very high <sup>b</sup>	23	22	18
High <sup>c</sup>	24	28	36
Moderate <sup>d</sup>	29	23	22
Low <sup>e</sup>	23	27	20

<sup>a</sup> Entry use levels approximate use quartiles, with "Very high" including the entry points that have the highest individual use and "Low" those that have the lowest use levels.

<sup>b</sup> Moose Lake, Lake One.

<sup>c</sup> Sawbill, Saganaga, Fall, Brule, Moose River-North, Sea Gull.

<sup>d</sup> Trout, Kawishiwi, Indian Sioux-North, Range, Snowbank, East Bearskin, Sea Gull-restricted, Magnetic, Duncan, Clearwater, Lizz.

<sup>e</sup> All others.

28% of the total permits issued in 1991 and 24% of the sample. Another 11 entry points made up the next 23% of the permits issued; a sample of users at 9 of these locations contributed 29% of the total sample of users. The remaining 58 entry points combined accounted for 27% of the use in 1991. We sampled 19 of those 58 entry points for 23% of our sample of users.

This stratification system was based on the assumption that visitor densities would vary across these four strata, providing an opportunity to examine whether solitude was achieved by visitors choosing the most heavily used or least heavily used entry points. The effects of a quota system based on limiting permits at individual entry points must be related directly to the entry points used by the visitors surveyed. An analysis of the quota reductions proposed by the Forest Service (USDA Forest Service 1992) (Table 1) indicates that the number of permits available for the various sample strata would be reduced between 18 and 36% to achieve a maximum of 67% campsite occupancy in all travel zones. The proposal would most dramatically affect the number of permits available for the six entry points, representing the second highest quartile of use. The proportional reduction in number of permits available at these points is double that of the highest use quartile and at least 160% that of the other quartiles.

Visitors were contacted at entry points to encourage their participation in the study. No visitors refused to participate. A 13-page mailback questionnaire was sent to 398 participants. The total usable sample size of 295 resulted from a 74% overall response rate to the mailback questionnaire.

In the questionnaire, visitors were asked to estimate the total number of paddler groups they saw during their trip, and they were asked to record the fewest paddler groups they saw during any one day of their trip. Visitors were also asked similar questions about the number of groups camped within sight or sound of them. The primary statistics reported here on encounters are the average number of encounters per day or night (based on the total groups seen divided by length of stay in days or nights), and the number of groups seen on the day (or night) with the fewest encounters.

Visitors were also asked to indicate the range of encounters they would consider acceptable during one day in the BWCAW. Their answer was given on a horizontal scale of 0 to 50 encounters, with one unit increments indicated, 5 unit increments highlighted, and 10 unit increments labeled. From that acceptable range, they were asked to indicate the encounter level they most preferred. Previous analysis of data obtained using this measurement scale at other wildernesses (Watson et al. 1992, Williams et al. 1992, Roggenbuck et al. 1993), has suggested there is substantial variability in responses across subjects. In past efforts, these scale responses were used in attempts to describe central tendencies and determine level of group consensus for visitor acceptance of social impacts. Williams et al. (1992) concluded that sample sizes of 100 to 300 visitors allow results based on these scales to be applied more generally. Despite the variability in responses from visitor to visitor, acceptable levels for social impacts are not very different across diverse areas. In the study reported here, the primary interest is not in estimating central tendencies or determining the level of group consensus, however, but in comparing individuals' preference and tolerance levels to conditions they actually encountered. One concern is that measures of preference and tolerance taken after a trip may be affected by social conditions encountered on the trip. High encounter levels may encourage greater tolerance than would be indicated if the survey had been taken before the trip, or high encounter levels may create short-term intolerance that may not reflect tolerance and preferences over the long term. Whether or not individual responses are stable over the long term, this study represents responses to specific conditions encountered at a specific site on a particular trip.

Other questions in the survey asked whether the respondents felt crowded during the trip, asked respondents to compare their expectations for encountering others with the number of encounters on their trip, and asked respondents to evaluate the current quota system.

Chi-square analysis was used to test differences in categorical responses across the four groups of visitors representing the four strata of use at the different entry points. Differences between group means were tested by analyses of variance with Tukey's test (SAS 1989) to determine which means were different. Distributions were examined and transformations were applied as needed to correct for nonnormality before tests were conducted on means.

## Results

Analyses of questions related to visitor density, preference, and tolerance provide a good method of evaluating existing opportunities for solitude in the BWCAW.

### Encounter Levels

As expected, significant differences in encounter levels were reported by the different entry point groups. Users who entered through the two most heavily used points averaged 4.6 encounters daily with paddler groups (Table 2). Those entering through the least heavily used entry points averaged only 2.2 paddler group encounters per day. The least number of paddlers encountered daily also varied from the most heavily used to the least heavily used entry points, ranging from about 3.2 groups per day to 1.3 groups per day. This suggests that even at interior destinations, those entering through the most heavily used entry points will have a greater number of daily encounters.

Visitors entering through the more heavily used entrances were also likely to average significantly more groups camped near them each night (though the average and median were well below one group per night). At least 50% of users entering at all points reported no one camped near them on at least one night of their trip.

### Crowded Conditions

Even though encounter levels differed, there were no significant differences between visitors at the most heavily and least heavily used entry points in the percentage that reported feeling crowded. From 49 to 65% of the visitors sampled felt the BWCAW was crowded in at least a few areas (Table 3). We do not regard this as an indicator of solitude achievement, but as an indicator of the proportion of visitors that reported some loss of solitude during their trips. The majority of those feeling crowded did not change their route or the length of their visit to avoid crowded conditions (Table 3). This suggests that a general report of crowded conditions probably is not a serious indication that solitude opportunities do not exist. A substantial number of visitors in each group (about one-third) reported difficulty finding an unoccupied campsite at some time during their trip. About as many concluded too many people were in the area (Table 3). Even though half the visitors reported feeling crowded at some time during the trip, only about one-third concluded too many people were in the wilderness. This reminds us that

**Table 2. Encounter levels (average and least per day) for visitors to the Boundary Waters Canoe Area Wilderness.**

Type of encounter	Entry use level				Significance (Tukey's test)
	Very high	High	Moderate	Low	
	Mean <sup>a</sup> (median)				
Average number of paddle groups/day	4.6a(3)	3.5ab(3)	2.8bc(2)	2.2c(2)	0.0001
Least number of paddle groups/day	3.2a(2)	2.3a(2)	1.6b(1)	1.3b(1)	0.0001
Average number of campers/night	0.6a(.5)	0.7a(.5)	0.4b(.3)	0.3b(.1)	0.0001
Least number of campers/night	0.7a(0)	0.6a(0)	0.5a(0)	0.3a(0)	0.0723

<sup>a</sup> Means with the same letter in each row are not significantly different at  $P \leq 0.05$ .

**Table 3. Visitor evaluations of crowded feelings.**

Response	Entry use level				Significance (Chi-square)
	Very high	High	Moderate	Low	
	(%)				
A. Did the visitor feel the BWCAW was crowded?					0.4160
No	38	35	52	43	
Yes, in a few areas	54	56	38	47	
Yes, in most places	7	9	11	10	
Didn't notice	1	1	3	0	
B. Did the visitor change the route or length of trip due to crowded conditions?					0.1370
No	80	59	67	73	
Yes, the length	2	4	0	8	
Yes, the route	13	26	25	16	
Yes, both	5	11	8	4	
C. Finding an unoccupied campsite					0.4680
Not a problem	74	63	65	70	
Problem	26	37	35	30	
D. Too many people in area					0.3680
Not a problem	70	61	74	69	
Problem	30	39	26	31	

conclusions that too many people were in the wilderness could be related to resource impacts, as well as the loss of solitude opportunities. This also reminds us that solitude evaluations involve more than just the number of people met during a trip.

#### Preferred Level of Encounters

Visitors from the four groups of entry points did not differ in their preference for the number of encounters with groups of paddlers, preferring an average of about six to eight groups per day. Median preferences were consistently five groups of paddlers per day. Preferences for the number of groups camped nearby did differ among the four groups; those entering the least heavily used access points preferred to encounter only about half as many groups camped nearby as those who had entered at the two heavily used entry points (Table 4). Medians were similar, about two to three groups per night.

#### Acceptable Level of Encounters

The average number of encounters visitors would be willing to accept tended to be about twice as great or greater than the average number they preferred. Those entering through the most heavily used access points tolerated significantly more encounters while paddling and when camping

(Table 5). Across all entry points, half of the visitors were willing to accept encountering more than 8 to 10 paddler groups per day, and more than 3 to 5 camping groups within sight or sound of their camp.

#### Comparing Encounters with Preferences

Slightly more than one-fourth of all visitors reported encountering more groups of paddlers daily than they preferred, with no significant differences across the strata of access points (Table 6). Only about 9 to 18% of visitors encountered more paddlers than they preferred on the day with the fewest encounters. About 85% of visitors who experienced more encounters than they preferred, either averaged over the entire trip or on the day with the fewest encounters, reported some level of crowding during their visit.

The pattern was similar for encounters at campsites, with nearly one-fourth reporting more nearby campers than they preferred; only about 7 to 12% reported encountering more campers than they preferred on the night with the fewest encounters. Three-quarters of the visitors who encountered more campers, on average, than they preferred, and 82% of those who encountered more campers than they preferred on the night with fewest encounters, reported feeling crowded during the trip.

**Table 4. Preferred numbers of encounters in the Boundary Waters Canoe Area Wilderness.**

Type of encounter	Entry use level				Significance (Tukey's test)
	Very high	High	Moderate	Low	
	Mean <sup>a</sup> (median)				
Number of paddling groups/day	8.5a(5)	8.3a(5)	6.4a(5)	5.8a(5)	0.1653
Number of campers nearby/night	5.5a(3)	5.7a(2)	2.5b(2)	2.7b(2)	0.0311

<sup>a</sup> Means with the same letter in each row are not significantly different at  $P < 0.05$ .

**Table 5. Acceptable numbers of encounters in the Boundary Waters Canoe Area Wilderness.**

Type of encounter	Entry use level				Significance (Tukey's test)
	Very high	High	Moderate	Low	
	Mean <sup>a</sup> (median)				
Number of paddling groups/day	14.6a(10)	14.2a(10)	11.6ab(10)	10.2b(8)	0.0169
Number of campers nearby/night	10.3a(5)	8.1ab(5)	5.7b(5)	6.7b(3)	0.0572

<sup>a</sup> Means with the same letter in each row are not significantly different at  $P \leq 0.05$ .

### Comparing Encounters with Acceptable Levels

Visitors entering at the most heavily used entry points were the most likely to have more encounters with other groups of paddlers than they considered acceptable; about 20% encountered more groups, on average, than they considered acceptable (Table 7), and 9% encountered more groups than they considered acceptable on the day with the fewest encounters. Seldom did any visitors from less heavily used entry points report encountering more paddlers than they considered acceptable on the day with the fewest encounters. Ninety-two percent of the visitors who reported encountering more groups of paddlers than considered acceptable, on average, also reported crowded conditions. Every visitor who reported encountering more groups of paddlers than they considered acceptable on the day with the fewest encounters said they experienced crowded conditions.

About 4 to 10% of all visitors encountered more campers, on average, than they considered acceptable. Less than 7% of all visitors encountered more campers than they considered acceptable on the night when the fewest camping groups were nearby. All visitors who encountered more campers than they considered acceptable, either on average or on the night with the fewest camping groups nearby, also reported some level of crowding.

### Visitor Expectations

Most visitors had expectations about the number of people they would see on their visit, with nearly half reporting they saw about the number of other people they had expected (Table 8). About one-third (32 to 38%) of the visitors encountered more paddlers than they anticipated, while only 14 to 22% encountered fewer paddlers than anticipated. Eighty-four percent of the visitors who encountered more paddlers than anticipated reported feeling crowded at some time on their trip. Visitors entering at the moderate use access points were more likely to encounter fewer campers than anticipated; only about a third of these visitors encountered

about as many campers as they anticipated. Of the visitors entering at the other three groups of entry points, 54 to 64% encountered about as many campers as they anticipated. Of all visitors who encountered more campers than anticipated, 85% said they experienced crowded conditions at some point during the trip.

### Evaluation of the Current Quota System

Visitors entering at the four groups of entry points did not differ in their evaluation of the current quota system (Table 9). One-half to two-thirds thought the system was okay, although 22 to 34% supported decreasing the number of permits. Very few supported increasing the number of permits, though about 10% of those entering at the most heavily used entry points had no opinion; none of those entering at the least heavily used entry points had no opinion on the current quota system.

### Application

This research leads to three major conclusions related to measurement of solitude opportunities in the Boundary Waters Canoe Area Wilderness. First, about one-third of all visitors have difficulty finding unoccupied campsites at some time during their visits, and managers should address this problem. One option is to increase the number of campsites without increasing the number of campers. However, this would place new impacts on the resource. Another option, which the Forest Service has proposed, is to reduce traffic in travel zones by further restricting the number of permits. This would ease feelings of congestion caused by difficulty in finding unoccupied campsites. The entry points where the greatest reduction in available permits is proposed are those with moderate use, also the entry points where visitors report the greatest problem finding unoccupied campsites (37% had a problem), and where visitors were most likely to support reducing the number of available permits (34% supported the

**Table 6. Proportion of visitors who experienced more than their preferred number of encounters in the Boundary Waters Canoe Area Wilderness.**

Type of encounter	Entry use level				Significance (Chi-square)
	Very high	High	Moderate	Low	
	(%)				
Average number of paddlers/day	28	30	25	31	0.874
Least number of paddlers/day	13	17	9	18	0.463
Average number of campers/night	25	20	17	22	0.806
Least number of campers/night	8	7	10	12	0.766

**Table 7. Proportion of visitors who experienced more encounters than they considered acceptable in the Boundary Waters Canoe Area Wilderness.**

Type of encounter	Entry use level				Significance (Chi-square)
	Very high	High	Moderate	Low	
	(%)				
Average number of paddlers/day	20	6	7	8	0.041
Least number of paddlers/day	9	3	2	0	0.031
Average number of campers/night	8	4	9	10	0.601
Least number of campers/night	4	0	7	4	0.161

**Table 8. A comparison of visitors' expectations to the number of encounters they experienced in the Boundary Waters Canoe Area Wilderness.**

Type of encounter	Entry use level				Significance (Chi-square)
	Very high	High	Moderate	Low	
	(%)				
Paddlers seen					0.2580
Far fewer	5	3	5	0	
Fewer	9	17	17	17	
About what expected	55	43	40	49	
More	18	25	26	29	
Far More	14	11	12	6	
Campers nearby					0.0050
Far fewer	14	1	11	12	
Fewer	8	14	25	9	
About what expected	55	54	39	64	
More	15	25	25	14	
Far more	9	6	0	2	

reduction). The proportion of visitors who have difficulty finding an unoccupied campsite could be one potential indicator of solitude opportunities in the BWCAW.

A second relevant indicator of solitude would be the relationship between the number of encounters visitors consider acceptable in wilderness and the number they experience. This indicator would relate well to the concept of limits of acceptable change in wilderness and to previous solitude research; in addition, it values individual definitions of solitude that are rarely valued in wilderness planning. Rather than trying to reach agreement on some number of encounters per day, with the false premise that number is relevant to all users, adoption of a more precise indicator of solitude, based on individual reports of the relationship between acceptable

levels of encounters and those experienced, provides a more meaningful indicator of solitude achievement.

A third potential indicator of opportunities for solitude would be the proportion of visitors for whom the number of encounters was unacceptable on the day with the fewest encounters. These visitors had no opportunity to experience solitude, as they defined it. The Wilderness Act establishes the goal of providing opportunities for solitude. Very few people have interpreted this goal as stipulating that at all times, every visitor should be able to experience total solitude. Instead, recent policy has been to acknowledge that different portions of a wilderness may offer different opportunities. The Limits of Acceptable Change (Stankey et al. 1985) system of establishing objectives for wilderness man-

**Table 9. Visitor evaluation of the current permit quota system.**

	Entry use level				Significance (Chi-square)
	Very high	High	Moderate	Low	
	(%)				
Support for quota system					0.2680
Okay as is	63	53	62	62	
Support fewer permits	21	34	22	32	
Support more permits	7	7	10	6	
No opinion	9	6	6	0	

agement clearly suggests variation in opportunities available for visitors. The Limits of Acceptable Change system even incorporates the term "opportunity classes" to describe zones that are differentiated by varying management standards and visitor experience expectations. It is common to plan for a high probability that visitors will experience relatively few or no encounters each day in the most pristine opportunity class.

The relationship between encounter levels and visitor preferences may be more a question of the quality of the wilderness experience than a question of whether the experience met minimally acceptable conditions under the Wilderness Act. The relationship between acceptable numbers of encounters and the number of encounters experienced does provide a basis for establishing *limits of departure from ideal wilderness conditions*. On the other hand, the relationship between the preferred number of encounters and the number of encounters experienced provides an opportunity to set objectives for *desired conditions*. Establishing agreement on desired conditions is not an integral part of Limits of Acceptable Change planning, and, in fact, the failure to do so appears to be a shortcoming of that planning approach.

The Forest Service proposal to reduce the number of permits issued seems to offer benefits to visitors. While the number of encounters for visitors entering at all entry points seems to be mostly within levels they consider acceptable, some visitors are not finding the mandated opportunity for solitude. This problem could become more serious because current quotas are not always filled. If use levels rose to the allowable levels, solitude opportunities would almost certainly decrease. It is difficult to predict the exact relationship between campsite occupancy levels and the opportunity for solitude, but a move to reduce maximum occupancy rates in travel zones to a standard level (67%) would likely help. The justification is the need to increase the likelihood visitors will feel they have found solitude and to reduce the proportion of visitors who have difficulty finding unoccupied campsites.

There are problems with basing management objectives on visitors' stated preferences and acceptance levels. Levels visitors consider acceptable may change over time. If management allowed more encounters as visitors became more tolerant of encounters, the wilderness experience could change substantially. Those visitors less tolerant of encounters would go elsewhere. Other approaches, such as setting standards for social conditions based on median tolerance values (normative standards) as described in Vaske et al. (1992), have this same difficulty. Median tolerance values also may change over time. A recent study of trends in visitor characteristics and attitudes suggests that tolerance for interparty contacts at the BWCAW actually declined from 1969 to 1991 as use levels increased (Cole et al., in prep.).

The problem with individual or societal definitions of solitude changing over time and the ways that might influence management policy need to be examined further. The threat appears to be greatest in the heaviest used portions of wilderness. There will always be some people who recognize the value of visiting places with little or no encounters. This trait is not likely to disappear completely from our society. However, a growing number of people may be willing to accept encountering more people in the peripheral portions of wilderness. If managers allowed use to increase based on increased tolerance, use in peripheral portions of wilderness could increase beyond current levels. The potential change in visitors' tolerance makes it important that we begin right away to examine the relationship between conditions visitors are encountering in wilderness and those they consider acceptable. Both of these variables are essential in determining if we are providing opportunities for solitude.

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NOTE: Beginning with the 1994 use season, the average daily number of permits available for overnight use was reduced to 280.5, essentially the reduction proposed by the Forest Service (originally 276) (USDA 1993).