

PATTERNS OF WILDERNESS USE AS RELATED TO
CONGESTION AND SOLITUDE

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The Wilderness Act of 1964 (Public Law 88-577) established a system of federally protected areas across the nation. Two principal criteria concerning the definition of Wilderness are contained in the Act: (1) such areas should reflect primarily the forces of nature, with man's influence "substantially unnoticeable," and (2) such areas should have "outstanding opportunities for solitude or a primitive and unconfined type of recreation."

Steady, rapid growth in the use of wilderness and related primitive settings, coupled with pressures on the de facto wilderness resource base make the full achievement of the above goals difficult and uncertain. For instance, use of National Forest Wilderness has increased steadily at a 10 to 12 percent annual rate since estimates began nearly three decades ago. From 1950 to 1970, reported annual visits to these areas grew from less than 250,000 to over 2 million (Lucas, 1973). Use of National Park backcountry is similarly increasing. Moreover, projections of future demand suggest considerable potential for growth (Cicchetti, Seneca, and Davidson; 1969).

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While this rapid increase in demand has occurred, supply has remained relatively static. Official Wilderness (including Primitive Areas which are National Forest areas managed essentially the same as Wilderness, but not designated as "Wilderness" by the Wilderness Act) has remained nearly constant at about 14½ million acres since the late 1930's. Under the terms of the Wilderness Act, the Forest Service, National Park Service, and Bureau of Sports Fisheries and Wildlife are conducting reviews of lands they manage for possible addition to the National Wilderness Preservation System.

As of January 1, 1973, there were 95 units in the National Wilderness Preservation system. Sixty-six of the areas (70 percent) are on National Forest lands; 25 are Bureau of Sports Fisheries and Wildlife areas and the remaining four are in National Parks. Of the 11 million acres of land in the system, (omitting the Primitive Areas under study for possible addition), 10.7 million are in National Forests. Nearly all of the classified Wilderness acreage is west of the 100th meridian; only about 1.1 million acres are in the mid-west and east, and almost all of that (1,029,690 acres) is in one area--the Boundary Waters Canoe Areas in northeastern Minnesota. Thus the major population centers of the nation are sharply separated from the bulk of classified Wilderness acreage.

Estimates as to the potential size of the system vary. The growth in roads, settlements and extractive land uses has eroded substantially the once vast acreages of de facto wilderness. Although a recent inventory of roadless areas indicated over 56 million acres of de facto wilderness remained on the National Forests alone (Roadless and Undeveloped Areas, Final Environmental Statement, 1973), it is unlikely the entire national Wilderness System ever will encompass much more than around 70 million acres (Stankey, 1971), given the fact these unprotected de facto lands also have the capability to serve other objectives incompatible with wilderness (Krutilla, 1973).

These supply and demand conditions will result in increasing use pressures that threaten both the socio-psychological qualities of the recreational experience provided by Wilderness as well as the integrity of the ecosystems in these areas. Our concern in this paper lies principally with the recreational experience issue. As increased congestion occurs, a gradual diminution of the particular kind of experience offered by Wilderness can be expected to occur. Multiple satisfactions flow from the Wilderness experience, but visitor studies show the quality of the physical-biological environment and the typically low-density use levels are particularly important components (e.g., Stankey, 1973). Both of these components, however, are fragile, and can change quickly as use increases.

Managerial responses to these conditions while needed, are nonetheless restricted in their scope. The gradual deterioration of trails and campsites could be offset by a program of actions designed to "harden" the environment (e.g., paving trails, planting hardy species on high impact locations, etc.). However, it is generally accepted that such actions conflict with the spirit of the Wilderness Act (Lucas, 1973). At the same time, inaction is not a viable alternative. In some southern California Wildernesses, use levels around popular lakes create a scene more reminiscent of a carnival than a "primitive and unconfined type of recreation" experience. The costs of inaction include continued resource deterioration and the loss of an irreproducible, relatively scarce resource which is largely without substitute in terms of either the biological richness of these areas or of their unique capability to provide special recreational experiences (Hendee and Stankey, 1973).

Wilderness congestion, however, is not universal throughout the systems or consistent within areas. Spatial and temporal patterns of congestion vary both between and within areas. In the following discussion, focused on Wilderness under Forest Service administration, we explore these inter- and intra-area variations in use distributions, and discuss some of the management implications and research opportunities associated with these geographic imbalances.

INTER-AREA VARIATIONS IN CONGESTION

Reported visitor use of Wilderness shows substantial variation. The most heavily used unit is the Boundary Waters Canoe Area (BWCA) in northern Minnesota, which reported slightly more than one million visitor-days¹ of use in 1973--about 15 percent of the total Forest Service visitor-day useage reported for the National Wilderness Preservation System for that year. On the other end of the scale, use in the Galiuro Wilderness in Arizona was only about 400 visitor-days.

These use figures give us little information regarding congestion, however. For one thing areas vary in size. For example, the use in the BWCA is distributed over one million acres; the Galiuro covers only 52,000 acres. In the following table, we have converted the acreage and use figures for selected areas into a use per unit area measure that permits inter-area comparisons.

1/ The standard unit for reporting recreation use on National Forests is the visitor-day, defined as an aggregate stay of one person for 12 hours, 2 persons for 6 hours, etc.

Table 1.--Use Intensities in Selected Wildernesses, 1972.

<u>Wilderness (State)</u>	<u>1972 Visitor- days</u>	<u>Gross Acreage</u>	<u>Visitor days/Acre</u>
1. Desolation (California)	305,700	63,479	4.8
2. Great Gulf (New Hampshire)	25,300	5,552	4.6
3. San Jacinto (California)	79,700	21,955	3.6
4. John Muir (California)	872,600	504,263	1.7
5. Boundary Waters Canoe Area (Minnesota)	955,800	1,029,690	0.9
6. Three Sisters (Oregon)	172,500	196,708	0.9
7. High Uintas (Utah)	119,700	237,177	0.5
8. Selway-Bitterroot (Montana-Idaho)	136,800	989,179	0.1
9. Bob Marshall (Montana)	115,300	950,000	0.1

There are broad differences in the relative degree of congestion one might encounter in any area (Table 1). For instance, although total use in the High Uintas and Bob Marshall is about the same, a visitor-day of use in the Bob Marshall is accommodated over about four times as much area.

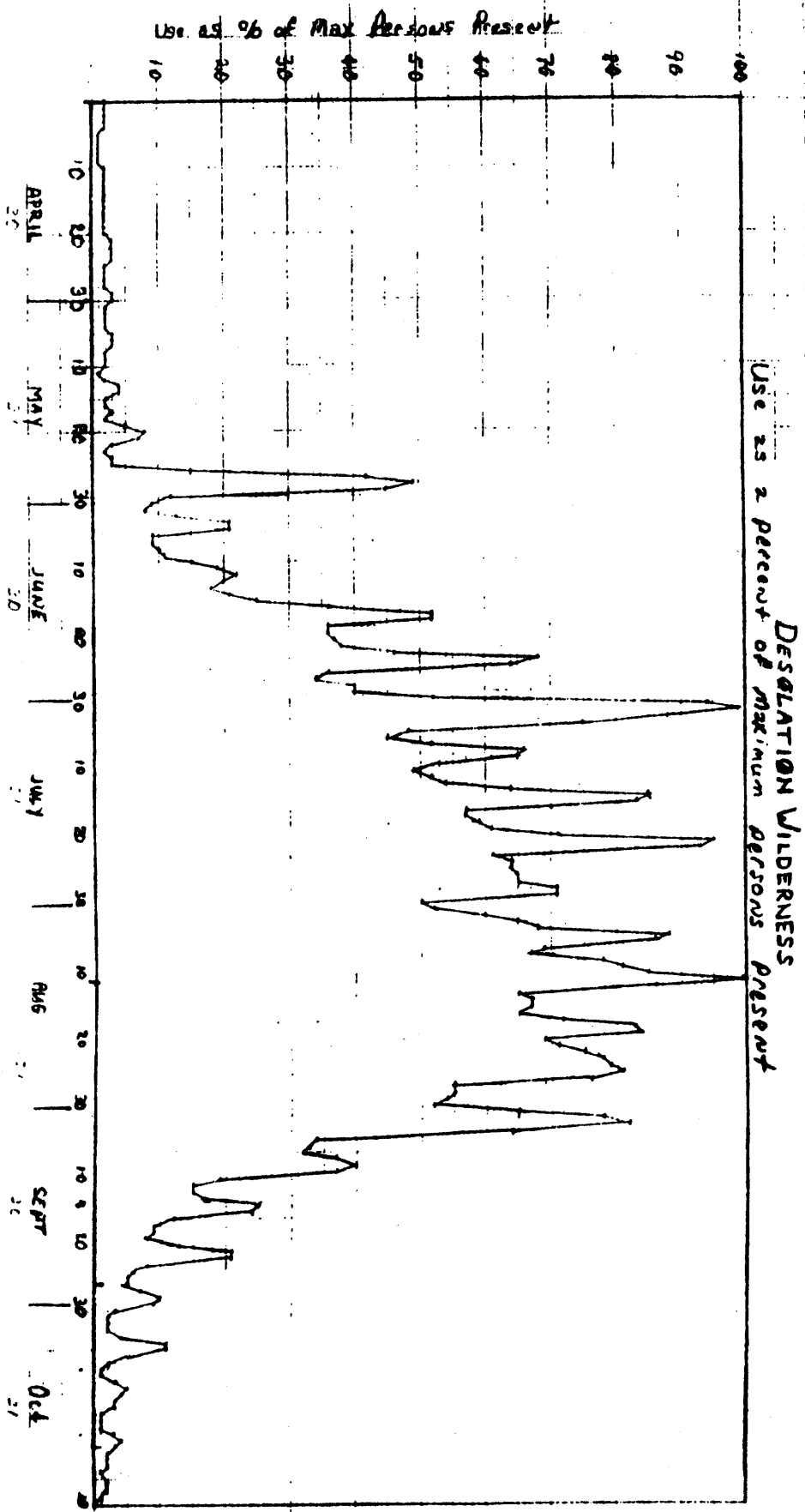
Although Table 1 improves our understanding of inter-area differences in congestion, it is still simplistic and does not give an accurate picture of congestion. At least 3 additional factors should be considered in describing levels of wilderness congestion in addition to size. First, there are large variations in the length of season between areas. In the northern Rocky Mountains, the main use season might be less than two months (because of trails blocked by snow, etc.) In northern California, use begins in late May and might run until September or October. In the milder regions of the country, the season might even be longer. For instance, the Salmon River in Idaho, only about 2,000 feet above sea level, is used almost year round.

Therefore, by adding a "length of season" variable to our measure of congestion, the effect is to produce even higher levels than Table 1 might suggest. For instance, the one million visitor-days of use in 1973 in the BWCA was not distributed evenly over time--91 percent of the visitor-days of use came between the first of May and the first of September.

Second, the proportion of "effective" acreage is not the same in all Wildernesses. Although all wilderness acreage is "available" in the sense it provides at least a backdrop for the recreational and space for isolation, only a portion is "used" directly by the visitor. Steepness of slope, type of vegetation, abundance of lakes and streams, etc., affect the amount of land available for the distribution of use. On the San Jacinto Wilderness in southern California, for example, it was estimated that of the 690 acres in one travel zone (management area),, approximately 400 acres were unavailable for use because of excessive steepness, vegetation, and the presence of excessively wet meadows.² Other areas are even more rugged and the proportion of the area useable may be much smaller.

And third, there are dramatic differences in how use is distributed over the individual weeks of the season. Figures 1 and 2 present information on the daily occupancy in two California Wildernesses--the Desolation, located near Lake Tahoe, and the Marble Mountain, just south of the Oregon border. Use is shown as a percent of the maximum number of persons present in the area on one day. In the Desolation, the weekend peaks of use are clear, along with the sharp increase on Memorial Day and again on Labor Day. In the Marble Mountains, the weekend peaking is much less sharp and the overall pattern of use is more even. The average length of stay, as one might expect, is about twice as long in the

^{2/} San Jacinto Wilderness Management Plan, San Bernardino National Forest (1972).



MARBLE MOUNTAIN WILDERNESS
 Use as % of maximum persons present

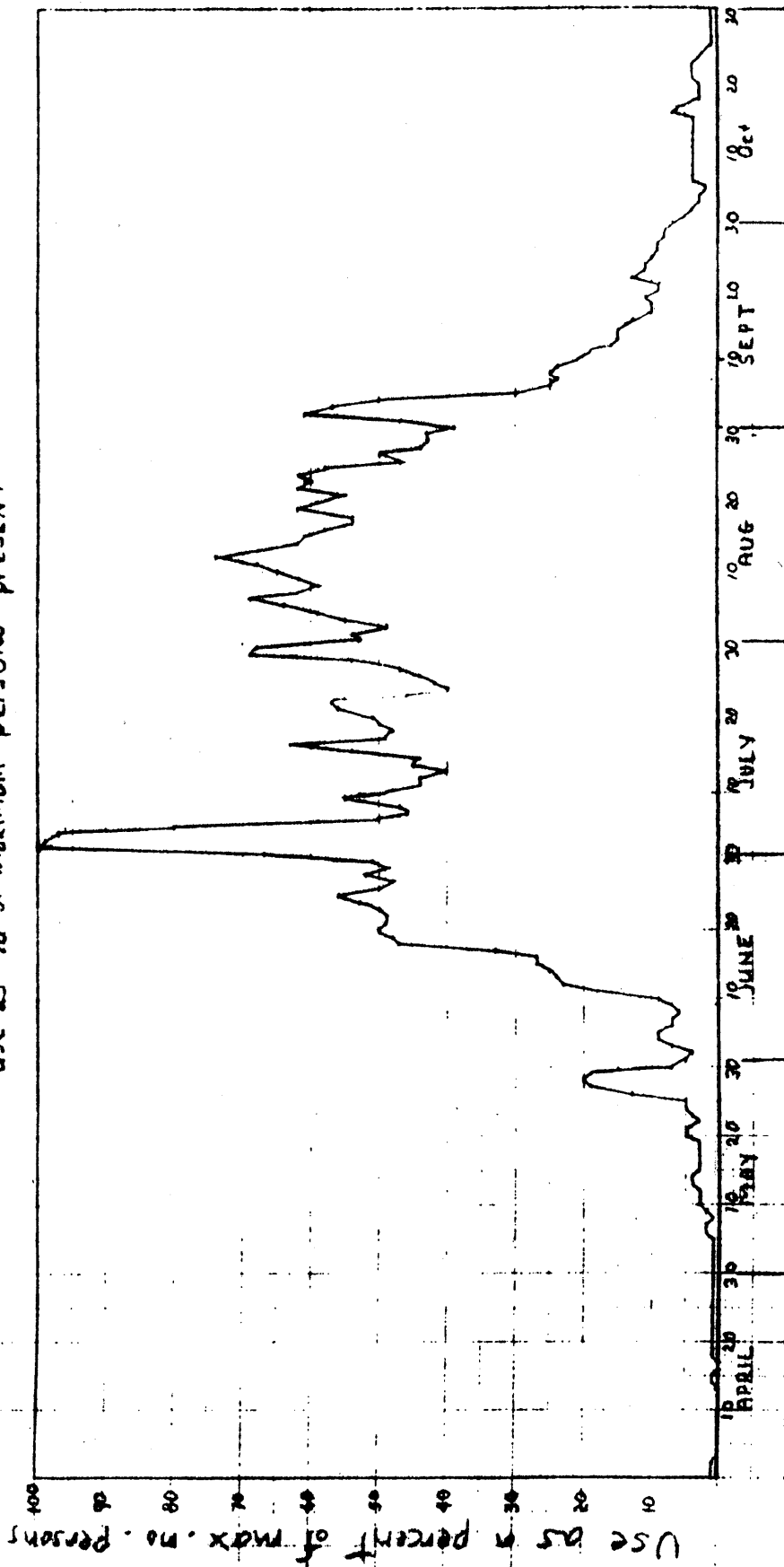


Fig 2 -- Marble Mountains Wilderness, California
 Distribution of Use

Marble Mountains as in the Desolation (9.4 12-hour visitor-days, versus 5.0 visitor-days). The locational characteristics of the two areas are also substantially different. The Desolation is easily accessible from the Sacramento-San Francisco region and, consequently, is more susceptible to the short, weekend style of use. The Marble Mountain Wilderness, on the other hand, is much less accessible and the time required to reach the area leads to longer visits.

It is clear that, at the macro-scale, use is far from evenly distributed. Use pressures in some areas are currently intense while in other areas, use is so light that administrative concerns about requiring permits or instituting rationing are viewed as unnecessary. But the pattern of congestion is yet more complex than we have suggested. Knowledge of intra-area use patterns also is crucial for management decisions that will help insure achievement of the goals outlined in the Wilderness Act.

INTRA-AREA PATTERNS OF CONGESTION

One consistent fact emerges from studies of use in individual wildernesses: the use patterns are highly skewed, both spatially and, as pointed out in the previous section, temporally. For instance, in the BWCA in 1973, about 70 percent of the use groups entered through only seven of the area's 70 entry points. In fact, two entry points accounted for one-third of all groups entering the area. In the Mission Mountains, Lucas et.al. found over 90 percent of the groups traveled on only two of the area's 19 trails. (Lucas, Schreuder, and James; 1971).

Figure 3 is representative of the spatial distribution of use found in most Wildernesses. It shows the use pattern in the Spanish Peaks Primitive Area, near Bozeman, Montana, for the 1970 season. Most of the use is heavily concentrated along some rather short segments of the trail system--for instance, the trail leading into Lava Lake is only a little over two miles long. Nearly two-thirds of the area's use is day use which accounts for the heavy use of short in-and-out routes such as the Lava Lake trail.

The heavy concentration of use along only a few trail miles is graphed in Figure 4. Total travel, in visitor-miles, is graphed against total trail miles. The higher the index number, the more concentrated the use. In the Spanish Peaks, the use is relatively concentrated: for instance, 35 percent of the cumulative trail mileage accounts for about 75 percent of the cumulative visitor travel.

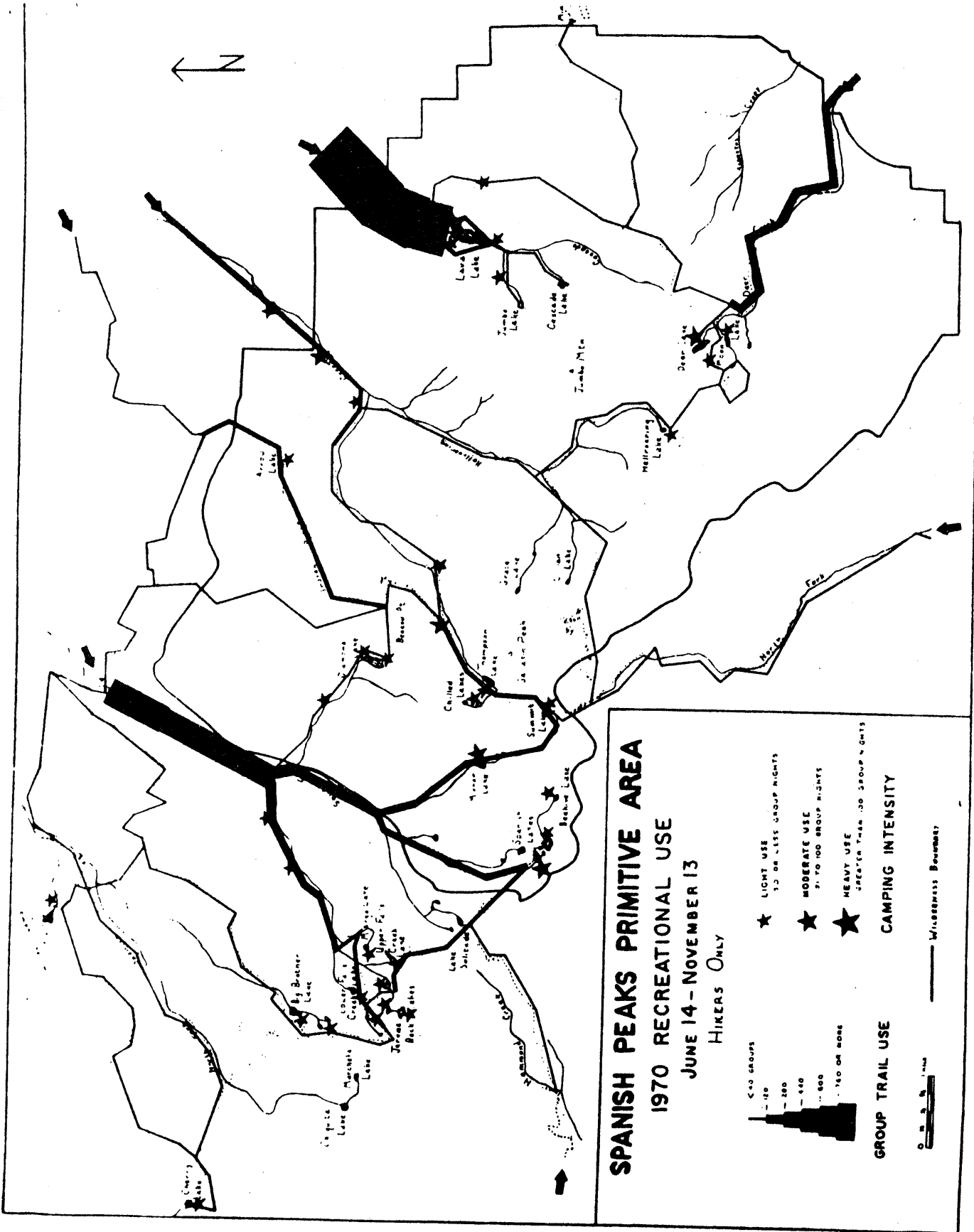


Fig. 3 -- Spanish Peaks Primitive Area, Montana

SPANISH PEAKS USE CONCENTRATION INDEX

ALL TRAIL USE, 1970

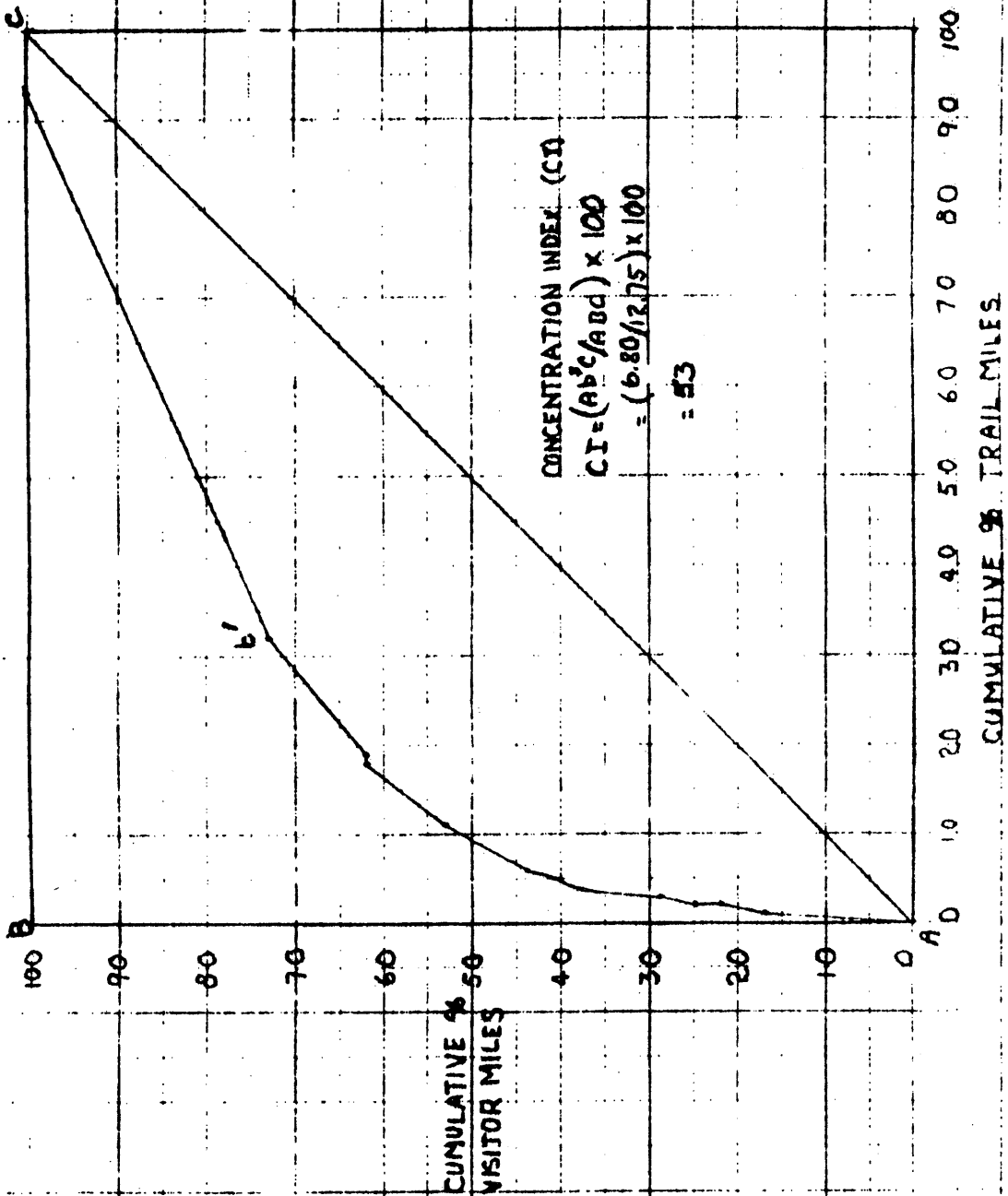
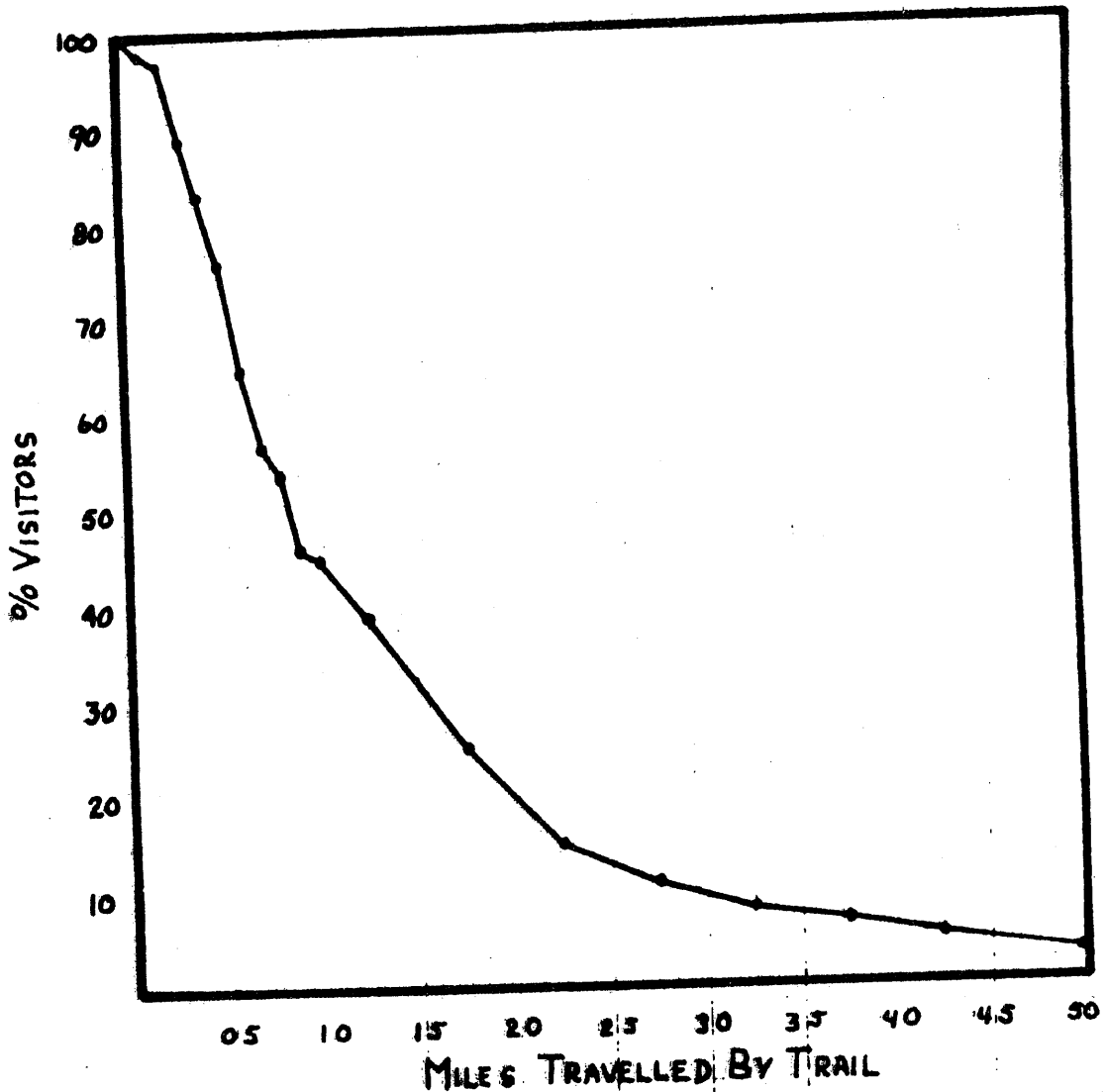


Fig. 4 -- Trail Use Concentration Spanish Peaks

Again this pattern of short trips, both spatially and temporally, is characteristic for most Wildernesses. In Figure 5, for example, visitor trail travel for ten Montana and Idaho Wildernesses and backcountry areas is shown. Only about 20 percent of the visitors traveled over 20 miles round trip in the Wilderness--which tends to refute the notion that wilderness trips are typically long. Less than five percent of the visitors traveled over 50 miles.

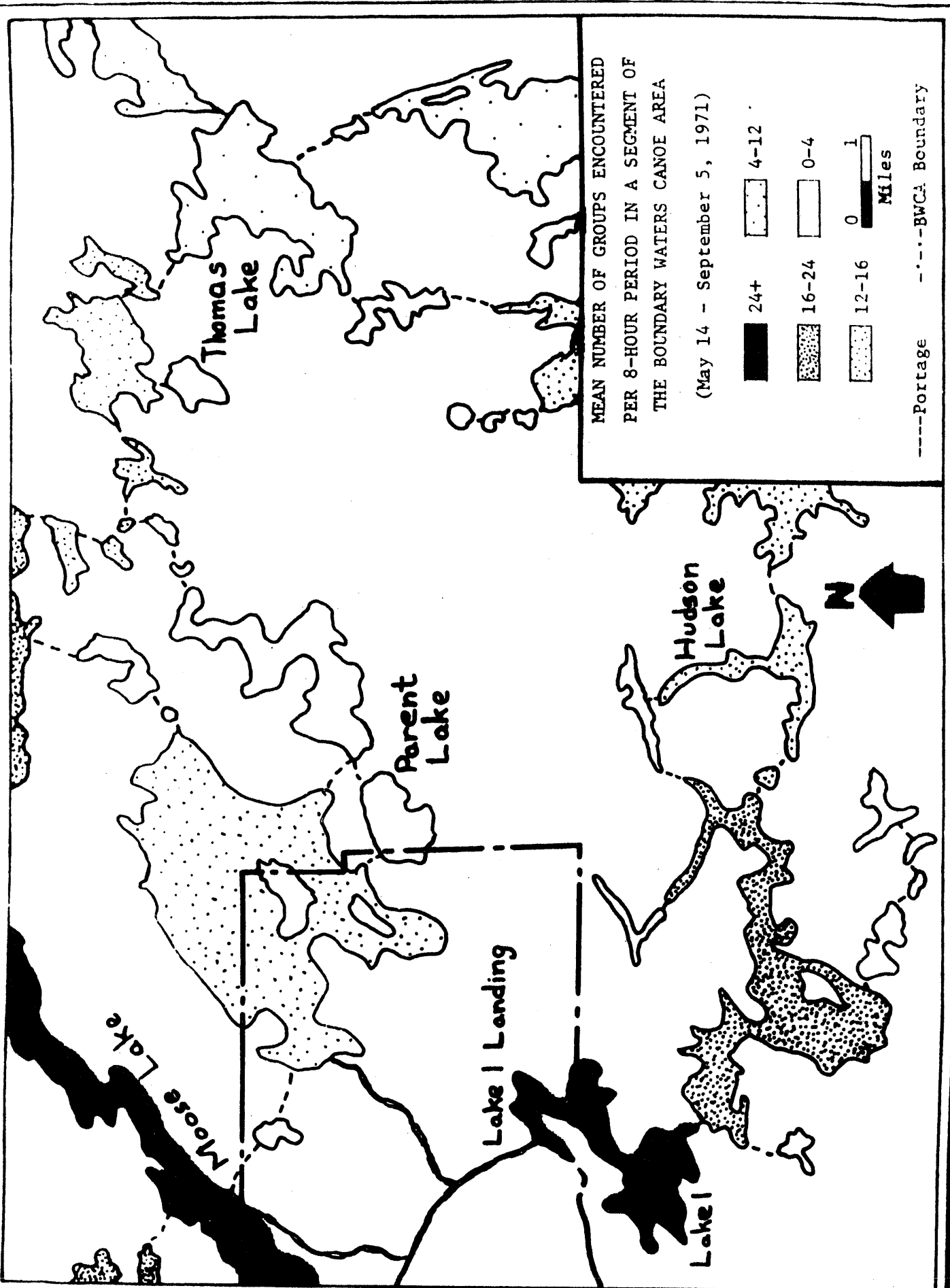
Another way of describing congestion in Wilderness is to measure the number of other parties a group would meet per hour or day in a given portion of the wilderness. In the Boundary Waters Canoe Area, data collected from Trip Diaries during the main summer use-season in 1971 (Lime 1970) revealed wide variation in frequency of encounters by lake. Groups identified the number of other parties they saw on individual lakes each day and the number of hours spent on the lake. Visitors to some lakes encountered more than forty times as many groups as did other visitors. Often, only one or two portages separated very heavily and lightly congested lakes, as illustrated for a small portion of the Area (Figure 6).

TRAIL USE DISTRIBUTION



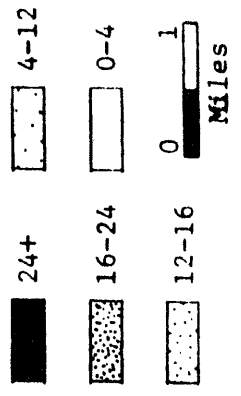
Based on 1970-71 survey of 2,264 visitors to ten wilderness and backcountry areas in Montana and Idaho.

Fig. 5 -- Distance traveled per trip, 10 Wilderness Areas.



MEAN NUMBER OF GROUPS ENCOUNTERED
 PER 8-HOUR PERIOD IN A SEGMENT OF
 THE BOUNDARY WATERS CANOE AREA

(May 14 - September 5, 1971)



-----Portage - - - - -BWCA Boundary

On nearly 25 percent of the surface water acreage sampled (238 lakes representing the major use-area), the mean number of groups encountered per eight-hour period was 16 or more (table 2). Hourly encounters were multiplied by 8 to approximate a typical day's experience. On almost 50 percent of the acreage, the encounter rate averaged 12 or more groups per 8 hours. For only 20 percent of acreage sampled was the encounter rate 4 groups or less; 7 percent showed a high level of solitude with 0-2 groups per 8 hours. Although there are lakes in the BWCA to experience low frequencies of encounters (including others in addition to those sampled), the higher levels of congestion experienced in much of the area are disturbing because several studies of paddle canoeist's attitudes suggest when the daily encounter rate exceeds 3 or 4 groups, relative satisfaction drops sharply (Stankey 1973, Lime, manuscript in progress).

Table 2.--Frequency of Encounters by Percent of Total Surface

Water Acreage Sampled (BWCA, May 14 through September 5, 1971).

<u>Mean Number of Groups Encountered Per Eight-Hour Period</u>	<u>Percent of Total Water Acreage^{1/}</u>
24 or more	10
16-24	14
12-16	24
8-12	18
4-8	14
0-4	<u>20</u>
	100

^{1/} Total surface acreage sampled was 126,000, or 66 percent of estimated 190,000 acres in the BWCA.

The use patterns in most Wildernesses are strongly trail-related. From our studies of Forest Service Wilderness areas, we estimate that a little under 20 percent of the visitors travel cross country at all. And, an even smaller percentage of the total distance visitors cover in the Wilderness is off-trail travel. The specific amount depends on the area and the motives, interests, and experience of the visitors.

Strategies to Offset Congestion

Congestion in Wilderness is a problem of growing significance. Surveys in different areas and at different times confirm that solitude and the opportunity for a low-density type of recreation are important satisfactions derived from Wilderness. Congestion is significant influence on the extent to which these satisfactions are realized.

A commonly proposed solution to congestion problems is use redistribution spreading use more evenly throughout the Wilderness. Certainly use redistribution could be advantageous. As we have indicated, patterns of use are highly uneven. However, redistribution is not a panacea for overuse for at least two reasons. First techniques to change use distributions are poorly understood tools now--that is, unless managers resort to authoritarian control. (Which is discussed more below.) For instance, adding a new trail, upgrading an existing one, or developing a new entry point might or might not influence the pattern of use--and might result in more total use. Second, we would argue that a uniform distribution of use within a Wilderness is neither desirable nor possible. Diversity in use levels is desirable because resource capabilities and visitor desires vary. In fulfilling the Wilderness Act directive to maintain "outstanding opportunities for solitude," some unevenness in use distribution seems important.

A uniform distribution appears impossible because of the branching of travel routes and variation in trip lengths.

Other methods for reducing crowding and overuse have been suggested. One of the most common is to increase the supply of classified Wilderness and related primitive environments. The implication is that with increased acreage, the volume of use can be spread out more to reduce crowding and possibly the need for use regulation. However, this assumes that additional areas classified as Wilderness are now "empty"--that is, they presently have little or no use in them. Actually many de facto wilderness areas sustain quite high use levels currently. Although there are reasons why the Wilderness Preservation System should be expanded, we do not see expanded capacity as one of the major ones.

One of the most useful steps, we think, would be to fill in the middle of the recreation opportunity spectrum, between Wilderness and road-access areas. Studies of Wilderness users suggest a substantial percentage of them might find their desired experience more readily in a non-Wilderness setting (Lime, 1969; Stankey, 1973). This type of "backcountry area" where the management focus is on recreation rather than the maintenance of undisturbed natural processes is badly needed, but at present there are virtually no positive programs to provide this opportunity. It is likely that much of the current pressure on Wilderness stems from persons simply seeking a chance to hike or get away from the highly developed, civilized world for a short time. The failure to provide opportunities for people with these desires probably leads or almost forces many of them to Wilderness, where they conflict with persons whose primary objective is more closely related to the objectives for which Wilderness is managed.

Both visitors and the Wilderness suffer.

Within the Wilderness there is a need to expand the supply of isolated campsites. Studies of wilderness carrying capacity suggest that opportunities for camping out of sight and sound of other parties are especially valued by users. Such locations might very well represent a critical "bottleneck" on wilderness capacity. Programs to inventory such locations and provide this information to visitors could help reduce a significant type of crowding.

A variety of direct and indirect regulation of use can be utilized to contend with congestion. By direct, we mean measures that focus explicit attention on the visitor's behavior, such as fees or permits used to ration use. Indirect measures, on the other hand, would seek to modify this behavior less overtly. For instance, reducing trail maintenance, or extending the length of the trail leading from the road to the Wilderness boundary might lead some people to decide not to visit an area. Table 3 presents a continuum of actions, ranging from heavy-handed to less obtrusive, more subtle techniques managers might utilize in dealing with overuse. As a general strategy, we would argue that control on wilderness use should be as light and subtle as possible (Lucas, 1973). Geographic research in the location choice process could aid immensely in developing these methods. Where more authoritarian measures seem called for, whenever possible they should be applied prior to the visitor's entering the wilderness, and the visitor left free to roam within the area.

Table 3.--Some Measures to Control the Character and Intensity of Wilderness Use.

Type of Control	Method	Specific Control Techniques
<u>Direct</u> (Emphasis on regulation of behavior--Individual choice restricted. High degree of control),	Increased policy enforcement	Impose fines Increase surveillance of area
	Zoning Regulations	Spatial zoning of incompatible uses (Hiker only zones, etc.) Temporal zoning of uses Limit camping in some campsites to one night, or some other limit.
	Restrictions on Use intensity	Rotating use (open or close access points, trails, campsites) Require reservations Assign campsites and/or travel routes to each camper group Limit usage via access point Limit size of groups, number of horses Limit camping to designated campsites only Limit length of stay in area (max/min)
	Restrictions on activities	Restrictions on building campfires Restrictions on hunting or fishing
<u>Indirect</u> (Emphasis on influencing or modifying behavior. Individual retains freedom to choose. Control less complete, more variation in use possible)	Physical Alterations	Improve (or not) access roads Improve (or not) campsites Make trails more or less difficult Leave trailless (or not) Improve (or not) fish or wildlife populations (stock, allow to die out, etc.)
	Information dispersal	Advertise specific attributes of the Wilderness Identify the range of recreation opportunities in surrounding area Educate users to basic concepts of ecology and care of ecosystem Advertise underused areas and general patterns of use
	Eligibility Requirements	Charge constant entrance fee Charge differential fees by trail, zones, season, etc. Require proof of camping and ecological knowledge and/or skills

Modified from "Toward a Model of Travel Behavior in the Boundary Waters Canoe Area," C. Gorman Gilbert, George L. Peterson, and David W. Lime. Environment and Behavior 4(2): 137.

One relatively new management tool that offers considerable potential for planning to modify use patterns, particularly if restrictions are applied only at portals, is a Wilderness Area Travel Simulation Model, recently developed in a cooperative effort by the USDA Forest Service, Resources for the Future, Inc., and IBM. The model provides the ability to predict various conditions of congestion under alternative patterns and levels of use. Output provides a measure of encounters with other parties (both on the trail and at campsites) and tells what types of parties are involved (hiker, horseback, small, large, etc.), as well as where encounters occur. The model seems to offer great potential in contending with increasing use of wilderness. Used in conjunction with survey and behavioral research results on visitor attitudes and reactions towards crowding, it would permit managers to consider alternative strategies for managing use and to make informed judgments regarding appropriate techniques to offset undesirable conditions. This is obviously much more effective and far faster than trial-and-error on the ground.

CONCLUSIONS

The rapid growth in Wilderness use and the probability of continued rapid increases, with limited opportunities for enlarging the supply, have created conditions of congestion and crowding in a type of area explicitly defined for solitude. Sharp differences in congestion exist between the various units of the National Wilderness Preservation System and within the individual areas.

A variety of research issues can be posed to help deal with pressing management problems. For example, we have cited the need for a measure of "effective acreage" for capacity calculations. Work is needed in analyzing use patterns, particularly what influences such patterns and how they can be modified. Studies on possible spatial and temporal changes in visitor behavior are crucial to decisions regarding the allocation of areas for wilderness or other purposes. The geographic community should find abundant opportunity for challenging work that draws on many traditional themes within the discipline and provides an opportunity to apply, test, and refine a number of geographical theories and concepts.

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