United States
Department
of Agriculture

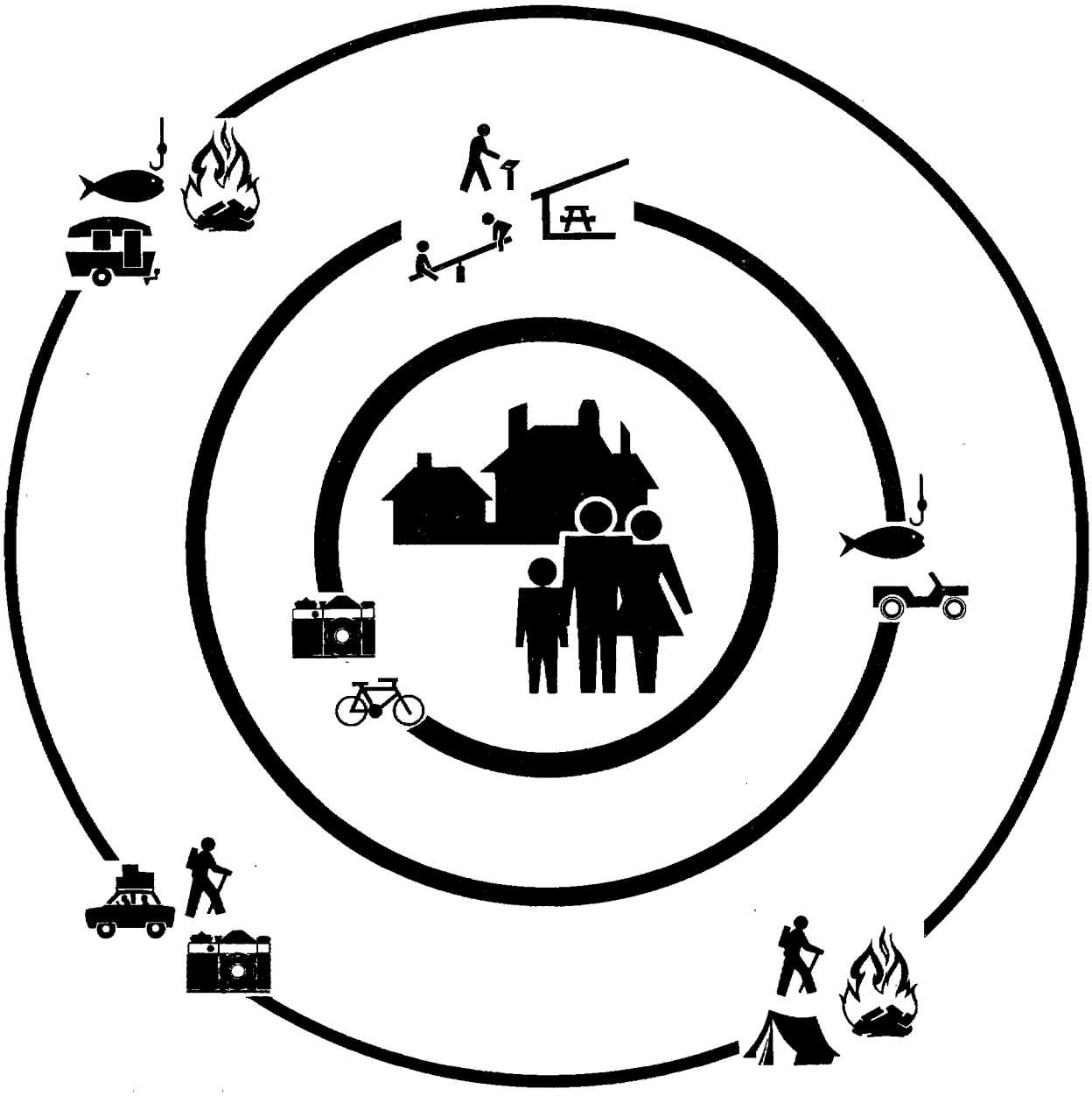
Forest Service

**Northeastern Forest
Experiment Station**

Research Paper NE-685

National Forest Trail Users: Planning for Recreation Opportunities

John J. Daigle
Alan E. Watson
Glenn E. Haas



Abstract

Trail users in four geographical regions have been classified into clusters of recreation activities: day hiking, undeveloped recreation, and camping-hiking. The regions are grouped as Appalachian, Pacific, Rocky Mountain, and Southwestern.

Distance, time traveled, and time at site varied depending on the mix of activities. Average distance traveled remained approximately the same for all groups when substitute sites were available. However, visitors in the Rocky Mountain and Pacific regions indicated there were no alternative sites, or they were unaware of any.

The Authors

JOHN J. DAIGLE, outdoor recreation planner, received a bachelor's degree in Recreation Resources Management from the University of Maine in 1986 and a master's degree in Recreation Resources and Landscape Architecture from Colorado State University in 1990. He joined the U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station in 1988 and transferred to the Northeastern Forest Experiment Station in 1991. Currently, Daigle is engaged in research on rural community development in a doctoral program at the University of Massachusetts.

ALAN E. WATSON is research social scientist with the Intermountain Research Station, Wilderness Management Research Work Unit at the Forestry Sciences Laboratory on the University of Montana campus, Missoula. Dr. Watson attended the School of Forestry and Wildlife Resources, Virginia Polytechnic Institute and State University, Blacksburg, receiving bachelor's and master's degrees, and in 1983, a Ph.D. degree. His research interests primarily are in wilderness experience quality, including the influences of conflict, solitude, and visitor impacts.

GLENN E. HAAS is professor and Chairman of the Department of Recreation Resources and Landscape Architecture at Colorado State University. Dr. Haas received his Ph.D. from Colorado State University in 1977. He has written many papers on recreation management, particularly on characteristics of use and users.

Acknowledgment

Special acknowledgment to David N. Cole, Research Ecologist, Intermountain Research Station; Lawrence A. Hartmann, Assistant Director, Planning and Application, Northeastern Forest Experiment Station of the U.S. Department of Agriculture, Forest Service; Stephen F. McCool, Professor, Department of Forestry, University of Montana; and Morgan P. Miles, Assistant Professor, Department of Marketing, Georgia Southern University, for helpful suggestions and review comments.

Manuscript received for publication 14 August 1993

USDA FOREST SERVICE
5 RADNOR CORP CTR STE 200
PO BOX 6775
RADNOR, PA 19087-8775

March 1994

Introduction

An increased use of trails in national forests concurrent with a decline in the number of trails available to visitors suggests that the U.S. Department of Agriculture (USDA), Forest Service must manage carefully the existing trails. The volume of use has nearly doubled in the past 15 years while trail mileage has decreased by approximately 30 percent (Wells Associates, Inc. 1985; U.S. General Accounting Office 1989). The trails provide for a variety of recreation activities. Trail use often involves other recreation: sightseeing, camping, and fishing.

To maximize the potential of these trails, there is a need for better knowledge about trail users. Our current knowledge of trail users is very limited, despite wilderness visitors whose primary mode of travel involves hiking on trails. Characteristics of trail use and users is important information in understanding the needs of the public and in developing of management planning such as the Limits of Acceptable Change (Stankey and others 1985). Marketing research offers a strategy to identify specific visitors to national forests. While the USDA Forest Service traditionally has marketed itself to the public, it has not determined possible recreation marketing strategies in a national and regional context (Drake 1988). As the Forest Service plans broader ecosystem management goals, information on trail use will become increasingly important.

Public recreation services traditionally have been directed to "everyone" or the "average user" rather than to "specific somebodies" (Crompton 1983). Knowledge of visitor characteristics permits an understanding of who, how many, when, where, and by what means people receive benefits. This information assists in identifying clientele, their behavior, and the causes and potential solutions to visitor-caused social and ecological impacts (Echelberger and Moeller 1977; Roggenbuck and Lucas 1987). The identification of trail users based upon participation in recreation activities separates the average user into specific users.

Several studies have demonstrated the potential of market segmentation in recreation planning (Havitz and Fridgen 1985; Uysal and McDonald 1989). Rather than planning for some "average visitor," meaningful profiles of subgroups of visitors can be of immense value to decision makers. Shafer (1969), in his study of New York campers, concluded that the average camper does not exist. Campers differed not only from campground to campground, but also at the same campground from month to month. Crompton (1983) suggests that identifying specific groups, or target markets, provides the agency with a perspective on whose needs should be served before deciding what needs to serve.

The purpose of this paper is to determine if market segmentation by activity clusters provides a meaningful customer description typology. If so, this typology will increase the understanding of the trail users and their interests. This knowledge should contribute to more responsive trail system management.

The research reported here represents findings from four objectives of the original study (Daigle 1990):

- Identify an activity profile associated with national forest trail users in four regions of the United States.
- Examine the relationship of various activity profiles in each region to the distance traveled in measurement of both hours and mileage.
- Examine the relationship of length of stay to both activity profiles and distance traveled in each region.
- Examine the relationship of availability of location with respect to activity profiles and distances traveled in each region.

Participation in Multiple Recreation Activities

Most studies that examine recreation opportunities focus on a "primary" or "singular" activity. Profiles often are developed that include trip characteristics and socio-economic information (McCollum et al. 1990). Trend studies concerning participation in trail and other related outdoor recreation activities have focused on "main" or "primary" activity (Betz and Cordell 1989; Hartmann et al. 1989). While this research is extremely useful and needs to be continued, information also is needed that identifies the mix of recreation activities that a visitor participates in while visiting a recreation area.

The majority of outdoor recreationists participate in a variety of activities during a visit (Clark and Stankey 1979; Hendee et al. 1971; Williams 1988). Visitor characteristics, such as participation in multiple activities, may suggest a particular emphasis on the area's management. Certain dominant uses and a management desire to provide a specific opportunity may result in a net loss of other opportunities (Watson et al. 1992). Knowing the full range of experiences sought by visitors may help in determining appropriate management strategies.

The combination of activities that recreationists would like to participate in and opportunities offered by the resource may not coincide. As the number and cultural diversity of recreationists who visit national forests increase, there may be greater need and desire for certain recreation opportunities. Dwyer (1992) found important differences in the kind and location of outdoor recreation among Blacks, Whites, Hispanics, and Asians. The visitor must decide upon activities based upon available recreation opportunites, personal interests, and social orientation.

Home Range for Recreation Management

The concept of home range has evolved from numerous habitat studies of animal behavior. Many wildlife texts associate home range with Aldo Leopold (1933) and his "radius of mobility." Aldo Leopold (1966) used an analogy to explain the concept by telling of his dog chasing after a rabbit near his farm. The rabbit knew all the hiding places, such as the wood pile and an old rotten log, and these allowed the rabbit to stay just out of the dog's reach. Familiarity of a place

appears to be an underlying factor in Leopold's concept of home range:

> ...the wild things that live on my farm are reluctant to tell me, in so many words, how much of my township is included within their daily or nightly beat. I am curious about this, for it gives me the ratio between the size of their universe and the size of mine, and begs the much more important question, who is more thoroughly acquainted with the world in which he lives?....

Clark and Downing (1985) suggest home range as a geographically bounded and behaviorally relevant area for individuals that influences most decisions made for a given activity or experience. The size of this home range may vary for different activities and experiences sought by individuals. Home range may vary in terms of time required to travel to the site, length of stay, and availability of alternative locations for participating in certain activities.

To a degree, resource managers control the basic factors that determine activities and experiences available to recreationists. Understanding the relationship between available opportunities and use is important in predicting consequences of resource management options for the public (Clark and Downing 1985). "Home range" as a research tool allows for assessing the relative availability of, and demand for, different types of place-related opportunites for activities and experiences sought within a particular region.

Recreational home range involves self-imposed geographical and temporal boundaries consciously or unconsciously set when considering recreation activities. A multitude of considerations such as time, money, number of people, weather conditions, interests of other group members, and so forth are part of the decision process that determines how far a person travels from home. The self-imposed boundaries are flexible when considering a combination of activities or even a single activity. These results represent the more easily measurable aspects of home range, such as distance traveled in miles and hours, and the length of stay, which are perceived to be the basic foundation in defining home range for various trail users.

Data and Associated Methods

Public Area Recreation Visitor Survey

The 1985-86 Public Area Recreation Visitors Survey (PARVS) was initiated to gain more knowledge about recreation users on both state and federally owned public recreation areas. Recreation users were surveyed in recreation areas of the U.S. Department of Agriculture, Forest Service, the National Park Service, the Tennessee Valley Authority, and the U.S. Army Corps of Engineers, plus 12 state agencies (Cordell and others 1987). PARVS had three primary objectives:

- Describe the activity patterns of recreators onsite on public recreation lands.
- Obtain a description of people visiting public recreation areas for recreation.
- Provide visitor expenditure data that would result in estimates of the regional income and employment growth resulting from publicly provided recreation opportunities.

PARVS consisted of an onsite questionnaire, administered to randomly selected recreation site users, and a detailed mail-back questionnaire. In this research project, information obtained from onsite interviews at USDA Forest Service sites were utilized. The onsite questionnaire was a lengthy, but tightly designed survey divided into six sections; 1) interview number and site identification, 2) screening questions to identify recreation visitors, 3) onsite activity profile of current trip, 4) annual activity profile of recreation trips during the past 12 months, 5) travel time, distance, hours, origin, and destination, and 6) recreationist's income and trip expense.

Three distinct stratifications were used in identifying national forest trail users and in examining home range factors. First, a sample was partitioned into known national forest trail users. Visitors needed to indicate that they participated in at least one of the following activities on a national forest site: hiking, backpacking, horse riding, cross-country skiing, motor trail use, jogging, bicycling, or interpretive walking. Second, because this study examined home range factors, the sample excluded individuals who indicated that the visit to the national forest was not the primary destination for their trip. The final stratification merged trail users into geographical regions that offered similar resource characteristics.

Study Areas

The basic sampling unit for PARVS was a USDA Forest Service ranger district. From the 786 ranger districts on all national forests, 57 were selected for PARVS recreation-site interviewing (McCollum et al. 1990). For the analysis, PARVS study sites were divided into four geographic regions. This approach by geographic region attempted to group respondents into homogeneous populations and recreation opportunities in examining home range factors. A total of 38 districts and 16 wilderness areas was included for this study. Four regions were defined for this study: 1) Appalachian, 2) Pacific, 3) Rocky Mountain, and 4) Southwestern (Appendices 1-4). Sample size of trail users for each area numbered 302, 851, 1019, and 351, respectfully.

Cluster Analysis

National forest trail users were described based upon participation in clusters of recreation activities. The Wards minimum-variance clustering method was employed to group people based on activities measured on dichotomous nominal scales of "yes" or "no" responses for 19 selected activities (Appendix 5). The Wards method has a built-in dissimilarity coefficient called an index E, which is sensitive to additive and proportional translations of data profiles (SAS 1985, 1987). The method follows a series of clustering steps

that begins with a number of clusters equal to the number of objects (one object per cluster), and it begins grouping observations based upon similarities until one cluster containing all objects is formed. A total of five clusters was identified for the Appalachian region and six clusters in each of the Pacific, Rocky Mountain, and Southwestern regions.

Three criteria recommended by Everitt and Dunn (1983) were followed in identifying clusters: 1) recreation activities within each cluster would be collinear, or as similar as possible; 2) an attempt would be made to keep each cluster orthogonal or as nearly independent of the others as possible; and 3) an attempt would be made to account for as much variability through recreation activity combinations as possible.

Four steps were involved in clustering people based upon participation in recreation activities (Daigle 1990). First, a computer randomly selected a split half-sample for each interview site within a given region. Second, the clustering method was applied to one of the sample halves in each region. A cluster history was formulated and separate clusters examined to determine the extent of collinearity and amount of variability. Third, logic statements were developed that assigned individuals to the clusters suggested by the Wards method. This process merely interpreted the outcome of the cluster analysis. These statements were developed in an attempt to make each cluster unique, or independent, from the others. The final step involved the application of the logic statements to the remaining half of the region level data. This procedure tested the success in assigning individuals to clusters; a high percentage of individuals assigned indicated high success with clustering. A success rate of 85 percent or higher was accepted as an indication of successful clustering.

Home Range Factors

In addition to describing national forest trail users based upon participation in clusters of recreation activities, clusters were compared with home range factors of distance traveled in miles and of hours, length of stay, and substitute location. The home range variables were examined for missing information or miscoded data. Some of the onsite interview forms had mileage that was missing; however, the origin and number of hours traveled to the site were present. A road atlas was used to calculate mileage from the area visited to the county and state from where the trip originated. In a few cases in which travel time was missing, mileage was used to estimate travel time. If no information existed to help estimate miles or hours traveled, a missing value was accepted for that particular variable.

A weighted mean for mileage and hours to the recreation area, hours stayed, and distance to an alternative site were calculated for each activity cluster (Daigle 1990). One-way analysis of variance was used in comparing the dependent variables of home range factors to the independent variables of trail users. Three hypotheses were tested: 1) There is not a significant amount of variation in miles traveled to the site explained by activity cluster membership; 2) There is not a significant amount of variation in hours traveled to the site explained by activity cluster membership; and 3) There is not a significant amount of variation in length of stay explained by activity cluster membership. If a significant difference was detected ($p<.05$), a comparison of weighted means using the Student-Newman-Kuels test was used in determining where differences existed (Howell 1982).

Results

Appalachian Region

Table 1 illustrates the distribution of individuals across activity clusters in the Appalachian region. Primary differentiating activities are listed along with the percentages of individuals participating in each activity. Eighty-eight percent of Appalachian trail users successfully were distributed across the five clusters for the split half-sample. For the entire combined regional sample (263), 87 percent of trail users were assigned to clusters. The remaining individuals not classified by the logic statements were dropped from further analyses.

The first cluster consists of all backpackers who did not participate in primitive camping. More than half of the respondents in this profile specifically indicated having participated in viewing and hiking. The second cluster contains visitors who participated in primitive camping but not in developed camping. One did not have to be a backpacker in this cluster, though 50 percent were backpackers. The third cluster consists of individuals who participated in hiking and developed camping but did not indicate participation in family social and backpacking activities. Nonmotorized and viewing activities were indicated by approximately half the visitors in this cluster. The fourth cluster is comprised of hikers who, most likely, are day users of the recreation area. Respondents in this cluster indicated no participation in developed and undeveloped camping nor in backpacking activities. The final cluster contains individuals who hiked and used developed camping facilities. Unlike the third cluster, all of these individuals participated in family social and nonmotorized activities. None of these users participated in undeveloped camping or backpacking, and like the previous four clusters, viewing continued to be indicated by most of the respondents.

Potential market segments were found to differ somewhat on all dependent variables tested (Table 1). There was great variation between groups in distance and time traveled to the site. The backpacking group tended to travel farther and the developed camping group with strong interests in family social activities traveled less distance to the site. However, this developed camping group stayed significantly longer than all other groups. The day hiking group stayed significantly shorter with a mean of 16.3 hours. The median for this group actually was 4.5 hours, suggesting that some day-use individuals probably stayed overnight or day hiked over several visits. While mean comparisons were not made for distances to alternative sites due to the small number of visitors who specified an alternative, most groups appeared to identify substitute sites at nearly the same distance from home as the site visited. Developed campers with family

Table 1.--Comparison of recreation activity clusters and their home ranges, Appalachian Region

Cluster	Composition		Recreation home ranges			
			Travel miles[a]	Travel hours[b]	Length of stay[c]	Alternate site[d]
	Number	*Percent*	*Mean*			
Backpacking	52	100.0	271.7	6.2	70.1	262.7
Viewing	39	75.0				
Hiking	30	57.7				
Undeveloped camping	0	0.0				
Primitive or undeveloped camping	31	100.0	197.3	4.6	52.3	167.2
Viewing	24	77.0				
Hiking	22	71.0				
Backpacking	15	48.4				
Developed camping	0	0.0				
Hiking and developed camping	43	100.0	205.2	4.6	63.9	201.8
Viewing	25	58.1				
Nonmotorized water	20	46.5				
Family social, backpacking	0	0.0				
Day hiking	104	100.0	120.7	3.0	16.3	112.7
Viewing	82	78.8				
Driving	59	56.7				
Developed, undeveloped camping	0	0.0				
Hiking, developed camping, family social and nonmotorized water	33	100.0	92.8	2.6	112.7	139.5
Viewing	25	75.8				
Collection	20	60.6				
Undeveloped camping, backpacking	0	0.0				

[a]Average miles traveled for backpacking; primitive camping; hiking and developed camping were found to be significantly different from day hiking; hiking, developed camping, family social and nonmotorized water ($p<.01$).

[b]Average hours traveled for backpacking; primitive camping; hiking and developed camping were found to be significantly different from day hiking; hiking, developed camping, family social and nonmotorized water ($p<.01$).

[c]Mean length of stay for hiking, developed camping, family social and nonmotorized water was found to be significantly different from other cluster groups. Means for the backpacking; primitive camping; and hiking and developed camping were found to be significantly different from day hiking and hiking, developed camping, family social and non-motorized water ($p<.01$).

[d]Comparison of means was not calculated because of small sample sizes for this variable.

social activities showed an approximately 45-percent increase in this distance, suggesting alternatives to be more difficult to obtain for this group.

Pacific Region

Table 2 indicates how individuals of the Pacific region were distributed across activity clusters. Eighty-five percent of the individual cases successfully were assigned to six clusters for the split half-sample. For the entire combined regional sample (733), 86 percent of the trail users were assigned to clusters.

The first cluster contains visitors who participated in hiking, fishing, and developed camping. None of these individuals participated in undeveloped camping or pleasure driving. The second cluster includes individuals very similar to the first except that the activity of fishing is absent. All individuals hiked and participated in developed camping or driving for pleasure. The third cluster of individuals all participated in driving and family social activities. None of the visitors participated in undeveloped camping; however, 50 percent indicated participating in developed camping. The fourth cluster contains visitors who are similar to the first three in that they all participated in the activity of hiking. This cluster

Table 2.--Comparison of recreation activity clusters and their home ranges, Pacific Region

Cluster	Composition		Recreation home ranges			
			Travel miles[a]	Travel hours[b]	Length of stay[c]	Alternate site[d]
	Number	*Percent*	*Mean*			
Hiking, developed camping, fishing	84	100.0	135.0	3.4	73.0	106.5
Viewing	58	69.0				
Undeveloped camping, driving	0	0.0				
Hiking, developed camping, no fishing	129	100.0	142.3	3.6	90.8	131.2
Viewing	84	65.1				
Family social	66	51.2				
Fishing, undeveloped camping, driving	0	0.0				
Driving and family social	148	100.0	39.7	4.8	93.3	104.9
Viewing, hiking	137	92.6				
Developed camping	73	49.3				
Undeveloped camping	0	0.0				
Hiking and undeveloped camping	129	100.0	111.6	2.9	76.3	135.1
Viewing	83	64.3				
Collection	66	51.2				
Developed camping	0	0.0				
No hiking and driving	109	0.0	124.6	2.8	57.4	88.2
Viewing	62	56.9				
Backpacking	48	44.0				
Undeveloped camping	46	42.2				
Day hiking	134	100.0	98.0	2.8	26.1	544.6
Viewing	82	61.2				
Family social, undeveloped, developed camping	0	0.0				

[a]No significant differences were found between groups for average miles traveled.

[b]Average hours traveled for driving and family social was found to be significantly different from other clusters ($p<.01$).

[c]Mean length of stay for hiking, developed camping, no fishing; driving and family social were found to be significantly different from all other clusters. Mean for no hiking and driving was found to be significantly different from hiking, developed camping, no fishing; driving and family social; and day hiking ($p<.01$). Mean for the activity, cluster day hiking, was found to be significantly different from all other clusters ($p<.01$).

[d]Comparison of means was not calculated because of small sample sizes for this variable.

is unique, however, in that these visitors all participated in undeveloped camping. The fifth cluster has individuals who did not participate in hiking or driving but split between backpacking and undeveloped camping. The final cluster had no overnight users.

When potential user segments were compared, visitors from all clusters were found to travel similar distances to the site chosen. There was a significant difference in time traveled to the site, however. The cluster indicating high involvement with family social and pleasure driving types of activities took longer to arrive at the site from home. This isn't too surprising. This driving, family-social cluster appeared similar to the developed camping group--which also was very interested in family social activities--in the length of time at the site. The average length of stay for these two groups was nearly 4 days. The day hikers had dramatically shorter stays but relatively long lengths of stay considering they were day users. The median stay within this group was much lower than the mean. Even though this group was significantly lower in length of stay than the others, some group members may not have been day users. Visitors who identified an

alternate site reported similar distances to those sites as the distance from home to the interview site. Day users were the exception to this, reporting much longer distances to the substitute sites.

Rocky Mountain Region

Eighty-nine percent of trail users in the Rocky Mountain region were assigned successfully to seven clusters for the

Table 3.--Comparison of recreation activity clusters and their home ranges, Rocky Mountain Region

Cluster	Composition		Recreation home ranges			
			Travel miles[a]	Travel hours[b]	Length of stay[c]	Alternate site[d]
	Number	*Percent*	*Mean*			
Hunting	88	100.0	104.3	3.7	64.3	96.2
Hiking	60	68.2				
Viewing	47	53.4				
Motorized trail use	0	0.0				
Motorized trail day use	46	100.0	76.8	3.3	31.9	61.6
Developed and undeveloped camping	0	0.0				
Primitive camping	126	100.0	157.1	4.3	73.8	292.8
Hiking, viewing	91	72.2				
Developed camping, hunting	0	0.0				
Hiking and developed camping	134	100.0	182.8	5.1	80.1	196.5
Viewing	91	67.9				
Hunt, fish, collection, undeveloped camping	0	0.0				
Day hiking	228	100.0	95.6	2.7	29.7	76.8
Viewing	62	56.9				
Motorized trail, hunting, fishing	0	0.0				
Developed and undeveloped camping	0	0.0				
Hiking, developed camping, collection	154	100.0	173.0	4.9	88.8	278.4
Viewing	124	80.5				
Family social	96	62.3				
Undeveloped camping, hunting	0	0.0				
Hiking, fishing, no collection	138	100.0	161.1	4.3	71.4	257.0
Viewing	97	70.3				
Developed camping	84	60.9				
Undeveloped camping, collection	0	0.0				
Motorized trail, hunting	0	0.0				

[a]Average miles traveled for hiking and developed camping; hiking, developed camping, and collection were found to be significantly different from the cluster, motorized trail day-use ($p<.01$).

[b]Analysis of variance test showed a significant difference existed, however, the Student-Newman-Kuels test failed to reveal differences ($p<.01$).

[c]Mean length of stay for the activity clusters, hunting; primitive camping; hiking and developed camping; hiking, developed camping, collection; hiking, fishing, no collection, were found to be significantly different from motorized-trail day use; and day hiking ($p<.01$).

[d]Comparison of means was not calculated because of small sample sizes for this variable.

split half-sample. For the entire combined regional sample (914), 90 percent were assigned to clusters.

One cluster identified in this region consisted of hunters who did not participate in any motorized trail activities (Table 3). Hunting activities included a variety of types: big game, small game, and waterfowl. Another cluster included day users, all of whom participated in motorized trail activities. A third cluster contained undeveloped campers who did not participate in hunting. These individuals were much more involved in the activities of backpacking and fishing than the first cluster. A fourth cluster consisted of all hikers who camped at developed sites. They did not hunt, fish, or participate in any type of collection activities. Members of a fifth cluster, a fairly large group of 228 visitors, were day hikers. These individuals did not participate in hunting or any motorized trail activities. Another cluster consisted of individuals who participated in the activities of hiking and developed camping. Unlike the fourth cluster, the activity of collection (such things as berries, mushrooms, or firewood for home use) was indicated by all respondents. The seventh and final cluster consisted of hikers who participated in the activity of fishing. None of these respondents indicated that they took part in hunting, collecting, undeveloped camping, or motorized activity.

When the cluster groups were compared the average distances traveled were found to be fairly similar. With a range of 77-183 miles across the group means, only one of the day-use groups was found to report significantly shorter travel distances than the two developed camping groups. No differences were found in the length of time it took visitors to travel to the site. Once they arrived at the site, however, the two predominantly day-use groups stayed significantly shorter lengths of time than all other groups. Relatively few individuals identified an alternative site for this visit. Over 30 percent of the individuals in the hunting cluster thought there was no alternative site. Over 20 percent of that group didn't know if an alternative site existed.

Southwestern Region

Table 4 indicates the distribution of individuals in the Southwestern region across activity clusters. Ninety-five percent of the individual cases were assigned successfully to six clusters for the split half-sample. For the entire combined regional sample (332), 95 percent of the trail users were assigned to clusters.

The first cluster includes visitors who participated in developed camping, but not pleasure driving or fishing. The second cluster consisted of day users who hiked and participated in pleasure driving activities. None of these individuals fished. Visitors in the third cluster camped at developed sites and all reported participating in pleasure driving activities. None of these people fished. The fourth cluster was a group of people who fished and camped at developed sites. The fifth cluster contained day hikers who did not participate in pleasure driving activities. The final cluster is described as undeveloped campers.

Members of two out of thee developed camping segments, and the undeveloped segment, traveled significantly farther to the site than the day users or the one developed camping group. The day users showed corresponding shorter travel times to the sites, as well as significantly shorter lengths of stay. The two developed camping groups most similar in travel distance also had the longest mean length of stay at the sites. The other developed camping group and the undeveloped camping group were intermediate in length of stay, shorter than the developed camping groups, but longer than the day-use groups. Only 13-52 percent of the individuals in various clusters indicated an alternative site and the distance to it.

Research Implications

The use of cluster analysis methods to identify activity groups based on dichotomous nominal scales needs further verification. The Wards clustering method could be compared with other clustering methods to evaluate the effectiveness of classifying groups of visitors on this type of scale response. Conceptually linked activities such as social learning, passive free-play, appreciative-symbolic, and extractive-symbolic could be used in trying to explain clustered individuals (Hendee 1971, McCool 1978). However, clustering of individuals on Likert-type scales, which indicate the extent of participation in certain recreation activities, may provide more reliable clustering results than the Wards method. Dimanche et al. (1991) have proposed that a measure of involvement or participation also could increase the accuracy and applicability of segment definitions. Methods that assess desired opportunities in addition to activities participated in also may improve the success of marketing strategies based upon targeting segments.

The use of clustering activities illustrated some limitations when describing cluster groups. Conditional statements developed from suggested clustered groups were limited to a number of activities. A number of key activities distinguished among the groups while other activities made up the rest of the group in lower percentages. Consequently, these conditional statements developed from clustering resulted in a net loss of valid trail users ranging from 5 to 14 percent depending upon region. The separation of certain activity clusters like backpackers with no indication of participating in undeveloped camping in the Appalachian region suggests that perception of some activities may differ or automatically include other activities. This presents a two-edged sword in that they are different based upon stated activities by cluster identification, yet some visitors consider them similar. However, if specific activity or primary activity were examined, visitors may be misclassified or assumptions may be made that merit further in-depth evaluation.

Another limitation to clustering based on activities is the exclusion of other visitor data. Individuals who participated in day hiking sometimes had a very long length of stay, suggesting that groups made multiple trips during their visit to the national forest or perhaps were campers. Social meanings and cultural significance influencing choice of

Table 4.--Comparison of recreation activity clusters and their home ranges, Southwestern Region

Cluster	Composition		Recreation home ranges			
			Travel miles[a]	Travel hours[b]	Length of stay[c]	Alternate site[d]
	Number	*Percent*	*Mean*			
Hiking and developed camping	60	100.0	125.2	3.4	74.3	130.7
Viewing	38	63.3				
Undeveloped camping, driving, fishing	0	0.0				
Day users - driving and hiking	46	100.0	102.7	2.4	12.3	94.6
Hiking	44	95.7				
Viewing	40	87.0				
Developed and undeveloped camping, fishing	0	0.0				
Driving, developed camping	30	100.0	202.8	4.8	109.0	83.6
Hiking	28	93.3				
Viewing	25	83.3				
Family social	21	70.0				
Fishing	0	0.0				
Fishing, developed camping	69	100.0	194.6	4.8	107.7	229.0
Hiking	61	88.4				
Viewing	51	73.9				
Family social	42	60.9				
Undeveloped camping, driving	0	0.0				
Day hiking, no driving	85	100.0	97.4	2.6	13.8	67.6
Hiking	74	87.1				
Viewing	59	69.4				
Developed and undeveloped camping, fishing, driving	0	0.0				
Primitive camping	42	100.0	188.9	4.2	68.5	157.5
Hiking	33	78.6				
Viewing	31	73.8				
Developed camping	0	0.0				

[a]Average miles traveled for the activity clusters driving, developed camping; fishing, developed camping; primitive camping, were found to be significantly different from hiking and developed camping; day users - driving and hiking; and day hiking, no driving ($p<.01$).

[b]Average hours traveled for the activity clusters driving, developed camping; fishing, developed camping; primitive camping, were found to be significantly different from day users - driving and hiking; and day hiking, no driving ($p<.01$).

[c]Mean length of stay for the activity clusters driving, developed camping; fishing, developed camping were found to be significantly different from day users - driving and hiking; day hiking, no driving; primitive camping. Mean for the activity cluster primitive camping was found to be significantly different from day users - driving and hiking; day hiking, no driving. Mean for the activity cluster hiking and developed camping was found to be significantly different from day users - driving and hiking; day hiking, no driving ($p<.01$).

[d]Comparison of means was not calculated because of small sample sizes for this variable.

activities are masked (McCool 1978). The limited information on alternative sites could not be correlated directly with specific activities or special attributes associated with the trails at the national forest. Conditional statements made before clustering activities may be necessary to identify certain visitor characteristics.

Management Implications

Despite some of the limitations, cluster analysis to identify market groups of trail users appears to be a valuable segmenting procedure. Visitors should no longer be considered just hikers or campers. The complex assortment of activities they participate in can be sorted and described in meaningful ways with implications for management. Information on travel and trip characteristics of these visitors has potential implications to management and planning policy on both a micro- and macrolevel in the USDA Forest Service. Understanding the characteristics of the various cluster groups gives insight into the combinations of services that national forest visitors need. Strategies used to develop policies should utilize marketing techniques that target these clusters.

While the regions differed somewhat in the number of activity clusters defined, many similarities of groups of activities were evident across all four regions. In each of the four geographical regions at least one day-hiking and one undeveloped camping cluster was found. At least two developed camping and hiking activity clusters were evident in each region with various amounts of participation in other activities such as viewing, family social activities, nonmotorized water, and collecting. Hunting and motorized trail use activities clustered naturally in the Rocky Mountain region. For one cluster in the Pacific region and for two clusters in the Southwestern region, everyone participated in driving for pleasure. Collecting and family social activities were participated in at higher rates by individuals in the undeveloped and developed camping activity clusters in all four regions.

When activity clusters were compared in each region, average distances traveled to the sites generally were different. These differences were not necessarily consistent across regions, though day users (motorized and nonmotorized) tended to drive shorter distances and have corresponding short drive times. Campers drove farther for participation and took longer to get there, particularly those developed campers who report participation in pleasure driving. Generally, it appears that average driving distances are shortest for the Pacific Region of the country (grand mean of about 125 miles) and longest for the Appalachian Region (grand mean of about 170 miles). The overall mean driving times for the Appalachian and Rocky Mountain Regions appears similar (around 4 hours) and the Southwestern and Pacific Regions average about 3.5 hours travel time across all visitors interviewed. These results suggest an opposing view that travel to the more numerous and small sites in the East are shorter than travel to western locations (Lucas 1980; Watson et al. 1986).

Length of stay in all four regions varied significantly for the different activity clusters. Length of stay, as would be expected, tended to be much shorter for day-use clusters. The mean length of stay, however, tended to be very long for day-use clusters, suggesting that several visitors probably were campers or considered their excursions on the trail as only day use. There was some variation in camping clusters, with individuals who participated in undeveloped camping having shorter mean lengths of stay for the Southwestern, Appalachian, and Pacific regions. They were not distinguishable in the Rocky Mountain region. The information examined on alternative sites provides a unique perspective in looking at various activity clusters. In general, the mean distances to the alternative site were comparable to distances traveled to originally selected recreation sites. Some exceptions included the day- hiking activity cluster in the Pacific region and undeveloped camping cluster in the Rocky Mountain region. Day hikers in the Pacific region would have to travel 4 to 5 times the mean distance to actual sites visited, and Rocky Mountain campers would have to travel twice the distance to a substituted undeveloped site.

The ability to identify visitor characteristics and label them into workable groups is the primary advantage of using a cluster analysis technique. The number of activities found to be participated in by members in each activity cluster supports previous studies. Provided the opportunity, an individual typically will participate in a variety of activities during an outdoor recreation visit. To know the various mixes of activities sought by current visitors is important information for planning, developing, and monitoring trail resources. Identification of different types of users could point out potential conflicts or problems caused by continual or increased use by specific activity clusters. Knowing the status of users and changes occurring within activity clusters would be a crucial aspect in monitoring to assure quality recreation experiences and opportunities.

Literature Cited

Betz, C. J.; Cordell, H. K. 1989. **Trends in recreation participation on public lands.** In: Watson, Alan E., comp. Outdoor recreation benchmark 1988: Proceedings of the national outdoor recreation forum; 1988 January 13-14; Tampa, FL. Gen. Tech. Rep. SE-52. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station: 128-146.

Clark, R. N.; Downing, K. B. 1985. **Why here and not there: the conditional nature of recreation choice.** In: Stankey, George H.; McCool, Stephen F., comps. Proceedings of the symposium on recreation choice behavior; 1984 March 22-23; Missoula, MT. Gen. Tech. Rep. INT-184. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 61-70.

Clark, R. N.; Stankey, G. H. 1979. **The recreation opportunity spectrum; a framework for planning, management, and research.** Gen. Tech. Rep. PNW-98. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 32 p.

Cordell, H. K.; Hartmann, L. A.; Watson, A. E.; Fritschen, J.; Propst, D. B.; Siverts, E. L. 1987. **The public area recreation visitor survey: a progress report.** In: Cordell, Barbara McDonald, ed. Proceedings, 1986 Southeastern Recreation research conference; 1986 February 18-29; Asheville, NC. Athens, GA: Recreation Technical Assistance Office, University of Georgia: 19-36.

Crompton, J. 1983. **Selecting target markets - a key to effective marketing.** Journal of Park and Recreation Administration. 1(1): 7-26.

Daigle, J. J. 1990. **An analysis of variation in home range factors across trail user activity groups.** Fort Collins, CO: Colorado State University, Department of Recreation Resources and Landscape Architecture. 109 p. M.S. thesis.

Dimanche, F.; Havitz, M. E.; Howard, D. R. 1991. **Testing the involvement profile (IP) scale in the context of selected recreational and touristic activities.** Journal of Leisure Research. 23(1): 51-66.

Drake, J. T. 1988. **National recreation strategy.** Letter to Forest Service employees, June 1988. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region. 10 p.

Dwyer, J. F. 1992. **Outdoor recreation participation: Blacks, Whites, Hispanics, and Asians in Illinois.** In: Chavez, Deborah., comp. Symposium on social aspects and recreation research; 1992 February 19-22; Ontario, CA. Albany, CA: U. S. Department of Agriculture, Forest Service, Pacific Southwest Research Station: 80-81.

Echelberger, H. E.; Moeller, G. H. 1977. **Use and users of the cranberry backcountry in West Virginia: insights for eastern backcountry management.** Res. Pap. NE-363. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 8 p.

Everitt, B. S.; Dunn, G. 1983. **Advanced methods of data exploration and modeling.** Heinemann. London. 253 p.

Hartmann, L. A.; Freilich, H. R.; Cordell, H. K. 1989. **Trends and current status of participation in outdoor recreation.** In: Watson, Alan E., comp. Outdoor recreation benchmark 1988: Proceedings of the national outdoor recreation forum; 1988 January 13-14; Tampa, FL. Gen. Tech. Rep. SE-52. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station: 147-165.

Havitz, M. E.; Fridgen, J. D. 1985. **Applying market research findings: the case of an urban canoe livery.** Journal of Park and Recreation Administration. 3(4): 31-43.

Hendee, J. C.; Gale, R. P.; Catton, W. R. 1971. **A typology of outdoor recreation activity preferences.** Journal of Environmental Education. 3(1): 28-34.

Howell, D. C. 1982. **Statistical methods for psychology.** Boston MA: Duxbury Press. 583 p.

Leopold, A. 1933. **Game Management.** New York, NY: Charges Scribner's Sons. 481 p.

Leopold, A. 1966. **A Sand County almanac.** New York, NY: Oxford Press. 295 p.

Lucas, R. C. 1980. **Use patterns and visitor characteristics, attributes, and preferences in nine wilderness and other roadless areas.** Research Paper INT-253. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 89 p.

McCollum, D. W.; Peterson, G. L.; Arnold, J. R.; Markstrom, D. C.; Hellerstein, D. M. 1990. **The net economic value of recreation on the national forests: twelve types of primary activity trips across nine Forest Service regions.** Res. Pap. RM-289. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 36 p.

McCool, S. F. 1978. **Recreation activity packages at water-based resources.** Leisure Sciences 1(2): 163-173.

Roggenbuck, J. W.; Lucas, R. C. 1987. **Wilderness use and user characteristics: 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. Gen. Tech. Rep. INT-220. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 204-245.

Shafer, E. L., Jr. 1969. **The average camper who doesn't exist.** Res. Pap. NE-142. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 27 p.

Stankey, G. H.; Cole, D. N.; Lucas, R. C.; Peterson, M. E.; Frissell, S. S. 1985. **The limits of acceptable change (LAC) system for wilderness planning.** Gen. Tech. Rep. INT-176. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 37 p.

Statistical Analysis System. 1985. **SAS users guide: statistics.** Version 5. Cary, NC: SAS Institute. 956 p.

Statistical Analysis System. 1987. **SAS/STAT guide for personal computers.** Cary, NC: SAS Institute. 1028 p.

U. S. General Accounting Office. 1989. **Maintenance and reconstruction backlog of national forest trails.** GAO/RCED-89-182. Government Printing Office: Washington, DC. 56 p.

Uysal, M.; McDonald, C. D. 1989. **Visitor segmentation by trip index.** Journal of Travel Research. 27(3): 38-42.

Watson, A. E.; Cordell, H. K.; Hartmann, L. A. 1986. **Unique characteristics of wilderness users in outdoor recreation assessment.** Paper presented at the First National Symposium on Social Sciences in Resource Management; [Dates unknown] Missoula, MT: [publisher unknown] 19 p.

Watson, A. E.; Williams, D. R.; Roggenbuck, J. W.; Daigle, J. J. 1992. **Visitor characteristics and preferences for three National Forest wildernesses in the South.** Res. Pap. INT-455. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 27 p.

Wells Associates, Inc. 1985. **National Forest trails: neglected and disappearing.** San Francisco, CA: Sierra Club. 14 p.

Williams, D. R. 1988. **Measuring perceived similarity among outdoor activities: a comparison of visual and verbal stimulus presentations.** Leisure Sciences. 10(3): 153-166.

Appendix 1

Appalachian Region

New Hampshire
Androscoggin District, White Mountain National Forest

North Carolina
Cheoha District, Nantahala National Forest
Joyce Kilmer-Slickrock Wilderness, Nantahala-Cherokee National Forest
Tellicao District, Cherokee National Forest

Tennessee
Citico Creek Wilderness, Cherokee national Forest

Vermont
Bristol Cliffs Wilderness, Green Mountain National Forest

West Virginia
Greenbriar District, Monongahela National Forest

Appendix 2

Pacific Region

California
Goosenest District, Klamath National Forest
Mt. Shasta Wilderness, Shasta-Trinity National Forest
Mammoth District, Inyo National Forest
Minarets District, Sierra National Forest
Monterey District, Los Padres National Forest
San Gorgonio Wilderness, San Bernardino National Forest
Valyermo District, Tahoe Basin Management Unit

Oregon
Ashland District, Rogue River National Forest
Big Summit District, Ochoco National Forest
Klamath District, Winema National Forest
McKenzie District, Willamette National Forest
Wenaha-Tucannon Wilderness, Umatilla National Forest
Unity District, Wallowa-Whitman National Forest
Oakridge District, WIllamette National Forest

Washington
Cle Elum District, Wenatchee National Forest
Colonel Bob Wilderness, Olympia National Forest
White River District, Mt. Baker-Snoqualmie National Forest

Appendix 3

Rocky Mountain Region

Colorado
Blanco District, White River National Forest
Dillon District, White River National Forest
Pine District, San Juan National Forest
La Garita Wilderness, Gunnison-Rio Grande National Forest Indian Peaks Wilderness, Arapaho- Roosevelt National
Forest
South Platte District, Pike-San Isabel National Forest

Idaho
New Meadows District, Payette National Forest
Elk City District, Nez Perce National Forest
Priest Lake District, Idaho Panhandle National Forest
Salmon River District, Nez Perce National Forest
Teton Basin District, TargeeNational Forest

Montana
Ashland District, Custer National Forest
Beartooth District, Custer National Forest
Great Bear Wilderness, Flathead National Forest
Hungry Horse District, Flathead National Forest

Utah
Cedar City District, Dixie National Forest
Flaming Gorge District, Ashley National Forest
Logan District, Wasatch-Cashe National Forest

Wyoming
Jedediah Smith Wilderness, Targee National Forest
Big Penny District, Bridger-Teton National Forest
Tensleep District, Bighorn National Forest

Appendix 4

Southwestern Region

Arizona
Bear Wallow Wilderness, Apache-Sitgreaves National Forest Payson District, Tonto National Forest
Pusch Ridge Wilderness, Coronda National Forest
Kachina Peaks Wilderness, Coconino National Forest
Sierra Vista District, Coronado National Forest
Springerville District, Apache-Sitgreaves National Forest

New Mexico
Dome Wilderness, Sante Fe National Forest
Glenwood District, Gila National Forest
Mimbres District, Gila National Forest
Espanola District, Santa Fe National Forest

Appendix 5

PARVS Activities Included in the Cluster Analysis:

Hiking
Hiking
Walking

Interpretive walks
Ranger talks
Self guided booklet

Motorized trail
Snowmobile
Off road vehicle

Backpacking

Jogging

Bicycling

Horseback riding

Cross country skiing

Fishing
Cold freshwater
Warm water
Anadromous

Developed camping

Undeveloped camping

Viewing
Photography
Sightseeing
Information center
Historic areas
Wildlife observation
Nature study

Family social
Picnicing
Family gathering
Campfire program
Attend special event

Nonmotorized water activities
Canoeing
Sailing
Outdoor pool
Swimming

Motorized water activities
Motorboat
Water skiing
Other motorized crafts

Winter Activities
Ice skating
Sledding
Downhill skiing
Other winter activities

Hunting
Big game hunting
Waterfowl hunting
Small game hunting
Other hunting

Collecting
Firewood
Berries

Driving

Printed on Recycled Paper

☆U. S. GOVERNMENT PRINTING OFFICE:1994-550-112/80012

Daigle, John J.; Watson, Alan E.; Haas, Glenn E. 1994. **National forest trail users: planning for recreation opportunities.** Research Paper NE-685. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 13 p.

National forest trail users in four geographical regions of the United States are described based on participation in clusters of recreation activities. Visitors are classified into day hiking, undeveloped recreation, and two developed camping and hiking activity clusters for the Appalachian, Pacific, Rocky Mountain, and Southwestern regions. Distance and time traveled to national forest sites from home varied for activity clusters. Length of time at the site varied across activity clusters. Recreation activities combined with home range allows for assessing relative availability of, and demand for, different types of place-related opportunities and experiences users seek within a particular region.

KEYWORDS: cluster analysis, home range, visitor management, recreation activities, market segmentation.

Headquarters of the Northeastern Forest Experiment Station is in Radnor, Pennsylvania. Field laboratories are maintained at:

Amherst, Massachusetts, in cooperation with the University of Massachusetts

Burlington, Vermont, in cooperation with the University of Vermont

Delaware, Ohio

Durham, New Hampshire, in cooperation with the University of New Hampshire

Hamden, Connecticut, in cooperation with Yale University

Morgantown, West Virginia, in cooperation with West Virginia University

Orono, Maine, in cooperation with the University of Maine

Parsons, West Virginia

Princeton, West Virginia

Syracuse, New York, in cooperation with the State University of New York, College of Environmental Sciences and Forestry at Syracuse University

University Park, Pennsylvania, in cooperation with The Pennsylvania State University

Warren, Pennsylvania

Persons of any race, color, national origin, sex, age, religion, or with any handicapping condition are welcome to use and enjoy all facilities, programs, and services of the USDA. Discrimination in any form is strictly against agency policy and should be reported to the Secretary of Agriculture, Washington, DC 20250.

"Caring for the Land and Serving People Through Research"

REMEMBER... Smokey Has for Fifty Years Prevent Forest Fires