ASSESSMENT OF OVERNIGHT USER BEHAVIOR IN THE HIGH PEAKS WILDERNESS AREA: STRATEGIES FOR TRENDS ANALYSIS

Stephen F. Langdon
Non-matriculated graduate student,
Center for Earth and Environmental Science,
Plattsburgh State University of New York

Abstract: The Eastern Portion of the Adirondacks' High Peaks Wilderness Area is a popular destination for wilderness users from the northeastern United States and Canada. This paper describes overnight user data collected on site, in two of the most popular backcountry camping areas in the High Peaks Wilderness management complex: Lake Colden and Marcy Dam. The study method used was the recording and analysis of daily observations of New York State Department of Environmental Conservation personnel assigned to interior management facilities at these locations. While employed by NYSDEC the author and a co-worker kept a journal of routine public education patrols and campsite inspections, recording campsite type and location, party size, trail head access point, party origin, group type, general age range, gender, and number and type of violations of camping rules and regulations. The data includes nearly 1700 parties, over 160 days of interior campsite inspections. The paper presents analysis of the data, including general demographics of overnight users, change in violations resulting from management interventions and regression analysis of variables affecting violations.

Introduction

Funding plays an important role in the process of deciding the extent of campsite monitoring efforts in wilderness; when resources are limited, managing agencies have fewer options for implementing such programs (Cole 1989). Standardizing a methodology of overnight user data collection that utilizes existing human resources without overburdening them, and provides managers information that is pertinent to the Limits of Acceptable Change (LAC) process could expand the options for wilderness management agencies with limited funds for monitoring programs. This paper presents an example of a standardized method of data collection that adds little significant time to the workloads of field personnel (approximately 15 minutes to routine nightly public education patrols) while at the same time providing baseline data that informs the judgement of managers.

The High Peaks Wilderness Complex (HPWC) of New York's Adirondack Park, has, for over a century, been a popular destination for wilderness recreation in some of the highest and most rugged mountains in the East. The Eastern zone of the HPWC sees the majority of visitors in the area and has been categorized as an intensive use area within the wilderness opportunity spectrum area (Johnson and Dawson 2001). In order to meet management challenges of recreational use in this area the New York State Department of Environmental Conservation (NYSDEC) adopted the High Peaks Wilderness Complex Unit Management Plan (HPWCUMP) in 1999 that incorporated the LAC management process. The parameters chosen by NYSDEC to gauge limits of acceptable change in this area that are monitored by this study are:

- General campsite condition,
- Campsite solitude - sight and sound spatial characteristics,
- Conflicts between differing user groups, and
- Encounters with large groups while camping (HPWCUMP).

In this study temporal and spatial distribution of overnight users is monitored for 80 percent of campsites in the highest overnight use corridor of the HPWC. By incorporating violations of camping rules and regulations observed on routine public education patrols, it is possible to gauge overnight users' understanding of (or willingness to comply with) rules and regulations. And, by incorporating this data with other monitoring data such as impact assessment of campsites (Cole 1989) the ecological impacts of behavior can also be measured. Monitoring violations can also be helpful in the prioritization of resource allocation, in developing appropriate management interventions and measuring the effectiveness of management interventions in reducing impact, an important function in monitoring systems (Marion 1995).

Study Area

Lake Colden and Marcy Dam are the most popular destinations for campers in the eastern zone of the HPWC. Lake Colden is a 41-acre lake at 2700 feet in elevation located in the heart of the Eastern High Peaks with 20 designated campsites at the south end of the lake. Camping at Lake Colden - a 6-mile hike from both Adirondak Loj trailhead to the north and Upper Works trailhead to the south - offers spectacular scenery and an ideal location to set up a base camp to hike many of the surrounding mountains. This area is the confluence of seven different trails. Marcy Dam is a 3-acre pond that offers high aesthetic qualities for a relatively short hike - 2.1-miles from Adirondack Loj trailhead - with 30 designated campsites. Because of its proximity to the most heavily used trailhead in the High Peaks Wilderness Area, Marcy Dam sees a higher level of day and overnight use than that seen at Lake Colden. In response to the impacts on the wilderness resource in this area a number of direct and indirect management actions were taken by NYSDEC in 1999. These include:

- Prohibiting the use of camp fires;
- Limiting camping to designated sites only;
- Reduction of the maximum overnight party size to eight persons;
- Requiring tents to be within 15 feet of the sign designating the site;
- Remediation of closed sites and impacted areas.

NYSDEC maintains interior outposts (ranger stations) at Lake Colden and Marcy Dam in order to facilitate management at these areas. The responsibilities of the caretakers at these cabins include trail maintenance, public education, assisting Forest Rangers with enforcement of rules and regulations, and search and rescue.

Methods

Backcountry personnel utilized as mechanisms for data collection were the Caretakers stationed at the interior outposts at Lake Colden and Marcy Dam. Caretakers were trained by forest rangers to recognize and correct violations of rules and regulations. Among the duties of the interior caretakers are routine public education patrols of the campsites in their work circles. Patrols of campsites take place generally in the evening, between 5:00pm and 9:00pm, though parties observed at any time of day were included in the data. The evening is the most effective time for public education because it is when overnight parties are in or arriving at the campsites. At this time of day backcountry personnel can direct parties to designated campsites that are not immediately apparent upon arrival in the camping areas, explain rules and regulation, and mitigate impact on the resource by correcting violations before they occur.

During the extent of this study the caretaker at Lake Colden (the author) was assigned to the outpost Friday through Tuesday and patrolled campsites on all nights of the tour of duty except Tuesday. The Caretaker at Marcy Dam was assigned to the outpost from Thursday to Monday. Data was collected at Marcy Dam less frequently, but generally on weekend nights.

The Data that was included was that which was most readily available through observation: campsite location, campsite type, number in party, gender of individuals in the party, general age range of party, number and type of violations. The violations that were recorded were:

a) Camping more than 15 feet from the sign (disk) designating a primitive campsite,
b) Camping within 150 feet of the trail or water in a non-designated site,
c) Making a campfire,
d) Leaving a campfire unattended,
e) Having an unleashed pet,
f) Exceeding the maximum overnight party size (8 persons),
g) Failing to properly secure food from bears,
h) Washing dishes in/polluting a stream,
i) Possessing glass containers, and
j) Failing to keep a neat and sanitary campsite.

Violations that were included were not necessarily those that enforcement personnel would consider deserving of enforcement action but can be characterized as illegal, careless, or unskilled (see Dawson and Hendee). The following is an account of what infractions were included as violations. (A, B) Camping greater than 15 feet from designated disks and camping in non-designated sites within 150 feet of trail or water were counted as violations if the party had set up their tent(s). Even if the tent had been set up for only a few minutes prior to the arrival of NYSDEC personnel and was then moved

to a legal site, this was counted as a violation. If the party had not set up a tent in this illegal site it was not counted as a violation, even if they intended to camp there, and/or were unaware of proper camping rules and regulations. Tent violations were counted as occurring in the site where the party was moved to, which was generally the nearest designated campsite. (C) No fires are permitted in the Eastern High Peaks. This regulation reads, "No person shall ignite or maintain a campfire for any purpose at any location in the Eastern High Peaks Zone." For the purposes of this study all parties gathering firewood and building fire rings, were counted as violations even if they did not ignite of maintain the fire. This is based on the idea that foraging for firewood has significant impact on the understory of the area. The intent of the fire ban is in part to reduce this impact. (F) The maximum overnight user group size in the Eastern High Peaks is eight persons. All instances of parties exceeding maximum overnight group size were counted as violations even if the party was split up (camping in two smaller parties greater than 1 mile apart, as per regulations) before spending the night. Parties larger than eight are not permitted to congregate, eat or camp in a single site. Not counted as violations were instances when separate parties would congregate in one campsite in a group larger than eight to cook or socialize. This occurs often at a few sites at Lake Colden where the view from the lean-to is much nicer than that of nearby campsites. (G) Parties are required to adequately secure their food from bears. Parties considered to be in violation were those that made no attempt to secure their food, brought no equipment to do this, or their attempt to secure food was sorely inadequate. Not counted as violations were parties who lost food to the bears after making a reasonable attempt to secure it. (I) Glass containers are not permitted in the Eastern High Peaks. Counted as violations were all glass containers in the possession of a party that were seen by the Caretaker (data collector). (J) Failing to keep a neat and sanitary campsite was counted as a violation only if there were food scraps or garbage in an unattended campsite.

Brief survey questions were used to determine party origin, trailhead access, and group type. These questions were asked in a casual manner: "Where did you folks hike in from today?" "Where are you from?" If there was some indication that the party was an organized group (i.e. larger groups with individuals of the same age or gender, with a clear leader, uniform equipment, etc.) the question, "What type of group is this?" was asked. The data was recorded in a notebook during and after the patrol and was then entered in a Microsoft Excel spreadsheet. Parties were not aware that information about them was being recorded.

A notable bias in this methodology is that uniformed personnel (data collectors) may influence the behavior of subjects being studied. If overnight users act differently (i.e., hide glass bottles, set up tents after personnel leave) when uniformed personnel are present one would assume that the results would show less violations than what actually occur. Further, observation of some violations require that the data collectors must be present at the exact time the violation occurs. Examples of this are washing dishes in the lake or stream, litter in the campsites or outhouses, a pet that is unleashed once the data collector has left, a poorly hung bear bag far from any campsite whose owner is not encountered. Another difficulty in assessing violations is that the results of violations cannot always be attributed to a specific party. Examples of this are, food scraps in the stream, human waste sites, garbage left in the outhouses, remains of campfires. Violations or results thereof that could not be tied to a specific party or campsite were not included in this study.

Another notable bias is that if the routine public education patrols are interrupted because of search, rescue, public assistance or other job requirements, the number of violations increases because personnel are not available to provide information on campsite locations, rules and regulation, and low impact camping techniques. The most notable example of this occurred at Lake Colden on the Canadian Victoria Day holiday weekend in mid-May 2001. The Lake Colden Caretaker was asked to respond to a rescue and was not able to patrol the campsites until 9:00 pm. where there were numerous violations because of lack of educational presence.

Altogether, this assessment of overnight user behavior shows fewer violations of infractions of applicable rules and regulations than actually occur. Additionally, since violating parties were educated by the caretakers, this data also can be used to

demonstrate the importance of backcountry personnel.

Results and Discussion

The data was collected in three sets: Lake Colden, summer 2001 containing observations of 561 overnight parties, 1832 individuals, over 58 days; Lake Colden 2002 containing observations of 637 overnight parties, 1914 individuals, over 69 days; and Marcy Dam 2002 containing observations of 479 overnight parties, 1691 individuals, over 34 days.

User origin. Most overnight users visiting Lake Colden and Marcy Dam were from the northeastern states and Canada (primarily Quebec). The difference in the proportion of Canadians to New Yorkers between the two camping areas is presumably because the trailheads that access Marcy Dam are on the northern boundary of the HPWC and are therefore a much closer drive from Canada. Lake Colden is equidistant from the northern trailheads and from the Upper Works trailhead to the south - a much shorter drive from Albany or New York City.

Temporal distribution. Temporal distribution of overnight use at Lake Colden is quite uneven over the summer season. Early season holidays (Victoria Day and Memorial Day) can be among the busiest of the year or have little use at all. This fluctuation is due primarily to the weather in the HPWC this time of year. On Victoria Day 2001 the weather was partly sunny and in the 50's; in 2002 it was raining and snowing. Overnight use drops off immediately in early June (no doubt in correlation with the area's notorious Black Fly season) and slowly increases throughout the summer with a peak around 4th of July. August sees the most use with number of parties exceeding campsites on most weekends. Labor Day weekend saw the highest level of overnight use at Lake Colden for both years.

Violation types. The primary type of violation (11.22% of all parties) in the total data set was camping in a non-designated site less than 150' from the trail stream or water. This was followed by camping greater than 15 feet from the disk designating the campsite (7.16% of parties). Discrepancies in tenting violations (the 150' rule as opposed to the 15' rule) between Lake Colden and

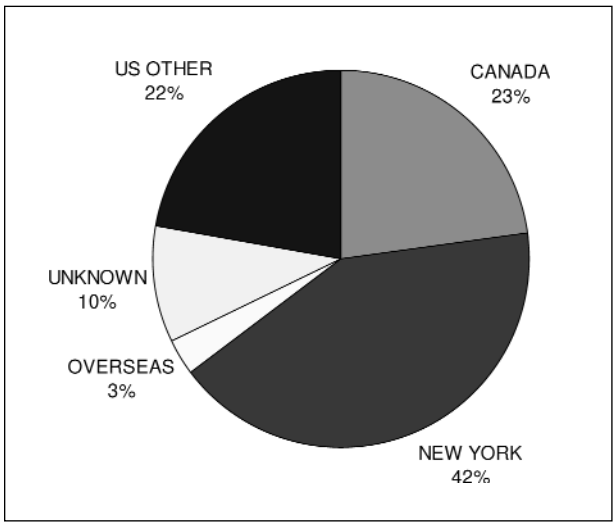

Figure 1: Lake Colden User Origin.

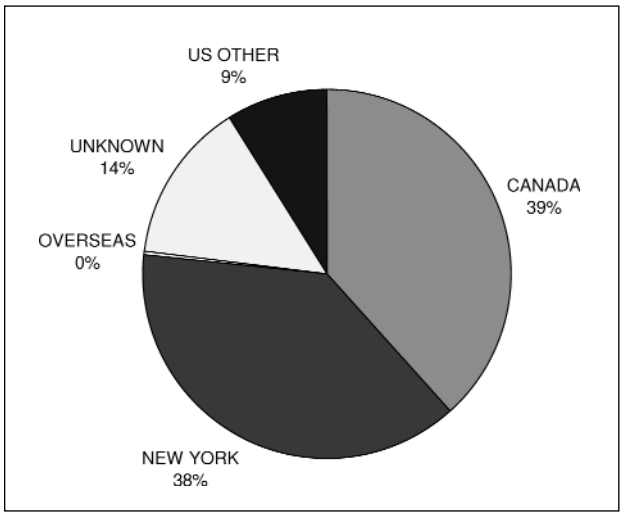

Figure 2. Marcy Dam User Origin.

Marcy Dam can be attributed to the data collector's interpretation of rules and regulations.

The greatest change in violations between 2001 and 2002 occurred at Lake Colden in the percentage of parties violating the camping greater than 15 feet from the disk rule. This is because of campsite remediation efforts implemented by the NYSDEC in both 2001 and 2002. In the summer of 2000 NYSDEC began closure of sites in the heavily impacted 'at large' tenting area at Lake Colden known as "Day Glow North" (because of

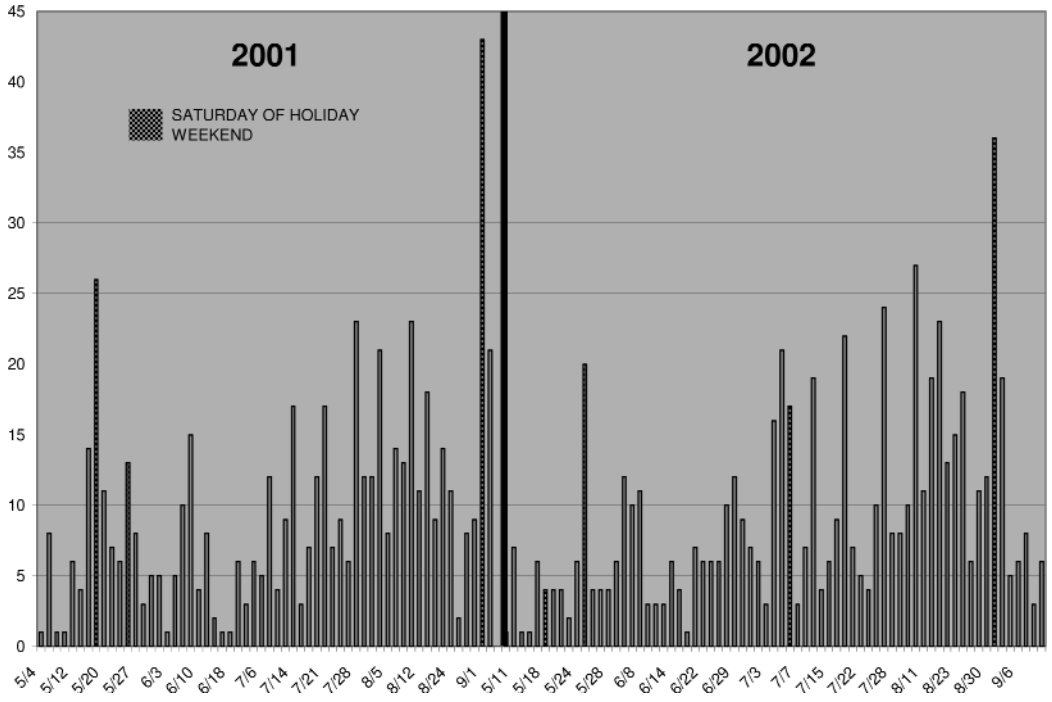

Figure 3: Temporal Distribution of Overnight Users at Lake Colden.

the glow, visible from a distance, of brightly colored tents lit from within with flashlights). Though four of seven 'Day Glow North' sites had been closed a year before, the only indicator of closure was the removal of the designated camping disks and their replacement with 'NO CAMPING' signs. In June of 2001 closed sites were revegetated with locally transplanted seedlings and seed logs, and brushed in with fallen trees. On two of the remaining sites, three eight-foot by eight-foot tent cribs were established to increase intrasite concentration of use (Marion 1996). A food bag cable was strung nearby to help secure campers' food from bears. This, along with the ban on campfires, further minimized trampling impacts on revegetation sites and peripheral areas. More remediation work followed in 2002 with the relocation of a lean-to further away from the water and from other campsites. Revegetation of impacted areas continues in summer 2003.

Regression analysis of Violations. To illustrate management applications of data collected using this methodology, descriptive statistical analysis was conducted using Microsoft Excel software. Regression analysis were used to examine the relationships between violations (specifically defined below) and descriptive variables. For multiple regression analysis, dummy variable coding was used for each classification of descriptive variable. Dependent variables are violations per night (VPN)- number of violations occurring on a single night, violations per party (VPP) - number of violations per party, and violations per campsite (VPC)- number of violations in a campsite on a single night.

Regression 1: Descriptive variable visitors/nights - the number of individuals at a camping area on a single night (Marcy Dam or Lake Colden)- versus dependent variable violations per night (VPN).
Regression 2: Descriptive variable parties per nights - the number of overnight parties in the camping areas on a single night versus VPN. Regression 2 is run for all the data set and then for each set; Lake Colden 2001, Lake Colden 2002 and Marcy Dam 2002.
Multiple regression 1: descriptive variable party origin (classified as New York, US Other and Canada) versus violations per party (VPP).
Multiple regression 2: Descriptive variable party type (classified as individual, friends/family and organizations) versus VPP.
Multiple regression 3: Descriptive variable campsite type (classified as tent site, remediated tent site and lean-to site) versus violations per campsite (VPC)
Multiple regression 4: Descriptive variable arrival time (classified as arriving before patrol or after patrol) versus VPP.
Multiple regression 5: Descriptive variable campsite

Table 1. — Violation Types As Percentage of Total Parties.

VIOLATION TYPE	ALL DATA	LC 2001	LC 2002	% CHANGE AT LAKE COLDEN	MARCY DAM
LESS THAN 150'	11.22%	8.02%	9.26%	1.24%	17.57%
15' FROM DISK	7.16%	15.15%	5.34%	-9.81%	0.21%
NO FIRES	2.33%	3.39%	1.88%	-1.50%	1.67%
UNATTENDED FIRE	0.06%	0.00%	0.16%	0.16%	0.00%
8 PERSON MAX	1.91%	2.32%	1.26%	-1.06%	2.30%
DISHES IN STREAM	0.54%	0.71%	0.47%	-0.24%	0.42%
BAD FOOD HANG	5.37%	2.50%	2.67%	0.17%	12.34%
NO GLASS	2.09%	0.71%	2.20%	1.48%	3.56%
LEASH PETS	1.67%	2.85%	1.88%	-0.97%	0.00%

Table 2. — Violations as Percentage of Total Parties Before and After Campsite Remediation.

VIOLATION TYPE	BEFORE REMEDIATION 2001	AFTER REMEDIATION 2001	AFTER REMEDIATION 2002
15' FROM DISK	75.86%	8.75%	2.61%
LESS THAN 150'	3.45%	5.00%	9.57%
NO FIRES	6.90%	0.00%	0.00%
LEASH PETS	3.45%	3.75%	0.87%
8 PERSON MAX	0.00%	3.75%	3.48%
BAD FOOD HANG	0.00%	1.25%	0.00%
NO GLASS	0.00%	0.00%	2.61%
N	29	80	115

sharing (classified as one party per site, two or more parties per tent site and, two or more parties per lean-to) versus VPP.

Variability in the data set is accounted for mostly by regression one and two, visitors per night and parties per night, R^2=.674 and .662 respectively. While there is no surprise that there is a strong relationship between number of parties and number of violations, defining this relationship provides a benchmark against which overnight user's knowledge of and willingness to comply to rules and regulations can be measured. In multiple regression 1 party origin accounts for little of the variability of violations in the data set (R^2=.017). It does shows with high probability that the coefficient of Canadian parties is greater. There is variation in the coefficient of party origin between Lake Colden 2001, Lake Colden 2002 and Marcy Dam 2002 (not shown) though in all of these data sets Canadian parties had the highest coefficients. At Marcy Dam 2002 the difference between Canadian and New York party was much less significant. Possibly accounting for this is Marcy Dam's accessibility and thus its attractiveness to novice campers. The change in the coefficient between Lake Colden 2001 and Lake Colden 2002 (-25%), corresponds, speculatively, to the change in early season holiday use (Victoria Day) and campsite remediation efforts.

In multiple regression 2, party type also accounted for little of the variability (R^2=.015), but showed that the coefficient of organized groups was greater than that of friends/families or individuals. In multiple regression 3, campsite type accounts for about 20 percent of the variability in violations per campsite. The coefficient in tent sites is much higher (almost double) than that in lean-tos or remediated tent sites. The most common violations (see above) have to do with where a tent is erected. Remediated tent sites, where intrasite use concentration was increased through indirect management intervention, effectively decreased number of violations. Such sites provide clear visual indication to parties of where tents belong. This also seems to be true for lean-tos. Again, it must be noted that violations were assigned to the site that parties stayed in for the night. When a tent was erected in a lean-to site and the party was moved to a tent site the violation was associated with the tent site. Because this happened very infrequently this flaw in data collection would insignificantly affect the coefficient.

Table 3. — Results of Regression analysis.

	Dependent variable	Descriptive Variable	N	R^2	coefficient	Standard Error	T-Stat	P-Value
Regression 1	violations per night	visitors per nights	161	0.67	0.11	0.00	27.18	7.52E-62
Regression 2	violations per night	parties per nights (PPN)	161	0.66	0.34	0.01	26.60	1.31E-60
Regression 2	violations per night	PPN Lake Colden 2001	58	0.76	0.38	0.02	18.52	8.57E-26
Regression 2	violations per night	PPN Lake Colden 2002	69	0.59	0.28	0.02	14.48	1.87E-22
Regression 2	violations per night	PPN Marcy Dam 2002	34	0.54	0.36	0.03	13.51	5.34E-15
Multiple Regression 1	violations per party	PARTY ORIGIN	1667	0.02				
		New York			0.30	0.02	14.17	4.16E-43
		US Other			0.30	0.03	9.47	8.89E-21
		Canada			0.41	0.03	15.77	2.64E-52
Multiple Regression 2	violations per party	PARTY TYPE	1667	0.02				
		Individual			0.16	0.05	3.15	0.001663
		Friends/Family			0.33	0.02	21.77	1.18E-92
		Organization			0.44	0.05	9.02	4.96E-19
Multiple Regression 3	violations per campsite inspection	CAMPSITE TYPE	1378	0.02				
		Lean-to			0.29	0.03	9.58	4.36E-21
		Tent			0.47	0.02	19.12	2.03E-72
		Remediated Tent Site			0.24	0.05	4.44	9.53E-06
Multiple Regression 4	violations per party	ARRIVAL TIME	479	0.33				
		After Patrol			0.71	0.09	8.21	2.13E-15
		Before Patrol			0.15	0.06	2.46	0.014229
Multiple Regression 5	violations per party	CAMPSITE SHARING	1676	0.00				
		One party per campsite			0.29	0.02	18.31	2.22E-68
		Shared campsite			0.37	0.03	14.60	1.65E-45

In multiple regression 4, arrival time accounted for one third of the variability in violations at Marcy Dam. There was a significant difference in the coefficient between parties arriving before and after evening patrols. Parties arriving at Marcy Dam after dark are more than four times as likely to have violations. It must be noted that morning patrols at Marcy Dam were not usually as comprehensive as evening patrols, thus biasing the results somewhat. None-the-less, the data collector was confident that 80 to 90 percent of parties were included.

In multiple regression 5, campsite sharing accounts for nearly none of the variability in the data set (R^2= .004) but the coefficient of shared campsites is higher than campsites that were not shared, indicating that parties sharing campsites more frequently have violations. Of the 1676 parties included in the data, 72 percent had a campsite to themselves, 19 percent shared a tent site with at least one other party, and 9 percent shared a lean-to with at least one other party.

Management implications

Coordinating this assessment of overnight user behavior with other monitoring programs could

potentially provide a broader view of conditions in the HPWC. NYSDEC has implemented two programs to monitor conditions in the backcountry. First, both day and overnight users are required to fill out Trip Tickets available at trailhead registers. This data provides more detailed information on user origin, party size and intended destination than what is available from trailhead register books. Comparing trailhead data to on-site data could illuminate the difference between overnight users' intended and actual destinations and lengths of stay. Second, a campsite inventory and impact assessment (Cole 1989) was undertaken starting in the fall of 2000. This provides baseline data for monitoring changes in ecological and aesthetic conditions of designated campsites. By supplementing these data with the overnight user data collected in this study (spatial analysis of violations) managers can gain a clearer picture of the effect of behavior on ecological conditions. This would also provide managers specific representations of use and violations, enabling prioritization of remediation efforts based on user behavior.

The HPWC faces management challenges presented by its overnight users' origin. Evaluation of the relationship of overnight party's origin and violations is useful to managers in directing user education resources. Research is required into why Canadian overnight users visiting Lake Colden and Marcy Dam violate rules and regulations more frequently than other users. This may simply be because of the accessibility of the HPWC to users from Canada, the timing of the Victoria Day holiday -before NYSDEC has hired its full seasonal staff of Assistant Forest Rangers (AFRs)- or a mix of sociological and cultural preferences and expectations of Canadian overnight users. Campsite remediation at Lake Colden has been essential in reducing ecological impact by curtailing the behavior (tent violations etc.) that stifles natural regeneration of understory and overstory vegetation (Marion 1996). Increasing intrasite use concentration through the use of tent cribs, revegetation and centralized food hanging areas is effective in reducing tent violations at Lake Colden and could be an effective management intervention in other areas heavily impacted by overnight use.

Overnight parties arriving after dark at Marcy Dam are frequently in violation of rules and regulations. Extending the shifts of personnel dedicated to trailhead education into the evening may also curb such behavior. Implementing limitations on how late in the day a party can start hiking to camp in the high use areas of the HPWC may be appropriate to curb the improper behavior of late arrivals at Marcy Dam. This may be a politically palatable alternative to other direct management use limitations such as a permit system.

Utilizing backcountry personnel for monitoring conditions in wilderness is nothing new. By recording observations made on routine public education patrols the management dialogue is enhanced. Identification of a managing agency's personnel who frequently interface with recreationists is the first step in the application of an assessment of use such as this.

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