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Anatomy of Backcountry Management Costs

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Abstract

Operation and management costs for several dispersed overnight site locations and backcountry trails in the White Mountain National Forest were studied. Average annual costs ranged from $200 to $1,500 per mile for trails and from $0.35 to $4.29 per visitor for overnight sites. Average annual costs for trails and overnight sites increased with elevation and use levels, but on a per-visitor basis, high-use trails cost less to maintain than low-use trails at all elevations. Costs per visitor at overnight sites were less well defined. The method used in this study may be useful to backcountry recreation managers in their efforts to acquire a better understanding of all the costs of providing backcountry recreation opportunities.

What's the Problem?

Dispersed recreation is the most prevalent use of national forests, and backcountry hiking and camping are among the most popular activities. Before the 1960's, relatively few people ventured into remote forest lands seeking wilderness or backcountry recreation experiences, and management needs were few. However, during the 1960's and early 1970's, visitation increases of 15 percent per year at overnight sites were common. Spencer and others (1980) noted a threefold increase in hiking and backpacking between 1965 and 1977, but felt that the rate of increase had declined between 1977 and 1980. From 1981 to 1984, total dispersed recreation in the National Forest System actually dropped from 151 to 145 million visitor-days.

However, these 20 years of heavy use have had an impact. Many trailheads have been expanded and in some cases paved to accommodate increased use. Trails have been reconstructed to reduce soil erosion and to provide easier and safer access to remote destinations. Overnight sites have been developed to reduce the physical impacts of camping as well as provide shelter and other amenities for overnight visitors. These improvements cost money, and annual maintenance must continue every year. Someone must bear these costs—usually the public land management agency or a trail-maintaining club.

The study of backcountry management costs is not a new endeavor. Tyre (1975) found that average costs in the southeastern United States ranged from $0.07 per visitor-day on general, undeveloped lands to $0.27 per visitor-day on wilderness areas. Guldin (1980) compared 1977 wilderness management costs on four areas in New England and found area costs of $1.80 to $8.37 per visitor-day. (These costs included payments in lieu of taxes, fire protection costs, and planning costs.) And, Irland (1980) stated that management costs on four different backcountry areas in Maine ranged from $1.36 to $4.98 per visitor-day. In each of these studies, opportunity costs were not included.

These studies have contributed to a better understanding of the fixed costs associated with providing backcountry and wilderness recreation opportunities. But, other important dimensions remain. The variable costs of specific facilities on different land types with different levels of use have not been investigated. In this paper, costs affected by these variable factors of backcountry management are examined. Because of the variation in terrain characteristics and trail locations within the eastern mountain regions, trail and overnight facility requirements might be expected to vary significantly with use levels.

To accommodate these variations, a framework was developed for relating the costs of providing backcountry hiking and camping opportunities to use levels and physical site characteristics: Recreation use levels—volume, fequency of use, and time of season—and physical site characteristics—topography, soil drainage, and plant community—require management actions to protect resources. These resources—structures, use management programs, and design techniques—incur management costs that vary with labor costs, material costs, transportation costs and administrative overhead. This framework can be easily integrated into the Design Capacity System introduced by Leonard and others (1977), which is influenced by the recreational objectives that management sets for an area, the physical ability of the area to fulfill the objectives, the financial resources available, and the social constraints that may be imposed by users.

In the White Mountain National Forest of New Hampshire, backcountry facilities are located on a variety of terrains with varying suitabilities for recreational use. The physical impact of hiking and camping tends to be concentrated on small portions of the recreation lands, mainly along trail corridors and at overnight sites. In this study, we investigated the types of management practices adopted for trails and overnight sites on various forest areas and the costs associated with those practices. Our primary interest was to compare the costs incurred for resource protection on various sites with different physical characteristics and use levels. Costs of land acquisition, fire protection, search and rescue operations, and off-site visitor information programs were not included.

Study Areas

The backcountry areas used for this study are composed of a mixture of granite and metamorphic gneiss and schists. Past glacial activity and the humid climate have weathered the White Mountains down to rounded land forms and produced four principal kinds of surface deposits: 1) angular boulders with little soil; 2) colluvium with shallow, weakly developed soils; 3) glacial till deposits of varied depths of rock and sediments; and 4) outwash soils.

The lower valley floors and toeslopes located at elevations generally below 2,300 feet are characterized by smooth terrain with deep, well-drained soils of cobbly, loamy sand or bouldery, sandy loam. The midslopes are characterized by a variety of glacial till deposits. The soils are generally deep, but surface drainage varies from slow to rapid, depending on the presence of shallow, hardpan layers, the distribution of subsurface boulders, and terrain undulations and rockiness. The upper elevation land types, generally occurring above 3,000 feet, have shallow soil with many angular boulders and bedrock or ledge frequently exposed to the surfaces. Above 4,200 feet the soils become very shallow and the climate severe. The vegetation changes from low, softwood forest to krummholz to alpine tundra; and, finally to rocky summits with no soil or alpine vegetation.

Study Method

A variety of trail segments and overnight sites were investigated to determine what types and amounts of improvements had been made. Sites were selected to provide a broad representation of land types, trail grades, and use levels.

About 75 miles of trail segments were examined on six different land types, ranging from hardwood forests on lower mountain slopes to alpine tundra on upper mountain slopes. Three trail grade classes (0 to 15 percent, 15 to 30 percent, and greater than 30 percent) were chosen to further divide trail maintenance needs within each land type. Daily trail use was estimated by managers and used to classify trail segments into four use-level groups (low—less than 10; moderate—10 to 30; high—30 to 100; and very high—greater than 100 persons per day). For purposes of a more manageable framework, the land types and trail grade classes were collapsed and combined into three categories—low elevation and low trail grades; mid-elevation and moderate trail grades; high elevation and steep trail grades. Trail use levels were also combined to low use (500 visitors per year) and high use (6,500 visitors per year). This resulted in each trail segment being placed in one of six categories.

For each trail category, trail maintenance structures (waterbars, steps, bridging and puncheon, side-hill cribbing, and so on) were counted, and the length of trail sections in need of maintenance was measured. Trail sections were considered problems if they had: 1) severely eroded sections (sections with gullies greater than 6 inches deep or with very loose, unstable soil on a steep grade) for more than 10 feet; 2) side-hill erosion from drainage crossing the trail; 3) poorly drained sections on flat areas that were greater than 10 feet long or that were causing trail widening problems. This inventory defined the number of improvements made in each trail category, and where necessary, the number of improvements required on problem sections to bring the trail up to management standards. The average number of improvements needed per mile of trail was computed by adding the number of improvements determined to be needed for each trail category and then dividing by the total length of trail observed in that category.

About two dozen overnight sites were classified into 12 site conditions, represented by three different land types and four different use levels. The use levels represented the capacities for which the sites had been designed and built. Low-use sites can accommodate 2 to 4 persons per night (200/year); moderate-use sites can accommodate 4 to 8 persons per night (600/year); high-use sites consist of shelters and/or tent platforms and can accommodate about 20 people per night (1,500/year); and very high-use sites have several shelters and tent platforms that can accommodate 50 to 60 people per night (3,000/year).

The management needs for each site condition were determined from observations of the practices adopted at well-managed sites. Where soil conditions dictated some form of human-waste disposal other than a pit privy, bin composting was chosen over a haul-out system. The Appalachian Mountain Club hut facilities were not included in this study because they are managed like hotels offering bedding and hot meals, rather than backcountry campsites.

Management costs for reconstruction and maintenance of trails and overnight sites were computed using a set of standard unit prices for each management structure and program. Standard unit prices were used for two reasons: records of actual expenditures for backcountry maintenance work were not available for the type of categories desired; and a comparison of actual costs would have confounded the results due to the great variation of costs for items such as labor, transportation, and materials. By calculating the costs with standard unit prices, we were able to compare the relative difference in costs between site and use-level conditions.

Estimates of unit prices for various trail maintenance jobs and overnight facilities were obtained from the Green Mountain National Forest in Vermont, the White Mountain National Forest in New Hampshire, and the Appalachian Mountain Club. For some of the overnight facilities, standard costs were calculated from itemized expense needs to which unit prices for labor, construction materials, travel, and overhead were applied. The unit prices used in this study are listed in Tables 1 and 2.

Table 1.—Trail construction and maintenance costs, in dollars

Item	Unit cost[a]
A. Trail construction	
1. Clearing	1,742/mile (0.33/linear foot)
2. Waterbars	16.50/waterbar
3. Ditching	1.65/linear foot
4. Steps—rock	15.10/step
—log	16.15/step
5. Cribbing—rock	9.45/linear foot
—log	5.85/linear foot
6. Puncheon (bridging) native	4.85/linear foot
7. Rock tread	
stepstones (1 step/2 feet)	2.10/linear foot
paving (all rock)	4.90/linear foot
8. Scree walls	2.00/linear foot[b]
9. Special provisions	
pin step	28.00/step[b]
cut step or ladder used on steep rock faces	45.00/step or ladder
B. Trail location markers	
1. Paint blazing	31.50/mile
2. Cairn building	
a. large, every 50 feet	10.40/cairn[b]
b. small, every 100 feet	2.60/cairn[b]
C. Trail maintenance	
1. Patrolling—every year clear blowdowns clean out drainage ditches	10.40/mile
2. Brushing—every 3 years	
a. low elevation (deciduous forest)	52.00/mile including patrolling
b. mid-elevation (softwood forest)	104.00/mile, including patrolling

[a] Most unit costs are based on Green Mountain National Forest co-op prices for 1979. Costs include 10 percent overhead.

[b] Appalachian Mountain Club estimates of labor times were used to compute unit costs for these items.

Table 2.—Overnight site facility and management program costs, in dollars

Category	Occurrence	Unit cost[a]
A. Facility		
1. Tent platforms Double size (10 ft × 12 ft)	10 years	656.00/platform
2. Shelter, 3-sided & precut Capacity 8	Every 20 years	6,555.75
3. Shelter, 3-sided & precut Capacity 10 to 14	Every 20 years	8,741.00
4. Special water supply and dishwashing areas	10 years	56.00
5. Signs	Replacements needed every 5 years	15.00/sign
6. Human-waste disposal facilities		
Outhouse and pit	20 years	610.00
Move outhouse to new pit	Depends on site use and soil conditions	160.00
7. Bin composting system		
Outhouse—modified for compost system	20 years	840.00
8. Equipment for 1 unit (max. 1,500 visitors/year	5 years	330.00/unit
Operating costs		
1-unit system	Annually	438.00
1-unit system at caretaker site	Annually	40.00
2-unit system	Annually	873.00
2-unit system at caretaker site	Annually	60.00
B. Management Program		
1. Caretaker programs		
a. Full-time, long season with law enforcement capability (Total—164 man-days)	Annually	10,899.00
b. Full-time, long season with no law enforcement capability	Annually	8,833.00
c. Full-time, no law enforcement capability (Total—98 man-days)	Annually	5,506.00
d. Peak-use, no law enforcement capability (Total—30 man-days)	Annually	1,764.00
2. Annual site maintenance programs (includes labor and materials for structure repairs)		
a. Patrolling only (at tentsite areas—3 trips/year)	Annually	42.50
b. Level I (at low-use sites, privy only)	Annually	138.60
c. Level II (at moderate-use sites) with no caretaker available	Annually	337.00
If at caretaker site, caretaker program costs cover most labor needs	Annually	200.00
d. Level III (at high-use or more structured sites)		
No caretaker available	Annually	674.00
If at caretaker site	Annually	400.00

[a] Includes labor costs (based on 1977 USDA Forest Service rates), material costs, transportation costs, and a 26 percent administration overhead cost.

The unit prices were applied to each of the reconstruction and maintenance jobs that would be required each year over a 20-year period. The lifetimes of the trail structures are not known, so an assumption was made that half of the structures would need replacement every 10 years. The cost per visitor per year was calculated as the average annual cost divided by an average number of users per year. An example of the cost calculations for one trail section is shown in Table 3.

Table 3.—Example of average annual cost calculations (AC), in dollars, for a trail at mid-elevation, of moderate (15-30%) grade, and with high use.

Year	Initial construction (C_o)	Unit cost	Cost/mile
0	Clearing & grubbing	1,742.00/mile	1,742.00
	Blazing	31.50/mile	31.50
	Structures:		
	steps (32)	15.10/step	483.20
	cribbing (28 ft)	5.85/lin ft	163.80
	waterbars (56)	16.50/waterbar	924.00
	ditching (13 ft)	1.65/lin ft	21.45
	Tread:		
	rock paving (30 ft)	4.90/lin ft	147.00
	log bridging (17 ft)	4.85/lin ft	82.45
		Total C_o =	3,595.40

Year	Maintenance costs (C_m)	Cost/mile
1	Patrolling	10.40
2	Patrolling	10.40
3	Brushing, patrolling, blazing ($104.00 + $31.50)	135.50
4	Patrolling	10.40
5	Patrolling	10.40
6	Brushing, patrolling, blazing	135.50
7	Patrolling	10.40
8	Patrolling	10.40
9	Brushing, patrolling, blazing	135.50
10	Patrolling	10.40
	Replace 1/2 C_o structures	910.95
	Total C_m =	1,390.25

$AC = (C_o + C_m) \div Y$
$= (\$3,595 + \$1,390) \div 10$
$= \$498.50$
Cost/visitor/year = $498.50 ÷ 6,500 = $0.08
Y = 10 years

What We Found

Trails

On low-elevation trails with low use and grades less than 15 percent, we observed no maintenance structures or trail problems. On similar trails receiving high use, a moderate amount of erosion control work had been done and some tread (rock paving or wood puncheon) had been used on flat, poorly drained areas. The calculated average annual costs for a 20-year period ranged from $210 per mile on low-use trails to $574 per mile on high-use trails (Table 4).

As previously stated, trail data were combined for the mid-elevation land types because of the complex variability in surface drainage conditions and trail grades. Trail improvements were few for low-use trails of moderate grade, and the calculated costs were similar to those on the low-elevation trails. On high-use trails, more trail structures were installed for erosion control and poorly drained areas. The calculated average annual cost was about twice that of the low-use trails. One of the most expensive trails was on a poorly drained basin floor beneath a cirque headwall in one of the mid-elevation land types. The trail was on a low grade and designed for very high use with extensive rock tread and wood puncheon. The calculated annual cost was $2,700 per mile.

The calculated average annual costs for steep-grade trails in the upper elevation, softwood forest ranged from $291 to $1,508 per mile. The low-use trail sections had little work, while the high-use trail sections had extensive erosion control work and were much more expensive to maintain.

In general, all the low-use trails, regardless of location, had the lowest costs, but because of fewer trail users, the costs per visitor were higher than those of the higher use trails. Trails with the most extensive work were those receiving high to very high use and were located in upper elevation, softwood forests over flat, poorly drained areas or on steep grades. Tundra trails also had extensive work and high costs if they were receiving high use. Tundra trails with low to moderate use, however, had annual costs that were lower than those for trails in the low-elevation hardwood forests.

Table 4.—Trail maintenance structures and calculated costs.

Trail location and grade	Structures and costs/mile	
	Low use (500 visitors/year)	High use (6,500 visitors/year)
Low elevation, hardwood forest, deep, well-drained soils—low trail grade	No structures C_o = $1,773[a] C_m = $32[a] AC = $210[a] ($0.42/visitor)	Waterbars—124 Steps—6 Tread—44 ft Scree—40 ft C_o = $4,200 C_m = $154 AC = $574 ($0.09/visitor)
Mid-elevation, mixed hardwoods-softwoods; soil drainage variable, bouldery terrain—moderate trail grade	Waterbars—3 C_o = $1,823 C_m = $50 AC = $233 ($0.47/visitor)	Waterbars—56 Steps—32 Cribbing—28 ft Ditching—13 ft Tread—47 ft C_o = $3,595 C_m = $139 AC = $499 ($0.08/visitor)
Upper-elevation, softwood forest; thin soils, bouldery terrain—steep trail grade	Steps—26 Waterbars—3 C_o = $2,216 C_m = $70 AC = $291 ($0.58/visitor)	Steps—420 Waterbars—98 C_o = $9,733 C_m = $535 AC = $1,508 ($0.23/visitor)

[a] C_o = Initial construction cost, including clearing and blazing
C_m = Average annual maintenance cost
AC = Average annual cost (See Table 3 for calculations)

Overnight Sites

The management practices that have been used for resource protection at designated overnight sites receiving clustered use include: 1) shelters or tent platforms to concentrate camping parties and reduce the surface area that becomes trampled and compacted; 2) a human-waste disposal system that does not rely on soil leaching; 3) delineated paths within the overnight site to discourage indiscriminate trampling of ground vegetation; 4) a drinking-water outlet pipe at a "hardened" collection point (this has been used to protect the ground surrounding a spring outlet, especially where frequent trampling could cause soil to wash into the water supply); and 5) resident caretakers to provide visitor information, maintain site facilities, operate compost systems, and where necessary, police the site. Routine maintenance is also required, including litter removal, shelter and privy cleaning and repairs, and sign replacement. At sites with caretakers, most of the routine maintenance jobs are handled without additional labor costs.

The calculated average annual costs (AC) of designated overnight camping areas ranged from $74 to $12,577 (Table 5). These costs were computed by adding the initial construction costs (C_o) to 19 years of average annual maintenance costs (C_m), which include replacement costs for facilities with less than a 20-year life and management program costs (see Table 2B), and dividing the sum by 20 for an average annual cost. The higher costs were required for areas designed for higher use or at higher elevations. These hypothetical costs represent costs that would be required to reconstruct and maintain the on-site facilities and management program adopted primarily for resource protection at various camping areas in the White Mountains. The costs per visitor are based on an average number of visitors per year that typically use the site.

Table 5.—Overnight site costs, in dollars, by use levels

Site location	Use levels (persons/year)			
	Low (200)	Moderate (600)	High (1,500)	Very high (3,000)
Low-elevation mountain slopes; hardwood forests; deep, well-drained soils on smooth terrain	Designated dispersed tentsites (4) C_o = 484[a] C_m = 52 AC = 74 (0.37/visitor)	Tentsites (Cap. 4) C_o = 1,387 C_m = 149 AC = 211 (0.35/visitor) Shelter (Cap. 8) C_o = 7,458 C_m = 370 AC = 724 (1.28/visitor)	Shelter & platforms (Cap. 20) C_o = 9,710 C_m = 2,273 AC = 2,645 (1.76/visitor)	Shelter & platforms (Cap. 60) C_o = 22,770 C_m = 12,040 AC = 12,577 (4.19/visitor)
Mid-elevation mountain slopes; mixed hardwood-softwood forest; soil drainage variable on undulating terrain	Designated dispersed tentsites (4) C_o = 484 C_m = 52 AC = 74 (0.37/visitor)	Tentsites (Cap. 4) C_o = 1,916 C_m = 636 AC = 700 (1.17/visitor) Shelter & platforms (Cap. 12) C_o = 8,810 C_m = 875 AC = 1,272 (2.12/visitor)	Shelter & platforms (Cap. 20) C_o = 10,543 C_m = 2,655 AC = 3,049 (2.03/visitor)	Shelter & platforms (Cap. 44) C_o = 17,309 C_m = 9,696 AC = 10,076 (3.36/visitor)
Upper-elevation mountain slopes; softwood forest; rapid to poorly drained, thin soils on bouldery terrain	Designated dispersed sites (4) C_o = 484 C_m = 177 AC = 192 (0.96/visitor)	Tent platforms (Cap. 10) C_o = 3,240 C_m = 2,305 AC = 2,352 (3.92/visitor) Shelter & platforms (Cap. 12) C_o = 8,838 C_m = 2,245 AC = 2,575 (4.29/visitor)	Shelter & platforms (Cap. 20) C_o = 10,375 C_m = 6,101 AC = 6,314 (4.21/visitor)	Shelter & platforms (Cap. 44) C_o = 17,450 C_m = 9,696 AC = 10,083 (3.36/visitor)

[a] C_o = Initial construction cost.
C_m = Average annual maintenance cost, based on 19 years, including replacement costs for facilities of less than a 20-year life.
AC = Average annual cost = $(C_o + 19\,C_m) \div 20$

The construction and annual maintenance costs rose more quickly for upper elevation, softwood sites than for lower elevation sites because of the need for a human-waste disposal system, added ground protection measures, and a caretaker program. Sites with the lowest average costs per visitor are the low-use sites that do not require facilities for ground protection or human-waste disposal. The site with the highest cost per visitor ($4.29) is an upper elevation location that could receive moderate use of about six to nine persons per night. At these use levels, several management facilities are needed, but the additional costs are not spread over a large number of visitors.

The sites with the highest average annual costs are the large sites designed for very high use. These sites tend to attract many inexperienced or inconsiderate visitors. They require full-time caretakers with law enforcement responsibilities plus most or all of the structural facilities needed at other locations. The low-elevation sites (AC = $12,577) have the added problem of close proximity to trailheads. Their high construction costs compounded by very high maintenance costs results in very high costs per visitor.

Discussion

Public agencies are being asked to do more every year with fewer dollars. Furthermore, this year's dollar does not go as far as last year's, and next year some recreation and park agencies may be asked to become more self-sufficient. How can the information in this paper help planners and managers meet this financial pinch? Before an agency can meet a financial pinch, it should know what its costs are. The operation and maintenance (O&M) costs of providing backcountry recreation opportunities in northern New England were computed using a cost-per-visitor mile and cost-per-visitor night framework that should not be too difficult to adopt in other locations. Based on use levels and land characteristics, and influenced by management's objectives, our study allows disaggregation of the costs of provision down to types of sites.

For example, the data in Table 5 show that "very high-use" sites at all elevations are extremely expensive to build and maintain, both in total dollars expended and in costs per visitor, when compared to costs of provision for sites that accommodate lower use levels. It also shows that upper elevation sites are very expensive to manage at almost all use levels. If the costs per visitor-night of these expensive or popular sites are to be controlled, then use levels of those sites should not be allowed to rise. This goal might be attained by issuing permits prior to a party's departure for expensive or popular sites and/or charging a "cost of provision fee" for the permit.

The framework we used to collect trail data was too detailed. Although use data were initially collected for four levels of trail use and on six different land types and at three trail grade classes, we combined the data into two use levels at three grade classes, with the grade classes encompassing the land types.

Managerial decisions based on the cost-per-visitor mile may not be quite as cut and dried as those based on costs-per-visitor night because as use rises, the per-unit costs go down. Operation and maintenance costs averaged about $0.50 per visitor-mile on low-use trails and about $0.10 on high-use trails except at upper elevations where the costs rose to $0.23 per visitor-mile. Perhaps a framework containing only six categories—two use levels at three elevation-grade levels—is enough detail for decisionmaking.

If visitor fees are adopted for backcountry recreation, knowledge of the management costs for different types of opportunities could be useful in determining fee schedules for different types of areas rather than charging all visitors the same fee. Visitors to low-use, low-maintenance areas may resent having to pay the same fee as visitors to high-maintenance areas offering more facilities. With the heightened attention on public expenditures, this would seem the time to start a standardized and regular monitoring system for backcountry recreation management costs.

Literature Cited

Guldin, Richard W. **Wilderness costs in New England.** Journal of Forestry. 78(9):548-552; 1980.

Irland, Lloyd C. **Costs of managing backcountry recreation areas in Maine, 1978.** Augusta, ME: Maine Department of Conservation, Bureau of Parks and Recreation; 1980; Tech. Rep. No. 5.

Leonard, R. E.; Plumley, H. J.; Holman, W. R. **A design capacity system.** In: Expanding America's Trail System, 4th National Trails Symposium Proceedings. 1977 September 8-10; Lake Junaluska, NC. National Trails Council; 1977: 160-163.

Spencer, Edward L.; Echelberger, Herbert E.; Leonard, Raymond E.; Evans, Craig. **Trends in hiking and backcountry use.** In: LaPage, Wilbur F., chairman. Proceedings 1980 national outdoor recreation trends symposium. Gen. Tech. Rep. NE-57, Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1980: 195-198.

Tyre, Gary L. **Average costs of recreation on national forests in the South.** Journal of Leisure Research. 7(2):114-120; 1975.

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