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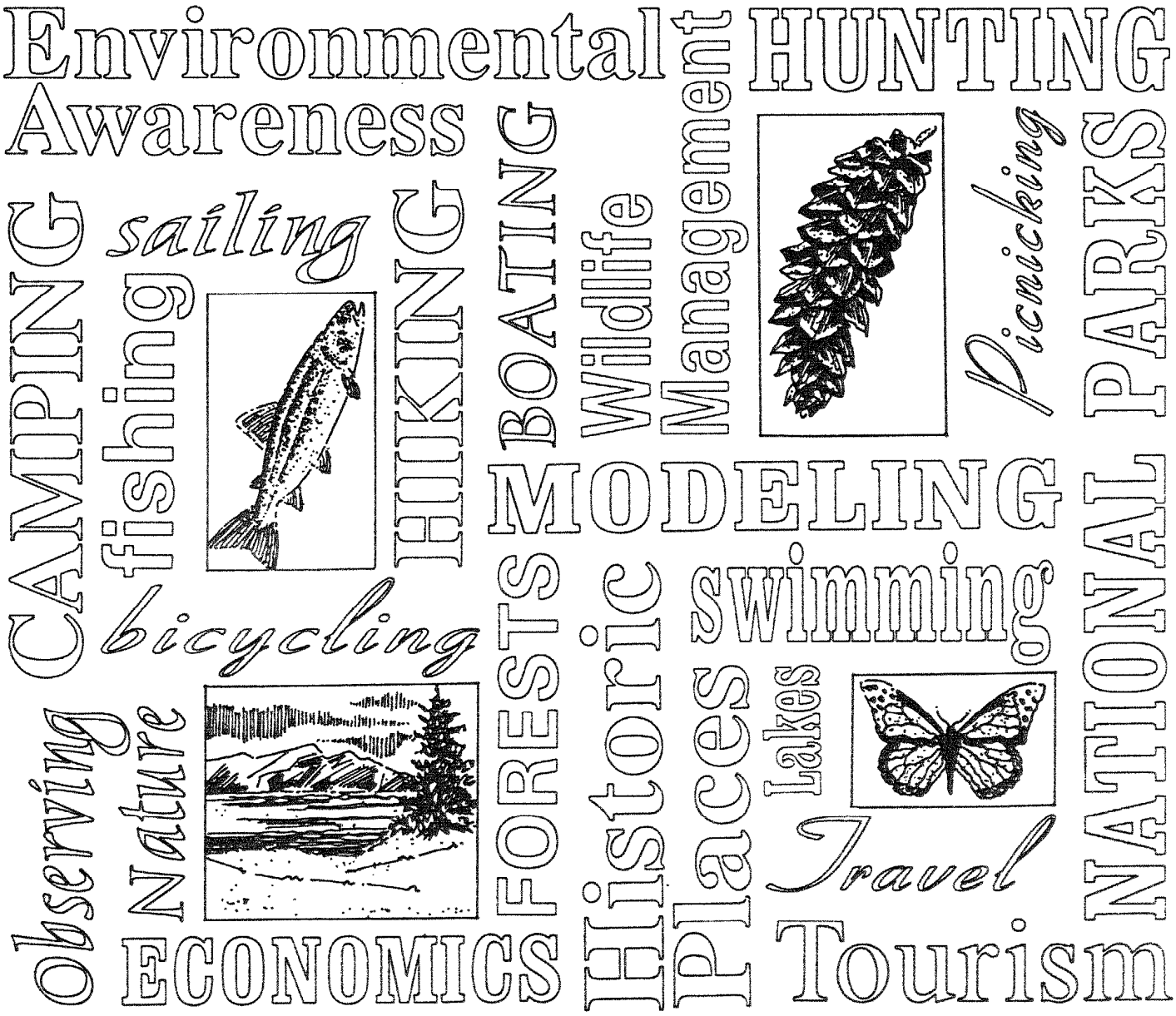
PROCEEDINGS of the 1993 NORTHEASTERN RECREATION RESEARCH SYMPOSIUM

April 18-20, 1993
Saratoga Springs, New York



NORTHEASTERN RECREATION RESEARCH MEETING POLICY STATEMENT

The Northeastern Recreation Research meeting seeks to foster quality information exchange between recreation and travel resource managers and researchers throughout the Northeast. The forum provides opportunities for managers from different agencies and states, and from different governmental levels, to discuss current issues and problems in the field. Students and all those interested in continuing education in recreation and travel resource management are particularly welcome.

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PROCEEDINGS of the 1993 NORTHEASTERN RECREATION RESEARCH SYMPOSIUM

April 18-20, 1993
State Parks Management and Research Institute
Saratoga Spa State Park
Saratoga Springs, New York

Compiled and Edited by:

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The Conscious Experience of Recreation. Tom More, USDA Forest Service; James Averill, University of Massachusetts.

ECONOMIC DEVELOPMENT ASPECTS OF TRAVEL AND TOURISM

Whitewater Rafting as a Tool for Economic Development. Sharon Hurt, West Virginia University.

GREENWAYS

LIVING ADJACENT TO RAIL-TRAILS: CHANGES IN LANDOWNERS' EXPERIENCES AND ATTITUDES

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This study examined the issue of how landowners' experiences with and attitudes toward adjacent rail-trails change over time. Specifically, it examined how 349 adjacent landowners' experiences with 17 trail-related problems changed as a result of trail development. The data were gathered in 1991 along three rail-trails in Florida, Iowa, and California. The results supported the notion that landowners find rail-trails to be better neighbors than they originally expected them to be.

Introduction

Rail-trails are multiple use public recreation trails built on the rights-of-way of unused railroad corridors. They are one category of greenway that has been growing in popularity and importance in the years following the President's Commission on Americans Outdoors recommendation that communities establish greenways of public and private lands and waters to provide people with access to open space close to their homes (President's Commission on Americans Outdoors, 1987).

Rail-trails are typically flat, straight, hard-surfaced and managed to accommodate a variety of uses, particularly bicycling, walking, and running. Some have suggested that rail-trails might form the backbone of a national network of greenways since railroads, in their heyday, connected nearly every town and city in the United States and are currently being abandoned at a rapid rate (Burwell, 1990). By mid-1992 there were 450 rail-trails in existence in 42 states totaling 4,925 miles. They had an average length of eleven miles and ranged from less than a mile to two hundred miles (Rails-to-Trails Conservancy, 1992). There are currently numerous efforts underway to establish additional rail-trails across the country.

Many adjacent property owners do not share the enthusiasm for converting rails to trails that is often expressed by public recreation agencies and trail enthusiasts. Such landowners often fear trails will cause problems for them personally, such as loss of privacy, crime, and reduced property values. Some feel that ownership of the unused corridors adjacent to their properties should revert to them rather than being "taken" for public use. These "not in my backyard" sentiments and property ownership issues have caused many rail-trail proposals to be abandoned.

In response to concerns that the development of a trail may cause problems for private property owners living immediately adjacent to it, trail advocates are quick to point out that they expect problems to be minor and certainly less bothersome than an active or abandoned rail-road railroad line. Active lines, they argue, are loud, dirty and dangerous. Abandoned rail-road corridors are generally unpatrolled and can become attractive nuisances where motorcycles, litter, vagrancy, and weeds and brush can become serious problems. They argue that developing a rail-trail on these sites can be a vast improvement. Maintenance and patrols by trail authorities and regular use by responsible trail users should alleviate the problems associated with living adjacent to active or unused rail-road lines.

Although there is some logic to this line of reasoning, few studies have looked at changes in landowner attitudes and experiences with rail-trails over time and even fewer have compared landowner experiences and attitudes prior to trail development with those after the trails have been established. Are fears of increased problems justified? Do such trails make bad neighbors? How do these landowners feel about the trails after they are in place? Do landowners who move adjacent to railroad rights-of-way after they have been converted to trails feel more positive about them than do the original owners who had the trails "forced on them?" Reliable information of this kind could prove valuable to recreation and land use planners as they contemplate proposing and developing recreation resources near private property. This study set out to explore these issues by answering three specific questions: Do problems increase or decrease for adjacent landowners when rail-road rights-of-way are converted to multi-use recreation trails. Do the attitudes and experiences of landowners who move adjacent to the trails after the trails are in place differ from those of landowners who lived adjacent to the railroad rights-of-way prior to their conversion to trails? And finally, do landowner attitudes and experiences differ along different trails?

Related Literature

The users and use of rail-trails have recently begun to receive research attention (Furuseth & Altman, 1991 and 1990; Gobster, 1990; and Schwecke, Sprehn & Hamilton, 1990). However, few studies have examined the attitudes and experiences of owners of property adjacent to these trails. The published findings indicate that there seem to be some negative aspects to living near these greenways, but they are not as serious as many landowners anticipate they will be. For example, in a study of two Minnesota rail-trails, landowner concerns prior to trail development were found to be greater than the problems actually experienced after the trails were established. Although the majority of landowners had not experienced problems with the trails, 25% to 33% reported that loss of privacy, trespass, litter, and access to their properties were of "some concern." New residents rated the trails as more desirable than continuing owners (87% to 63%). While no new owners considered the trails to be an undesirable feature, 23% of the continuing owners considered the trails to be undesirable (Mazour, 1988). Similarly, the Minnesota Department of Natural Resources (1980) conducted surveys of landowner attitudes along two proposed rail-trails and compared them to landowners' attitudes and experiences along two existing trails. They found that landowners along the existing trails were more positive and had experienced fewer problems than the landowners along the proposed trails were anticipating.

In a study of the Burke-Gilman Trail in Seattle (City of Seattle, 1987) no one surveyed felt current conditions were worse than prior to the trail being opened. New owners who bought their homes after the trail was opened were more likely to view the trail as a positive factor that increased the value of their home. A study of the Missouri State River Trail (Kaylen, et al., In press) found that landowners along the trail tended to have exaggerated fears of trail-related problems prior to the trail opening. The study examined the attitudes of 170 adjacent landowners along two pilot sections (9 and 27 miles long) about a year after the trails had been established. Before the trail opened, privacy, trespass and liability were the issues generating the most concern. These were still the issues generating the most concern after one year. However, concern with them as well as each of nine other issues investigated diminished once the trail had been established.

The effects of the suburban Lafayette/Moraga Trail near San Francisco on property owners adjacent to it were examined as part of a 1978 study (East Bay Regional Parks District, 1978). At that time the trail was four and one-half miles in length and adjacent to 219 private homes. Surveys asked owners to recall their initial reaction to the trail and report their current experiences and attitudes. Initially 66% of adjacent owners thought the idea of the trail was either "excellent" or "pretty good". At the time of the study (after the trail had been opened for about two years), 40% of those who had lived there prior to the trail opening reported that it was "better than they had expected" it to be and 53% felt it was "about what I expected." When asked about how the level of problems had changed as a result of the opening of the trail, 51% said that they had fewer problems with the trail than before there was a trail and another 31% reported that there were about the same number of problems as before. Of those who moved next to the trail after the trail opened, 41% said "I liked the idea of living next to the trail" and another 56% reported that "the presence of the trail did not affect my decision" to move there. The most commonly reported problems were found to be trespass (10.8%) and motor vehicle use of the trail (8.1%). However, over 60% percent reported having "not experienced the slightest problem" on account of the trail.

Methods

The data used in this study were gathered during the winter of 1990-91 from landowners living along three rail-trails. The trails were purposively selected in order to be diverse in terms of length, region of the country, setting through which the trail passed, and type of managing agency. The trails selected were the Heritage Trail near Dubuque , Iowa; the St. Marks Trail, near Tallahassee, Florida; and the Lafayette/Moraga Trail about 25 miles east of San Francisco.

The Heritage Trail, established in 1982, runs twenty-six miles due west from the outskirts of Dubuque. It is surfaced in crushed limestone and travels through extremely rural surroundings for nearly all of its length. The eastern two-thirds of the trail travels through a wooded river valley before emerging into open farmland for the remaining distance. Over 90% of the landowners along the Heritage Trail farm their properties. They also own significantly larger parcels than do the owners along the other two trails at an average of 149 acres.

The St. Marks Trail begins at the southern edge of Tallahassee and runs sixteen miles due south to the small town of St. Marks about five miles from the Gulf of Mexico. The trail is paved with asphalt and runs through a mix of settings including small towns, areas where home development is increasing, and long sections of undeveloped timber company land and national forest. All non-motorized uses are permitted including horseback riding which generally occurs on a separate narrow path near the pavement. It was officially dedicated in 1988, making it the youngest of the three study trails. Average property size is 9 acres.

The Lafayette/Moraga Trail, opened in 1976, is the oldest, shortest and most suburban of the study trails. It is 7.6 miles long and connects two cities that are about 40 minutes by car east of San Francisco. It passes through heavily developed, often affluent suburban areas for most of its length, crossing numerous roads and residential streets. Large sections are situated between the backyards of literally hundreds of private, single-family homes with an average lot size of .5 acres. All non-motorized uses are permitted including horseback riding. Bicycling and walking are the two most popular uses on each trail. However, the Lafayette/Moraga Trail is far more frequently used with an estimated 400,000 annual visits, compared to 135,000 for the Heritage and 170,000 for the St. Marks in spite of their greater lengths.

All residential property owners living immediately adjacent to the three trails were identified using property tax records and trail managers' records. All 79 adjacent landowners were selected along the Heritage Trail, while 210 (78%) and 250 (63%) adjacent owners were systematically selected along the St. Marks and Lafayette/Moraga Trails, respectively. An eight-page, self-administered, mail questionnaire was sent to each household in the sample along with a postcard reminder and two follow-up mailings to nonrespondents as necessary. Response rates varied from a high of 71% on the Lafayette/Moraga Trail to a low of 59% on the St. Marks Trail. Sixty-eight percent of those contacted on the Heritage Trail responded for an overall response rate of 66%. For a more detailed discussion of methods and descriptive results see Moore, Graefe, Gitelson & Porter (1992).

The first objective of this study was to determine what changes in problems had occurred for adjacent landowners since the development of the trails. A list of 17 potential problems that might be associated with trails was prepared based on previous research (Mazour, 1988; East Bay Regional Park District, 1978) and discussions with trail managers. Respondents were asked to report changes by answering the following question, "This trail was created on the right-of-way (R.O.W.) of an abandoned railroad line. *Compared to before the trail was opened*, how has each of the following changed?" The seventeen problems were arranged in a matrix form and respondents were asked to indicate on a seven-point scale how their experience with each problem had changed as a result of the opening of the trail ("1" for "much less of a problem now" to "7" for "much more of a problem now"). This question was only asked of those owners who had also lived next to the trails prior to trail development. These owners were also asked, "Overall, would you say living near the trail is better or worse than living near the right-of-way before it was converted into a trail?"

The second objective was to determine if there were differences in attitudes and experiences of landowners who moved adjacent to the trails after the trails were in place (new owners) and those who lived adjacent to the rail-road rights-of-way prior to their conversion to trails ("continuing owners"). Responses for these groups were compared for the following questions:

1. Overall, how satisfied are you with having the trail as a neighbor?
2. How do you feel the trail has affected the quality of your neighborhood?
3. Compare your initial reaction to the idea of living near the trail to how you feel about living near the trail today. Would you say living near the trail is better or worse than you expected it to be?

Each of these questions were measured using a seven-point scale with "1" being the most negative and "7" the most positive. The third objective was to examine any possible differences among the three trails in terms of landowner attitudes and experiences.

A final dependent variable measured how beneficial the landowners felt the trails were to their communities. This variable was an additive index constructed from the importance ratings landowners reported for the following nine potential benefits: preserving undeveloped open space, aesthetic beauty, community pride, tourism and business development, traffic reduction/transportation alternatives, health and fitness, access for disabled persons, public recreation opportunities, and public education about nature/environment. Importance ratings were obtained for each, using the following question, "Here is a list of broader benefits the trail might have *for its surrounding community*. Please indicate the number that best indicates how important you feel the trail is in providing *each* benefit listed." A 7-point scale was employed where 1 indicated "not at all important" and 7 indicated "extremely important." One-way analyses of variance were used to test for significant differences among the three trails in the attitudes and experiences of landowners. T-tests were used to examine differences between continuing and new owners.

Results

Table 1 presents a descriptive summary of the adjacent landowners along each trail. Owners along the Heritage Trail owned larger properties, had owned them longer, were more likely to have their properties severed by the trail, and were far more likely to have been engaged in farming than the owners along the other two trails. These results are consistent with the fact that the Heritage Trail travels through much more rural countryside than its two counterparts.

Table 1. Descriptive summary of adjacent landowners and their property.

	Heritage	St. Marks	Lafayette/Moraga	Differences
% Female (n=341)	49%	63%	42%	x^2=13.2 ***
Respondent's Age (n=333)	51	54	52	F=1.0
Acres Owned (n=338)	149	9	0.5	F=211.9 ***
Years Owned (n=335)	21	19	16	F=4.7 *
% With Trail Severing Their Property (n=341)	38%	4%	0%	x^2=101.7 ***
% Engaged in Farming (n=352)	81%	2%	0%	x^2= 254.8 ***
Percent of Households That Used Trail in Last Year(n=307)	89%	82%	99%	x^2=26.8 ***

* p<.05; ** p<.01; *** p<.001

Overall, landowners along all three trails reported they experienced fewer problems after the trail had been developed than they had with the unused railroad right-of-ways prior to trail development. Table 2 presents the percent of adjacent landowners who reported that the levels of various problems had either decreased or increased since the opening of the trail. On the 7-point scale used, values of 1, 2, and 3 indicated various levels of improvement as a result of trail development (combined to form "less of a problem" in Table 2) and values of 5, 6, and 7 indicated that the problem had worsened since trail development (combined to form "more of a problem" in Table 2). Those answering 4 to this question were indicating that the level of the problem had not changed (these values can be derived by subtracting the "less of a problem" and "more of a problem" values from 100% for each problem). In the case of every potential problem along each of the three trails, the majority of owners reported that the problem had either lessened or not changed. The problems which landowners were most likely to report had grown worse were "loss of privacy" along the Heritage Trail (38%), "illegal motor vehicle use" along the St. Marks Trail (24%), and "noise from the trail" along the Lafayette/Moraga Trail (36%).

Table 3 summarizes these findings regarding how experiences with the various problems changed since the development of the trails by presenting the mean responses for each problem. In the case of every potential problem along all three trails, the average responses indicated that the adjacent owners considered the trails an improvement over the unused rail corridors. The average responses ranged from a low of 2.5 for "lack of trail maintenance" on the Heritage Trail (indicating the greatest improvement accompanying trail development) to 3.9 for "noise from the trail" along the Lafayette/Moraga Trail (indicating the least improvement). The only significant difference across the three trails occurred for "illegal motor vehicle use" where the problem had decreased significantly more along the Lafayette/Moraga trail than along the other two. A second problem, "dog manure on/near property," decreased much less dramatically along the Lafayette/Moraga Trail than along the other two, although not quite reaching significance (p=.07).

Landowners who owned their properties prior to trail development were asked directly how the trail compared to the railroad it replaced. They were asked, "Overall, would you say living near the trail is better or worse than living near the right-of-way before it was converted into a trail?" which was coded on a 7-point scale where 1 represented "much worse than before" and 7 "much better than before." The mean responses of 4.5, 5.3, and 5.5 on the Heritage, St. Marks, and Lafayette/Moraga Trails, respectively indicated that, overall, the trail was considered an improvement over the railroad right-of-way. The Heritage owners were significantly less positive (.05 level) than either the St. Marks or Lafayette/Moraga owners.

The next analyses compared continuing owners (those who purchased their properties prior to trail development and still live there) to those who purchased their homes after the trails had been established. Over half the owners along the Lafayette/Moraga Trail were new owners while less than a quarter of those along the other two trails had purchased their properties after the trails had been developed (Table 4). This difference was statistically significant at the .001 level. This was due primarily to the fact that the Lafayette/Moraga Trail was considerably older than the other two and more turnover in property had resulted over the years.

Some differences were found between the new and continuing landowners' feelings towards the trails. In most instances, the new landowners were more positive about the trails than were the continuing owners. However, the differences were not always consistent among the three trails and few were significant (Table 5). The majority of adjacent owners reported being satisfied or very satisfied with having the trails as neighbors. Along the St. Marks and Lafayette/Moraga Trails, those who purchased their properties after the trails were in place were more satisfied than those owners who lived there before the trails were developed. This difference was only significant along the Lafayette/Moraga Trail and, in fact, the continuing owners were slightly more satisfied than the new owners along the Heritage Trail. The new owners along all three trails were most likely to feel the trails had improved the qualities of their neighborhoods.

Although many landowners were opposed to the idea of the trail initially, over 66% reported that the trail had turned out to be better or much better than they had expected it to be. On the Heritage and St. Marks Trails the new owners held this view more strongly than the continuing owners (significantly so on the St. Marks). However, on the Lafayette/Moraga Trail the continuing owners were significantly more pleasantly surprised than the new owners. On all three trails, the new owners rated the trails as being more beneficial to their communities than did the continuing owners. This difference was significant only along the St. Marks Trail, however.

Table 2. Percentage of adjacent owners reporting changes in the levels of various problems since the opening of the trail.

	Heritage (n=34)		St. Marks (n=79)		Lafayette/Moraga (n=81)	
Problem	Less of a Problem	More of a Problem	Less of a Problem	More of a Problem	Less of a Problem	More of a Problem
Cars parked on/near property	36%[a]	25%[b]	38%	11%	33%	17%
Dog manure on/near property	44	0	43	10	29	15
Noise from trail	32	24	37	21	25	36
Loss of privacy	38	38	40	23	25	25
Litter on/near property	44	18	39	19	39	10
Unleashed and roaming pets	47	19	40	14	27	16
Discourteous/rude users	52	9	44	6	35	13
Illegal motor vehicle use	45	32	36	24	54	5
Trespassing	43	19	39	13	34	5
Loitering on/near property	56	21	33	18	45	15
Animals harassed	48	6	41	9	37	4
Vandalism	47	9	47	5	40	6
Drainage problems	41	6	39	9	29	9
Fruit, vegetables, crops picked or damaged	44	9	45	9	29	10
Users ask to use phone, bathroom, etc.	45	6	43	7	35	4
Lack of trail maintenance	63	9	57	9	45	9
Burglary of property	48	6	45	5	32	4

a Percent responding either 1, 2 or 3 on the 7-point scale. b Percent responding either 5, 6 or 7 on the 7-point scale.

Table 3. Current level of each problem compared to before the trail was opened.[a]

	Heritage (n=34)	St. Marks (n=79)	Lafayette/Moraga (n=81)	
Problem	Average Response	Average Response	Average Response	F For Differences Among Trails
Cars parked on/near property	3.6	3.3	3.5	0.53
Dog manure on/near property	2.9	3.1	3.6	2.59
Noise from trail	3.5	3.5	3.9	1.42
Loss of privacy	3.7	3.5	3.8	0.58
Litter on/near property	3.3	3.3	3.3	0.03
Unleashed and roaming pets	3.1	3.3	3.7	1.96
Discourteous/rude users	2.9	3.0	3.3	1.24
Illegal motor vehicle use	3.5	3.5	2.7	4.81 ***
Trespassing	3.5	3.2	3.2	0.36
Loitering on/near property	3.3	3.5	3.1	1.17
Animals harassed	3.0	3.1	3.1	0.14
Vandalism	3.0	3.0	3.1	0.08
Drainage problems	3.1	3.1	3.4	0.55
Fruit, vegetables, crops picked or damaged	3.0	3.0	3.4	1.56
Users ask to use phone, bathroom, etc.	3.0	3.0	3.1	0.11
Lack of trail maintenance	2.5	2.7	3.1	1.84
Burglary of property	2.8	3.0	3.2	0.95 ns

a Average based on 7-point scale with "1" being "much less of a problem now" to "7" for "much more of a problem now."

Table 4. Breakdown of new and continuing adjacent landowners by trail.

	Heritage	St. Marks	Lafayette/ Moraga	Combined
New Owners	13 (24%)	15 (13%)	90 (52%)	118 (34%)
Continuing Owners	41 (76%)	105 (87%)	84 (48%)	230 (66%)
Totals	54 (100%)	120 (100%)	174 (100%)	348 (100%)

x^2=51.5; p=0.00

Table 5. Trail-related attitudes of continuing property owners compared to new property owners.

	Heritage		St. Marks		Lafayette/Moraga		Combined	
	New Owners(n)	Continuing Owners(n)	New Owners(n)	Continuing Owners(n)	New Owners(n)	Continuing Owners(n)	New Owners(n)	Continuing Owners(n)
Satisfaction With Trail[a]	4.3 (13)	4.4 (40)	5.9 (14)	5.0 100)	6.0 (90)	5.4 (83)*	5.8 (117)	5.1 (223)***
Trail's Effect On Neighborhood[b]	5.0 (12)	4.5 (37)	5.8 (15)	5.1 (94)	5.6 (90)	5.4 (82)	5.5 (117)	5.1 (213)**
Trail Better Than Expected[c]?	5.4 (12)	5.2 (39)	6.1 (13)	5.2 (97)*	5.1 (90)	5.6 (82)**	5.2 (115)	5.3 (218)
How Beneficial Is Trail?[d]	4.9 (12)	4.4 (27)	5.4 (9)	4.3 (74)**	5.0 (87)	4.7 (70)	5.0 (108)	4.5 (171)**

a Overall, how satisfied are you with having the trail as a neighbor? (7-point scale with 1 "very unsatisfied" and 7 "very satisfied").
b How do you feel the trail has affected the qquality of your neighborhood? (7-point scale with 1 "worsened quality of neighborhood" and 7 "improved quality of neighborhood").
c Compare your initial reaction to the idea of living near the trail to how you feel about living near the trail today. Would you say living near the trail is better or worse than you expected it to be? (7-point scale with 1 "much worse than I expected" and 7 "much better than I expected").
d Index of importance of trail in providing 9 community benefits. (7-point scale with 1 "not at all important" and 7 "extremely important").

Discussion

It is not surprising that the characteristics of the landowners of the three trails differed in many respects since the sample trails were selected to be as different as possible. The characteristics of landowners and their properties along rail-trails are closely related to the type of environment through which the trail happens to pass. The findings were consistent with the fact that the Heritage Trail is in a very rural farming environment while the Lafayette/Moraga Trail is in a densely populated suburban area.

The results supported the notion that adjacent landowners find rail-trails to be better neighbors than they initially expected them to be and better than living next to an unused railroad right-of-way. The results also supported the contention that such trails turn out to cause fewer problems than landowners initially fear they might. Both of these findings are consistent with the results of previous research. It is important to note that these results were quite consistent for three very different trails. The change in only one of the 17 problems (illegal motor vehicle use) was significantly different among the three trails.

Regardless of whether the landowners had moved in prior to or after the trails had been developed, they were positive about having the trails as neighbors overall. This held true for their overall satisfaction, how they felt the trails affected their neighborhoods, whether the trails were better or worse than expected, and how beneficial they felt the trails were to the communities. However, several differences were found between the new and continuing owners. In most cases, those who purchased their properties knowing that they would be moving in next to an existing trail (new owners) were more positive than those who already lived there when the trails were developed (continuing owners). This may be due to the fact that the new owners knowingly chose to live adjacent to the trails, whereas many continuing owners were initially opposed to the idea of living near a trail and had little choice in whether the trail would be built there.

Management Implications

Trail planners and managers, as well as landowners, should be encouraged by the results of this study. It supported and extended the previous evidence that initial landowner concerns about rail-trails may be exaggerated. It should be particularly encouraging that these findings were obtained using rigorous methods in three very different trail settings. This should give proponents more confidence in approaching neighbors along proposed trails and interacting with those along existing ones. Based on these results, planners and managers should consider putting these potential neighbors in touch with adjacent landowners along existing trails to talk about their actual trail experiences. This could help them develop a more realistic (and probably more positive) outlook regarding the proposed trail. They might do this through field trips to

existing trails, bringing neighbors of existing trails to meetings of affected landowners, or perhaps videotaping testimonials of experienced trail neighbors. However, planners and managers must keep in mind that even though problems decreased or did not change for most landowners in this study when the trails were developed, some problems did occur. Managers must be diligent in maintaining ongoing communications with trail neighbors to monitor such problems and address them.

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MANAGEMENT OPTIONS REGARDING THE PRESENCE OF IXODES SCAPULARIS, THE DEER TICK, ON THE APPALACHIAN TRAIL

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This paper reviews the ecology and biology of *Ixodes scapularis* (Acari: Ixodidae), the deer tick, and the ecology of the Appalachian Trail (AT) as suitable habitat for *I. scapularis*. Physical and ecological characteristics of the AT were recorded and surveys were conducted for *I. scapularis* on a 920 km segment of the AT during 1991. Suggestions for management of the Trail have been offered to the National Park Service and Appalachian Trail Conference in regard to the presence of *I. scapularis* on the AT.

Ixodes scapularis

The deer tick, *Ixodes scapularis* (Spielman et al. 1979), is the vector for the causative agent of Lyme disease, *Borrelia burgdorferi* (Johnson et al. 1984). *Ixodes scapularis* is a three-host tick with a two-year life cycle. During its three active stages (nymph, larva, adult), the tick alternates between host-seeking during favorable environmental conditions, and remaining in the leaf litter when unfavorable conditions occur (Lees & Milne 1951). Animal-trapping studies have shown that *I. scapularis* utilizes a variety of hosts (Anderson 1988) and that there is a tendency for each life stage to prefer a sequentially larger host for blood meals. Preferred hosts for *I. scapularis* include the white-footed mouse, *Peromyscus leucopus*, and the white-tailed deer, *Odocoilus virginianus* (Piesman & Spielman 1979). The deer tick will utilize other mammalian and avian hosts. Humans are most often parasitized by the adult or nymphal stages. When favorable conditions occur, the deer tick leaves the duff to host-seek by elevating itself on fallen leaves or on a blade or stem of vegetation. The tick waits for host signals such as the detection of shadows, carbon dioxide, body temperature and odor. When stimuli is received, the tick waves its first pair of legs to make contact with the host. Sustained body heat and host odor within 1 - 2 m from a tick may cause the tick to crawl actively towards the source (Balashov 1972). Desiccation is the main cause of mortality among ticks. If conditions become unfavorable for host-seeking, such as increasing mid-day heat, a tick will turn to the duff where a favorable microclimate exists. Ticks unsuccessful in obtaining a blood meal prior to the onset of cold weather will overwinter. Engorged ticks will either molt immediately and overwinter or may overwinter in an engorged condition. *Ixodes scapularis* mate while on a host and the male drops off to lay eggs in the leaf litter. Eggs deposited in the fall hatch during the spring. Eggs deposited in the spring hatch in the late summer (Yuval & Spielman 1990).

There is no data available for *I. scapularis* populations on the AT itself. However, *I. scapularis* is considered to populate many counties crossed by the AT throughout the study area (CDC 1992) and Lyme disease is endemic to each of the New York counties crossed by the AT: Orange, Rockland, Westchester, Putnam and Dutchess (personal communication, New York State Department of Health).

Several studies have focused on the habitat preference of *I. scapularis*. Siegel et al. (1991) studied the presence of *I. scapularis* in three habitat types within Illinois: wooded, meadow, and mixed. Larvae and nymphs were most prevalent in wooded areas. Nymphs, however, were also found in meadows. Adults were found within each habitat. Carroll et al. (1992) compared *I. scapularis* collections from maintained, residential lawns bordering other lawns versus lawns versus wooded tracts. More *I. scapularis* were collected from lawns bordering woods than from lawns bordering lawns. Additionally, there was a decline in relative abundance of ticks at increasing distances away from woods. Ginsberg & Ewing (1989) collected host-seeking ticks on and off trails on Fire Island, NY and designated habitats as "grass-shrub" with vegetation less than 1 m, "high shrub thickets" with vegetation ≥ 1 m, and "woods", sites with an enclosed tree canopy. Adult *I. scapularis* were more common on trails then in woods and were most often collected from high shrub thickets during the summer months but were collected from leaf litter in wooded habitats more often than from more open habitats. Overall, tick distribution was observed to be more concentrated on trails than off.

Methods for the control of *I. scapularis* are primarily experimental, however, three directives have been used in general for tick control: chemicals directed at the vegetation or hosts utilized by ticks, host eradication, and habitat modification. There are few practical or reliable biological control options for ticks.

The Appalachian Trail

The Appalachian Trail (AT) is a continuously marked footpath that extends 3,360 km through 14 eastern states. The southern terminus is on Springer Mountain, Georgia and the northern terminus is on Mount Katahdin, Maine. This popular recreational trail receives the most use during the spring, summer and fall months. The AT is best known for the hundreds of hikers who attempt to walk the entire length of the Trail within one calendar year, a feat requiring patience, discipline and persistence.

The AT is managed by the Appalachian Trail Conference (ATC) and the National Park Service (NPS). In 1979, the ATC Board of Managers adopted standards for trail design and maintenance to reflect the purposes of the AT: to route a passable and continuous footpath through protected lands, to promote public use and enjoyment of the footpath, and to manage the AT so that minimal disturbance occurs to the natural resources utilized by the footpath (Birchard & Proudman 1981).

To maintain the AT as a passable route, clearance standards were approved as a guide for trail maintainers. The ATC recommends that the vegetation of the treadway be cut back to allow a footpath measuring four feet (1.2 m) wide and eight feet (2.4 m) high to allow a user with a full backpack to pass unhindered. These standards are not applied when the AT traverses fragile ecosystems or when the terrain does not allow for the full width. Guidelines recommend that a canopy remain over the trail to slow the growth of path vegetation and that the trail be cleared twice per year during the spring and late fall. Vegetation should be cut back as close to the ground as possible but plants should not be uprooted (Birchard & Proudman 1981). Most maintenance of the AT is provided by volunteer members of AT sectional clubs. These individuals

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keep the AT passable by maintaining and relocating Trail segments, maintaining shelter areas and designated campsites, and monitoring the AT for signs of misuse. Maintenance of the footpath is time-consuming and labor intensive since most work must be done by hand. This is mostly done by volunteers assigned specific trail sections for maintenance, though some clubs schedule group work trips and maintenance hikes.

Methods

Within this study, the focus is on four components of the AT: central path, treadway, ecotone and corridor. The trail may contain a well-defined central path which is the area of the trail that receives the most direct foot traffic and appears to be the most impacted. The treadway is a wider, passable area that may be most apparent following trail maintenance. However, the treadway may exist alone as a cleared width within which no preferred path is discernible. A surveyed trail segment that contains both a central path and treadway is referred to as a combination site. The ecotone is the boundary between the treadway and the corridor. The AT corridor is the ecological community through which the trail passes.

This study was conducted along the mid-Atlantic section of the AT from the Massachusetts/Vermont border to the Maryland/ West Virginia border, a segment spanning 920 km. The research was divided into four surveying trips conducted between May and October, 1991. The timing of each trip coincided with periods of host-seeking activity for larval, nymphal and adult deer ticks. The initial survey, conducted between May 06 and May 21, focused on the New York segment of the AT. This segment was hiked north from the NJ/NY border to the NY/CT border and then a return hike south to the NJ/NY border. The second survey was conducted between May 25 to July 13 over the entire 920 km of the study area. The third survey was conducted from the MA/CT border south to the NJ/PA border between August 29 to September 16. The final survey was a repeat of NY during October 4 to 11.

Each surveying trip included site evaluations consisting of two parts: tick collections and the recording of physical and ecological characteristics for each site. Drag-sampling (flagging) was the method used to collect host-seeking ticks. An 80 cm by 120 cm piece of unbleached muslin cloth attached to a dowel rod handle and weighted by a 30 cm length of dowel was swept across vegetation and leaf litter on and along the trail. At each 4.8 km interval, a 30.5 m stretch of trail and its edge (ecotone) was flagged. Each trail component, i.e., central path, treadway and ecotone, was flagged separately at each site. The ecotone along both sides of the trail was flagged separately and followed trail sampling. The cloth was examined for attached ticks after sampling each component. Ticks were placed in vials labeled according to site identifi-cation number and trail location (central path, treadway, ecotone) and were returned to SUNY CESF for identification to species and life stage. A site was designated as positive if one or more deer ticks were found. Immediately after tick sampling, ecological and physical characteristics of the 30.5 m AT segment and the corridor were recorded. These included elevation, air temperature, relative humidity, vegetation types and heights and trail widths. Vegetation types were classified as either grass, herbs (wildflowers), shrubs or seedlings. Ecotone vegetation could be described as one type dominating (i.e., shrubs) or a combination (i.e., herbs and seedlings) of up to four types.

The data set contained a total of 17 numeric and coded variables derived from the site evaluation checklist. Statistical analysis of physical and ecological data was conducted using Version 6 of the Statistical Analysis System (SAS Institute 1982) at Syracuse University. Student t-Tests were used to test for differences between the means of numeric variables (air temperature, relative humidity, elevation, width of central path, width of the treadway) of positive and negative sites. Discriminant analysis was used to classify the data into two equally weighted site classes, sites positive for ticks and sites negative for ticks (Carey 1979, Schaalje & Wilkinson 1985).

Results

A total of 489 site surveys were conducted within 1,827 km (1,142 mi) of AT over an 88 day period. An average of 5 site evaluations were conducted each day. The 21 sites positive for *I. scapularis* were within a 331 km segment of the AT from Salisbury, Connecticut to Delaware Water Gap, Pennsylvania. A total of 46 *I. scapularis* were collected: 67% (n=31) larvae, 11% (n=5) nymphs and 22% (n=10) adults. One to six *I. scapularis* were collected at each positive site. Larvae were collected in early May, early June and early to mid-September. Nymphal ticks were collected in early June and during September. Adults were collected in mid-May and early October.

Trail widths less than 80 cm were designated as central paths. Widths up to 80 cm allow contact between the trail user and the ecotone where ticks may be host-seeking. Trail widths greater than or equal to 80 cm were designated as treadway sites. An Average widths of trail components surveyed within the study area were: central paths, 54 cm (±10) and treadways, 146 cm (±49). The central path and treadway at combination sites averaged 47 cm (±9) and 141 (±41) , respectively. Sixty-one percent (298) of the sites surveyed contained only a central path. Treadway sites comprised 105 of the sites. There were 95 combination sites. The dominant cover of central paths was leaf litter or bare soil-leaf litter, occurring 43% of the time. The dominant cover of treadways was leaf litter, bare soil-leaf litter and grass-rocks. The dominant vegetation of the ecotone was a mix of vegetation types (73%). Monocultures dominated the ecotone infrequently (20%) and ecotones relatively void of vegetation occurred at 7% of the sites.

Most *I. scapularis* were collected from the ecotone (72%). The dominant condition of the ecotone of positive sites was mixed vegetation at 19 sites (90%). An ecotone composed of mixed vegetation, i.e., grass-herbs-shrubs or other combination of the vegetation types designated in this study, may provide suitable habitat for *I. scapularis*. Ecotones dominated by one vegetation type, i.e., mostly shrubs or mostly herbs, or are sparsely vegetated appear to be less favorable for *I. scapularis*. The central path rarely served as a collecting origin for ticks (8%).

There were no significant differences between mean relative humidity and temperature in positive and negative sites. Elevations of all sites surveyed ranged from 300' to 3,300' with a mean elevation of 1,093'. The lowest and highest elevation at which *I. scapularis* was collected was 400' and 1,050', respectively. The mean elevation for all positive sites was 693' (±182'). The mean elevation of positive sites was significantly lower than the mean elevation of negative sites.

Discriminant analyses were performed on all sites and then on sites below the mean elevation, the latter to account for any potential contribution of lower altitude sites for *I. scapularis* habitat. Discriminant analysis using the variables that describe the vegetation type and height of the ecotone produced the highest percentage of properly classified sites (positive sites were designated as such) and were considered the most reliable indicators of a site's potential to support *I. scapularis*. To determine the number of sites having ecotone characteristics similar to positive sites, a discriminant analysis using the ecotone variables was performed. This resulted in 340 negative sites reclassified as positive sites. This suggests that these sites, though negative at the time of surveillance, contain suitable characteristics that may allow them to support *I. scapularis*. Since *I. scapularis* was collected at lower elevations, this data set was refined by selecting sites below the mean elevation (1093'). This resulted in 187 negative sites reclassified as positive sites. Of these, 84% occurred in Connecticut, New York and New Jersey. These sites were determined to provide an ideal questing habitat for *I. scapularis* because they contained an ecotone of mixed vegetation and were at elevations below 1,093'. A majority of these sites had a path width not exceeding 79 cm which allows contact between the trail user and the ecotone.

Appalachian Trail User Risk Assessment

The 163 km (102 mi) trail segment from Salisbury, CT to the AT crossing of the Palisades Interstate Parkway in New York from which most *I. scapularis* were collected is considered a high-risk area. The segments of the AT extending north to the MA/CT border and south to the NJ/PA border (170 km, 106 mi) are considered to have a moderate risk for deer ticks based on the ecology of the AT and the current distribution of *I. scapularis*. Considering the annual range expansion of *I. scapularis* and percentage of sites in this study with favorable habitat for *I. scapularis*, the AT in MA, PA and MD may eventually be subject to invasion by *I. scapularis*.

The activities of AT users may influence their risk of contact with *I. scapularis*. This study recognizes three groups of AT users: Long-distance (LD) hikers, short-term hikers and AT maintainers. The three groups have trail habits that influence their likelihood of encountering a tick questing on the ecotone. Long distance hikers gain experience in navigating around roots, rocks and other obstacles inherent to forest paths. These hikers develop a way of navigating along the trail to minimize contact with obstacles while on lengthy walks. This protects the legs and upper body while maintaining continuous motion. The ecotone serves as an obstacle because, by design, it defines the boundary of the cleared width. When the path is wide, vegetation of the ecotone can be avoided by choosing a central path route. If the Trail is narrow, contact with ecotone vegetation may be inevitable. However, a continuously moving hiker minimizes ecotone contact time which may decrease the success of *I. scapularis* grasping these AT users. Thus, this group has the overall lowest risk of encountering a questing tick. Short-term hikers (day users) plan a shorter distance and shorter length of stay along the AT. Short-term hikers may maintain a more casual pace or engage in activities, such as bird-watching or wildflower identification, which requires stopping and are more likely to have sustained contact with the ecotone or path vegetation.

Trail maintainers are those who keep the AT passable. Trail maintainers may be at greatest risk for contact with *I. scapularis*. Trail maintenance tends to be a slow-moving, stop-and-go procedure and places maintainers in direct and extended contact with trail vegetation.

Added to the risk associated with each hiker group is the risk factor associated with seasonal use of the trail by these groups: spring (March 21 - June 21), summer (June 21 - September 21) and fall (September 21 - December 21). Thus, LD hikers are most likely to be traversing the study area and the 163 km high risk segment during the summer. Whereas, short-term users and maintainers are more likely to have the highest trail use during the spring and fall. Tick risk is associated with the seasonal periodicity of host-seeking nymphal and adult *I. scapularis*, the stages infected with *B. burgdorferi* and responsible for disease transmission. The cumulative risk of each hiker group based on user and tick risk by season is illustrated in Table 1. Based on this risk matrix, trail maintainers are at greater risk for contact with *I. scapularis* and potential exposure to *B. burgdorferi* and period of increased risk for this group occurs during spring and fall. Short-term users also are at risk during spring and fall. Both short-term users and maintainers are considered to have reduced risk of tick contact during the summer. Long distance hikers have low risk during all seasons.

Table 1. Seasonal exposure risk to *Ixodes scapularis* for AT hiker groups.

		Spring				Summer				Fall			
Hiker Group	Hiker Risk[a]		Use Risk[b]		Tick Risk[c]	Total Risk[d]	Use Risk		Tick Risk	Total Risk	Use Risk		Tick Risk	Total Risk
LD	1	x	1	x	3	(3)	2	x	1	(2)	1	x	2	(2)
DH	2	x	2	x	3	(12)	3	x	1	(6)	3	x	2	(12)
TM	3	x	3	x	3	(27)	2	x	1	(6)	3	x	2	(18)

[a]**HIKER RISK**: Habits of trail user.
1 = Low: quick pace along the trail, brief contact with ecotone = Long Distance Hiker (LD)
2 = Medium: meandering, possible contact with ecotone = Day Hiker (DH)
3 = High: prolonged contact with ecotone = Trail Maintainer (TM)

[b]**USE RISK**: Use of trail in spring, summer and fall for hiker groups.
1 = Low Use
2 = Medium Use
3 = High Use

[c]**TICK RISK:** Seasonal activity of host-seeking I. scapularis.
1 = Low: Summer, few nymphs and no adults questing.
2 = Medium: Fall, adults questing.
3 = High: Spring, nymphs and adults questing.

[d]**TOTAL RISK** = Hiker risk x Use risk x Tick risk

Clearance standards suggest that the AT be cut back at least twice a year, ideally in the spring and late fall. However, the risk of maintainers coming into contact with questing *I. scapularis* during this time is greatest. Maintainers or long-distance trail users may have knowledge of *I. scapularis* and the risk of Lyme disease whereas short-term hikers may be unaware of this risk. This study recommends that the NPS/ATC institute, or continue, the following management practices along the 163 km high risk area of the AT and that consideration be given to the expansion of these practices into other areas identified in this study as containing suitable *I. scapularis* habitats.

Management Considerations

Ixodes scapularis utilizes vegetation for questing along trails and edge situations. As a host brushes past the vegetation on and along a path, questing ticks grasp the host. This research has established that *I. scapularis* utilizes the vegetation of the AT ecotone for questing. This is particularly true when the following conditions were met:

1) Corridor dominated by deciduous trees.
2) Elevation of site is <1,093'.
3) Path bordered by an ecotone composed of mixed vegetation types.
4) Path width is <80 cm.

The most effective strategy for the management of *I. scapularis* focuses on the ecotone. Since most *I. scapularis* were collected from the ecotone and because of the encroachment of the ecotone on the path, it is recommended that the NPS/ATC emphasize the four foot width by eight foot high AT clearance standards to reduce hiker contact with the ecotone. The passable width should be maintained by keeping the ecotone and trail vegetation cut back at least twice per hiking season, depending on each segment's ecology. Since risk of contact with infected, host-seeking *I. scapularis* is greatest during spring and late fall, most maintenance should be conducted during late July through August. However, most segments of the AT will require cutting earlier in the season to allow unimpeded passage by AT users. In this event, maintainers should adopt personal precautions when in *I. scapularis* habitat. Habitat modification, as achieved by cutting the ecotone back from the path, reduces tick abundance by reducing tick habitats and harborage areas for smaller mammalian tick hosts. This management suggestion is multi-purposed since it:

1) Decreases the potential for hiker contact with *I. scapularis* thus reducing the transmission of *B. burgdorferi* and development of Lyme disease in AT users.
2) Decreases the availability of small animal hosts for *I. scapularis*.
3) The widened path allows additional light penetration which diminishes suitable habitat for *I. scapularis* on the AT.

Unless void of vegetation, the treadway flora must be cut back, perhaps more frequently than the ecotone, to minimize contact by hikers with ticks questing upon the treadway. Additionally, it is recommended that ATC-sectional clubs post flyers warning AT users that they are entering tick-infested portions of the Trail. Flyers may be posted at road crossings, shelters and information boards and convey a simple warning of the presence of *I. scapularis* or a summary of the tick's biology and ecology. Individuals working or recreating in tick populated areas should take personal precautions to minimize contact with ticks. These include learning to recognize a tick, basic knowledge of general habits of ticks, symptoms of tick-borne diseases and adopting appropriate dress and body checks when venturing into potential tick habitat. Standard procedures are suggested for personal protection against *I. scapularis* and should be followed by AT users. These are, to wear long, light-colored pants tucked into light colored socks and to wear long-sleeved, light-colored shirts. These precautions lessen the chance for a tick to contact the skin while light-colored clothing allow ticks to be seen and removed. For reasons related to ease of movement, heat and pack weight, many long-distance hikers forego wearing long pants when hiking. During mid-summer, some are content to wear and carry only shorts and t-shirts. Hikers concerned with tick contact may wish to modify their attire when walking through areas known to be tick-infested. This risk may be offset by checking their bodies for the presence of ticks or through use of repellents. Based on current study results, warnings should be posted on the 163 km AT segment from the vicinity of the Palisades Parkway crossing, NY to the Salisbury, CT area.

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"VALUING" LINEAR TRAIL DEVELOPMENT: THE CASE OF THE RACCOON RIVER VALLEY TRAIL

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This paper describes the various market and non-market "values" associated with the development of linear recreation trails. The value estimates were collected through a scientific survey (with personal interview and mail questionnaire components) of visitors to the Raccoon River Valley Trail (RRVT) in central Iowa. The research provides substantial justification for the development of linear recreation trails.

Introduction

There is a growing interest in the development of linear recreation trails. Linear trail systems provide direct access to many natural, social, cultural and economic values for people. These values range from the non-monetary values associated with open space and quality of life, to the economic benefits realized from commercial development and increased tourist activity. Despite the many values and benefits associated with linear recreation trail development, only limited empirical data is available on the market and non-market values associated with linear recreation trials. To address these information needs the Dallas County Conservation Commission conducted a study of visitors to the Raccoon River Valley Trail during the summer of 1991.

Study Objectives

The purpose of this research was to collect information that the Dallas and Guthrie County Conservation Boards, state agencies, not-for profit organizations, and local businesses need to justify trail development expenditures, and to support their budget submission through an often unfavorable decision making process. The data collect will also help trail managers plan for the wise use and development of the Raccoon River Valley Trail and the associated, natural, cultural, and economic resources. More specifically, the objectives of this paper were:

- to document the sample of trail users willingness-to-pay for one days' use of the Raccoon River Valley Trail;
- to determine the level of trail user support for various trail users fees and the allocation of fee monies;
- to document the economic impact of trail users on the economy of communities adjacent to the trail; and
- to document the trail users perceptions of the costs and benefits associated with the use and development of linear recreation trails.

Research Setting

The setting for this research is the Raccoon River Valley Trail located in central Iowa. The Raccoon River Valley Trail (RRVT) provides the opportunity for various types of trail-based recreation. Completed during the summer of 1990, the trail is built on a former Chicago Northwestern Railroad right-a-away now owned by Central Iowa Energy Cooperative (CICEO). CICEO made an agreement with the Guthrie and Dallas County Conservation Boards to manage the right-a-way as a recreational trail. The trail was developed with grants and other support from the Iowa Department of Transportation, the Iowa Department of Natural Resources, Central Iowa Power Cooperative, the Iowa Trail Council, and Dallas County Brenton Bank. The trail is paved with 1%-2% grade and stretches 34 miles from Waukee, in Dallas County, Iowa to Yale in Guthrie County, Iowa. The cost of developing the trail was approximately $950,000, and visitation to the trail in 1991 was estimated at 48,096.

Methodology

Data for this study were collected during the summer of 1991. The research design included both a personal interview and mail survey component. The personal interviews were conducted from July 3 to September 3 by uniformed Dallas County Conservation staff members and volunteers. Approximately 950 visitors were contacted as they arrived or departed at six locations on the 35 mile trail. Of those initially contacted, 931 agreed to participate in the personal interview, for an on-site interview response rate of ninety-eight percent. The on-site interviews consisted of 10 questions. On average the interviews were completed in less than 2 minutes. The final question of the on-site survey asked the visitor if they would be willing to participate in a more detailed mail survey regarding the social and economic benefits of the Raccoon River Valley Trail. Over ninety percent of the persons completing the on-site interview agreed to complete the mail survey (n=840).

The mail survey was distributed to all of the persons agreeing to complete the mail survey approximately 3-5 working days after the initial on-site interview. The initial mailing of the survey was sent first class and included a postage paid pre-addressed envelope. After three weeks, those not responding were sent a follow-up post card reminder. Each mailing was addressed to the individual who provided their name and address during the on-site interview. Of the 840 trail users initially agreeing to participate in the mail survey, 648 returned usable questionnaires, for a final response rate of 77 percent. The number of interviews completed at each locations reflect the current patterns of recreation use. Attempts were made to contact trail users across a variety of time and days.

In order to achieve objectives of this research is to document meaningful differences among the sample of trail users according to where they live and their level of experience on the RRVT. It reports the results from difference in mean comparisons (one-way analysis of variance test) across three categories of residence: (1) trail users from an urban population center--Polk County (n=395), trail users from the counties that include the RRVT--Dallas and Guthrie County (n=119), and trail users from all other locations (n=119). This paper also reports the results from difference in mean comparisons (one-way analysis of variance) of three categories of trail users based upon their level of experience with the RRVT: (1) first time RRVT trail users (n=133), infrequent trail users (i.e., has used the trail before, but visit three times a year of less, n=171), and frequent trail users (i.e., visit the trail four times or more a year, n=330).

Profile of Trail Users

Base upon previous surveys, the sample of trail users would appear to be representative of Raccoon river Valley Trail users and of recreation trail users in Iowa, in general (Table 1, next page).

Table 1. Profile of sample of RRVT trail users.

Summary of Demographic Information	
Age	41 years (mean, mode, median)
Gender	Male (63%)
Total family income	$45,000 to $54,999 (15%)
Education	4-year college degree (29%)
Home residence	Des Moines, IA (33%)
Occupation	Professional/Managerial (59%)
Size of party	2 persons (44%)
Transportation to trail	Motor vehicle (83%)
Miles traveled to trail	14 miles (23%)
Summary of Trail Use Information	
Used trail previously	Yes (75%)
Number of visits to RRVT	4-10 times/season (19%)
Miles traveled on trail	25 miles (23%)
Hours spent on trail	3 hours (26%)

(1) Findings: Willingness to Pay

The trail user survey included a measure of willingness-to-pay for a trail-based recreation opportunity on the RRVT. The open-ended format used was straightforward; respondents were asked to write in the maximum amount they would pay of a single days recreation use of the Raccoon River Valley Trail. The results of the willingness to pay question suggest that half (50%) of the sample indicated that the maximum they would have paid for a single days use of the RRVT was 2 dollars or less, while the other half was willing to pay three dollars or more. The current fee for a single day use permit for the trail is 2 dollars. Extrapolating the results from the samples response willingness-to-pay question to the population of trail users, supplies an estimate of $146,762.. This figure represents the value of the recreation opportunities provided by the RRVT for the summer of 1991.

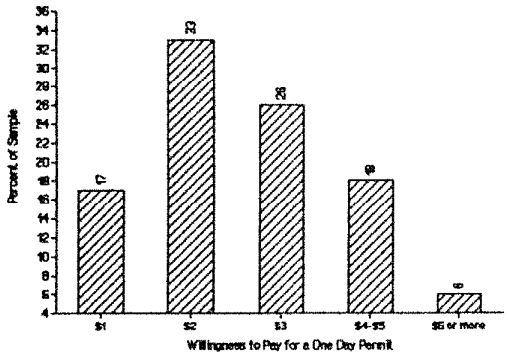

Figure 1. A measure of willingness to pay for a trail-based recreation experience.

There were not any significant differences in the amount the sample of trail users would pay for a permit across the three categories of residential locations or the three level of experience categories.

(2) Findings: Fee Structure

The sample of trail users were asked the extent that they agreed or disagreed with a number of statement related to current fees and the allocation of fee monies. A majority of respondents indicated the that they would be willing to pay increased user fees if the monies were dedicated to trail expansion and habitat protection programs (Table 2).

Table 2. Trail user attitudes towards fee structure and fee allocation process.

Statement	Disagree	Agree
I am willing to pay higher user fees if the money is dedicated to habitat protection programs.	16%	54%
I am willing to pay higher user fees to promote trail expansion.	14%	69%
I would like to make a . contribution to the RRVT foundation	23%	26%
Visiting the RRVT was worth the money I spent to recreate there.	1%	97%
The recreational benefits provided by the RRVT outweigh the fiscal and developmental costs.	1%	90%
I sometimes use the trail without purchasing a use permit.	68%	23%

There were differences in the level of agreement across both residential location and level of experience. For example, respondents from an urban county (Polk) were more likely to support higher fees for habitat protection; respondents from the counties that include the trail (Dallas and Guthrie) were more likely to agree with that the RRVT was worth the money I spent to recreate there; respondents from the urban county (Polk) were more likely to use the trail without purchasing a permit that person from the "all other" residential location category; respondents who were classified as frequent visitors were more likely to support higher fee to support trail expansion programs and to make a contribution to RRVT Foundation; and respondents who were classified as frequent visitors were less use the trail without purchasing a permit than infrequent trail users.

(3) Findings: Economic Impacts of Trail Users On Adjacent Communities

This section reports the results from a set of questions that asked the sample of trail uses to estimate their total expenditures in each of the six adjacent communities across four categories of products or services during their visit to the Raccoon Rover Valley Trail (Figure 2, next page).

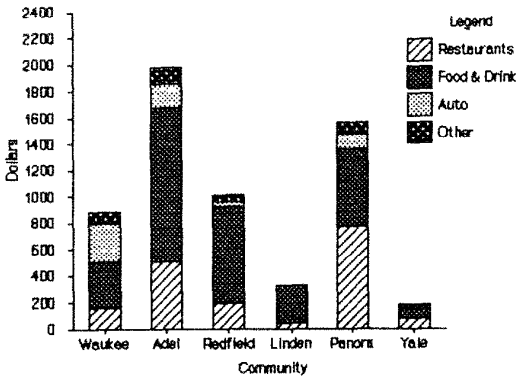

Figure 2. Expenditures in communities adjacent to RRVT for sample of trail users.

The results indicate that the sample of trail users spent the most money in Adel, Iowa. A majority of trail users spent the greatest sum of money in the food and drink category, followed by restaurants, auto services, and the "other" expenses (the other expenses categories include lodging, retail purchases and miscellaneous expenses category. The majority of respondents spent $7-$10 dollars during their visit to the trail (as indicated by the average score when all expenditures are totaled across all communities and all categories of expenditures). Extrapolating the average expenditures from the sample to the population estimates total trail users expenditures in adjacent communities within the $286,272 to $480,960 range for the 1991 trail use season.

There were differences in expenditure across both residential location and level of experience. For example, trail users from all other location spent significantly more money while visiting the RRVT. There were also significant differences across the specific expenditure categories and community categories (i.e., "all other location" spent more money in restaurants than other residential location types, and respondents from Polk county spent more money in Redfield restaurants that respondents from Dallas and Guthrie county). There were not any significant difference in total expenditures across the three level of experience categories. However there were a number of differences across the specific expenditure and location categories. For example, frequent users of the trail were more likely to spend money on food and drink in Waukee than infrequent trail users and first time users; and first time users were more likely to spend money in and Adel and Pandora restaurants than the other categories.

Additional analyses were conducted to see if trail user expenditure varies across access sites (i.e., where the respondents parked their car and entered the RRVT). For example, respondents entering the trail in Adel were more likely to spend money on food and drink in Adel that person entering the trail at Redfield or Pandora; and respondents entering the trail in Redfield were more likely to spend money in Pandora at restaurants that person entering the trail in Waukee and Adel.

(4) Findings: Effect of the RRVT on Adjacent Communities and Resources

The sample of trail users were provided a list of the many issues or topics that may or may not be effected by the operation of the Raccoon River Valley Trail. The trail users were asked if, in their opinion, the RRVT had a "negative", "no effect" or "positive" effect on each of these issues or concerns. The results of to this questionnaire interpreted through an examination of issues or concerns that received the greatest proportion of responses in the negative and positive categories (Table 3).

Table 3. Trail users' evaluation of the effects of RRVT on local resources and communities.

Effects of the RRVT	Percent
Top five NEGATIVE effects	
• Traffic congestion	16%
• Impacts on wildlife	13%
• Increased soil erosion	6%
• Destruction of prairie	6%
• Increased property taxes	5%
Top five POSITIVE effects	
• Increased recreation opportunities	96%
• Improved image to non-residents	96%
• Increased number of visitors to area	96%
• Improved local pride in community	94%
• Improved local economy	94%

There were no significant differences in expenditure across the level of experience category. There were however differences in across the three residential location types. For example, trail users living adjacent to the trail were less likely to identify the positive effect of the trail on local employment rates, the local economy, the quality of life in adjacent communities, wetland preservation, regional trail opportunities and local community pride than "all other" locations. In addition, trail users living adjacent to the trail were less likely to identify the positive effect of the RRVT on property taxes and property values than resident of Polk county.

Summary and Recommendations

This research provides substantial support for the development of linear recreation trails. For example, the measures of willingness-to-pay estimate the value of the opportunities provided by the trail at $146,762. With current levels of use the recreation opportunities provided by the trail would offset the developmental cost of the trail in approximately six years. The results also show considerable support for increased fees if the money is designated for specific programs. Trail users expenditures in local communities was estimated between $286,272 and $480,960 for the summer of 1991. Trail user expenditures represent an important addition to the sagging local economies of many rural communities. The following represents a collection of highlights from the research and the associated recommendations:

Finding:

Considerable support for increased fees if money is dedicated to for specific trail development and resource protection programs.

Recommendation:

Provide the opportunity for trail users to purchase a "habitat protection stamp" or a "trail expansion stamp" to be affixed to their trail permit.

Finding:

A number of trail users associated a reduction in wildlife habitat with the development of the RRVT.

Recommendation:

Develop habitat demonstration projects (i.e., bluebird and barn owl houses) with signage stressing the importance of linear corridors to viable wildlife populations.

Finding:

The communities of Adel and Pandora realized the greatest economic benefits from the development of the RRVT.

Recommendation:

Need to develop signage (and brochures) that inform trail users what amenities are available in the community.

Further research is needed that will help each community identify it's unique role within the RRVT system. The role of each community can be determined through a detailed examination of its internal social and community structure, it's relationships to the RRVT, other natural resources and other communities adjacent to RRVT.

Finding:

Trail users from communities adjacent to the trail are less likely to identify positive effects of the trail on local employment rates economy, and quality of life.

Recommendation:

Need to demonstrate the value of the trail to residents of adjacent communities. This could be accomplished through the joint sponsorship of facilities and program for local residents ad trail users with local governments, community groups and businesses (e.g., picnic shelters, comfort station, special events).

Urban Recreation

CUSTOMER DIVERSITY AND THE FUTURE DEMAND FOR OUTDOOR RECREATION

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Population projections for the U.S. call for reduced growth and increased aging, racial/ethnic diversity, and urban residence. If percent participating by age and racial/ethnic group remains at present levels for the years ahead, cohort-component projection models suggest that, given projected changes in the age and racial/ethnic structure of the population, participants in a number of outdoor recreation activities will increase at slower rates than in the past.

Demographic Trends

In the years ahead the U.S. population will grow more slowly than in the past, age significantly, have larger minority components, and be more urban (Spencer 1989). The U.S. population, which grew at 2 percent per year in the 1950's and 1 percent per year in the 1980's, is expected to grow at about 0.5 percent per year over the next several decades. Accompanying slower population growth and longer life spans will be increased aging. In 1900 the median age was 23, it increased to 30 in 1980, and is expected to reach 36 by the year 2000 and 41 by the year 2025. There will be increased racial/ethnic diversity in the years ahead as well. Between 1990 and 2025 the U.S. population is expected to increase by 50 million, of whom 17 million will be Hispanic Americans, 14 million African Americans, and 10 million will be from "other" groups. Thus 81 percent of the increase in population will be in minority groups. There are prospects for increased urban residence as well (Luloff and Krannich 1990). The 1980's witnessed a return to the long term trend of greater growth in metropolitan areas than in non-metro areas. The nation's non-metro areas grew at only half the rate of their metro counterparts, with many of the Nation's largest standard metropolitan statistical areas (SMSA's) attaining increases of 20% or more.

Variation in Participation

The next three sections look at variation in recreation participation at the national level in terms of racial/ethnic background, age, and urban/rural residence. The analysis is based on responses from 18,450 individuals from the U.S. Pleasure Travel Market Study conducted in 1989 by Longwoods Research Group Ltd. While only simple breakdowns by the three demographic categories are presented here, multivariate analyses indicate that most of the significant differences remain when other individual, household, and locational variables are taken into account as well (Dwyer 1993). Comparisons of participation by racial/ethnic groups for six major U.S. cities are provided by Dwyer (1993) as well as breakdowns by all three demographic categories for Illinois and at the national level from the National Survey of Fishing, Hunting, and Wildlife Associated Recreation.

Racial/Ethnic

Table 1 presents the percent of a large nationwide sample of African Americans, Hispanic Americans, whites, and "other" groups who reported participation in a wide range of recreation activities (Nadkarni and O'Leary 1992). There are statistically significant differences across racial/ethnic groups for each of the twenty-nine activities. The most distinct pattern is that African Americans are significantly less likely than the three other groups to participate in a large portion of the outdoor recreation activities studied, particularly those that take place in a wildland setting or involve water/snow/ice. It is in some athletic activities in which African Americans are significantly more likely than whites to participate. There is a tendency for one or more of the three "minority groups" to have significantly higher participation than whites in sports and athletic activities. Patterns of similarities and differences between whites, Hispanics, and "other" groups are not as clear; but in many instances Hispanics or "others" are the group most likely to participate in a particular activity. Perhaps the lack of a clear pattern of participation for Hispanic and "other" groups in comparison to whites and African Americans is because of the recent immigration of a number of individuals in these groups from a wide range of countries with diverse outdoor recreation patterns and traditions. What we are most likely observing here under groupings such as "Hispanic" or "other" is composites of a number of distinct patterns for specific ethnic groups. African Americans and whites are also composites of a number of ethnic groups; but they have an almost unanimous shared recent background in the United States. We also have relatively fewer observations with Hispanics and "other" groups, which may have hampered our efforts to identify a pattern with these groups or to compare them to others.

Age

Table 2 presents percent participating by age class for a wide range of recreation activities (Nadkarni and O'Leary 1992). There are significant differences in participation across the six age categories for every activity. The general trend is a decrease in participation with increasing age, with the difference between activities being when that decrease begins. With nearly half of the activities (and particularly sports and athletics) there is a fairly steady decline in percent participating with each age class after the first (18-24 years), with nearly all of the other activities starting decline after the second age class (25-34). A notable exception is birdwatching where percent participating increases with age class until age 55-64, and then decreases slowly.

Urban/Rural Residence

Differences in percent participating in outdoor recreation activities by urban/rural residence appear to be a reflection of different lifestyles and the availability of opportunities to participate in these activities in fairly close proximity to home. Table 3 indicates percent of the U.S. adult population participating in a wide range of recreation activities according to the size of the area where they lived (Nadkarni and O'Leary 1992). There are significant differences in percent participating by size of area for 25 out of 29 activities. Activities generally associated with substantial wildland areas are more likely to be participated in by individuals living in an area with a population of less than 50,000 than in areas with a larger population. Activities requiring the development of specialized facilities or programs are more likely to be participated in by individuals living in large urban areas where there are usually substantial recreation facilities and programs.

Some Projections for the Future

Murdock et. al. (1991) developed a cohort-component projection model that uses projections of the population by age and race/ethnicity, together with activity-specific rates of participation by age and race/ethnicity to project number of participants in recreation activities in the years ahead. They project the likely effects of demographic changes (age and race/ethnicity) on the number of persons who will participate in seven selected recreation activities in the U.S. through the year 2025 (backpacking, birdwatching, hunting, dayhiking, camping in a tent, walking for pleasure, and picnicking). Activity participation rates for combinations of age and race/ethnicity in each of the seven activities were derived from the survey conducted for the President's Commission on Americans Outdoors by Market Opinion Research Survey Organization. Projections of population characteristics were provided by the U.S. Bureau of the Census for three racial groups (white, Black, and "other") and one ethnic group

Table 1. Percent of U.S. adults participating in recreation activities by racial/ethnic group - 1989.

Activity	White (14,787)	Black (2,024)	Hispanic (1,184)	Other (455)
Swimming	36.6^{+-}	15.1^{---}	37.3^{+-}	45.9^{+++}
Bicycling	27.7^{+--}	17.3^{---}	36.3^{++}	40.7^{++}
Freshwater fishing	21.3^{+}	10.3^{---}	21.4^{+}	20.8^{+}
Camping	20.6^{++}	2.7^{---}	15.5^{-+-}	19.5^{++}
Aerobics	15.0^{---}	19.6^{+}	20.0^{+}	22.8^{+}
Jogging/running	10.5^{---}	12.9^{+-+}	23.3^{++}	22.4^{+-}
Golf	13.1^{++}	2.3^{---}	6.3^{-+-}	10.8^{++}
Weight lifting	10.2^{--}	11.2^{--}	21.0^{++}	22.4^{++}
Hiking/backpacking	12.3^{+}	1.3^{---}	13.8^{+}	13.3^{+}
Tennis	8.7^{--}	8.0^{--}	12.1^{++-}	25.0^{+++}
Power boating	9.5^{+++}	1.7^{---}	3.8^{-+}	5.6^{-+}
Hunting	8.3^{+++}	2.4^{--}	6.0^{-++}	2.3^{--}
Saltwater fishing	7.2^{+--}	3.1^{---}	12.7^{++}	11.5^{++}
Birdwatching	7.9^{++}	2.2^{---}	7.0^{+}	5.3^{-+}
Downhill skiing	6.3^{+--}	1.3^{---}	8.1^{++}	10.9^{++}
Waterskiing	6.8^{++}	0.3^{---}	7.0^{++}	4.3^{-+-}
Horseback riding	5.9^{+-}	3.8^{---}	7.1^{+}	8.4^{++}
Canoeing	6.4^{++}	1.1^{---}	2.4^{-+-}	4.7^{++}
Racquetball	4.9^{+--}	2.7^{---}	11.0^{++}	12.3^{+}
Sailing	4.4^{+}	0.8^{---}	5.1^{+}	4.3^{+}
Cross-country skiing	3.5^{+}	0.5^{---}	3.8^{+}	2.0^{+}
Mountain climbing	3.1^{++}	$0.^{---}$	1.6^{-+-}	3.8^{++}
Snowmobiling	2.3^{++}	0.4^{--}	2.7^{++}	0.8^{--}
Whitewater rafting	2.1^{++}	0.3^{---}	1.1^{-+}	1.3^{+}
Scuba diving	2.0^{+-}	0.2^{---}	2.7^{+-}	5.8^{+++}
Wind surfing	0.9^{++}	$0.^{--}$	1.0^{++}	$0.^{--}$
Hot air ballooning	0.8^{+}	0.2^{-}	0.5	0.4
Squash	0.3^{+-}	$0.^{---}$	0.3^{+}	1.0^{++}
Hang gliding	0.1^{-}	$0.^{--}$	0.4^{+-}	1.3^{+++}

NOTES: Differences between racial/ethnic groups are significant at the $p < .05$ level for each activity.
+ Percent participating is significantly higher than another group.
- Percent participating is significantly lower than another group.
Table derived from the Travel USA Data for 1989 (See Nadkarni and O'Leary 1992).

(Spanish origin). The single set of activity-specific participation rates for age and racial/ethnic groups was used for all years in the projection period. The general pattern in these activity-specific participation rates is for the proportion participating in an activity to decrease with increasing age and racial/ethnic minority background. This is consistent with earlier discussions of participation patterns of racial/ethnic and age class groups.

The projections of future participation suggest that, given U.S. Bureau of the Census assumptions concerning future growth of the population and changes in its age and racial/ethnic structure, as well as constant activity participation rates for particular age and racial/ethnic groups, growth in number of U.S. participants in six of the seven outdoor recreation activities during the period 1990-2025 will be lower than expected growth in the U.S. population. The number of participants in backpacking is projected to decrease slightly. Birdwatching participants are projected to grow in numbers at a slightly faster rate than the U.S. population (Table 4).

Given that Murdock et. al.'s (1991) cohort-component projection model uses the same activity-specific participation rates for age and racial/ethnic groups for all time periods, projected rates of change in participants at a different rate than the U.S. population are due to changing age structure and changing racial/ethnic composition of the population over time. The projected changes in number of participants in selected activities were attributed primarily to changing age structure, and to a much lesser extent to population growth and changing race/ethnicity (Table 5). In essence, growth in participation in an activity at a rate lower than population growth is attributable to shifts of the population into age and racial/ethnic groups with lower rates of participation. Birdwatching participants increased at a higher rate than population growth largely because the activity has relatively high popularity with older individuals. Birdwatching stood out among 29 activities (Table 2) for its relatively high popularity with older Americans. Relatively high rates of increase in pleasure walking and picnicking are also attributable to their popularity with older Americans. The projected drop in backpacking participation is largely attributable to its relatively high popularity with young adults. With backpacking and camping in a tent there is a projected decrease in the number of white participants. This is due, in part, to slow growth in the number of young whites (15-19 years of age) and an absolute decline in whites age 20-24 years. Activities in which participation is higher among younger population groups are projected to experience slow rates of increase in the future, particularly among whites.

Table 2. Percent of U.S. adults participating in recreation activities by age class - 1989.

Activity	18-24 (2,667)	25-34 (4,652)	36-44 (3,663)	45-54 (2,408)	55-64 (2,258)	65+ (2,782)	All (18,450)
Swimming	44.8	45.0	39.0	31.0	23.5	13.3	34.5
Bicycling	36.2	36.7	32.7	23.7	16.5	8.8	27.5
Freshwater fishing	23.3	26.6	21.9	19.9	13.6	9.1	20.1
Camping	21.6	25.5	21.8	16.7	10.8	5.9	18.3
Aerobics	22.7	23.6	18.0	12.4	7.9	4.1	16.0
Jogging/running	20.4	16.3	12.9	9.3	5.6	2.4	11.9
Golf	14.2	12.8	12.3	10.2	9.4	7.7	11.4
Weight lifting	24.5	17.8	11.1	4.8	3.0	.6	11.3
Hiking/backpacking	13.2	15.7	15.2	9.8	5.2	2.6	11.2
Tennis	17.9	12.7	9.2	7.0	3.8	1.4	9.2
Power boating	10.6	11.0	8.1	8.2	5.9	2.9	8.2
Hunting	9.4	9.9	8.0	7.5	4.9	2.1	7.3
Saltwater fishing	8.7	7.8	7.7	9.0	6.0	3.4	7.2
Birdwatching	2.7	6.6	7.3	9.1	9.9	8.1	7.1
Downhill skiing	12.1	8.9	6.1	4.8	1.2	.3	6.0
Water skiing	12.8	9.9	5.9	2.9	1.1	.2	6.1
Horseback riding	8.0	9.3	7.2	3.9	2.0	.8	5.8
Canoeing	6.7	7.9	7.5	4.6	2.5	1.0	5.5
Racquetball	12.6	8.0	4.5	3.0	.6	.1	5.2
Sailing	5.4	5.0	4.2	4.6	2.5	1.5	4.0
Cross country skiing	4.1	4.1	3.9	3.8	1.8	.4	3.2
Mountain climbing	3.2	3.3	3.6	2.6	1.8	.8	2.7
Snowmobiling	4.1	3.2	1.9	1.4	.9	.4	2.1
Whitewater rafting	2.0	3.0	2.5	1.1	.5	.4	1.8
Scuba diving	3.6	3.4	2.0	1.0	.4	.2	2.0
Wind surfing	1.3	1.2	.8	.5	.3	.0	.8
Hot air ballooning	1.0	.8	.8	1.3	.5	.2	.7
Squash	.4	.5	.3	.1	.0	.0	.3
Hang gliding	.2	.3	.2	.1	.1	.0	.2

NOTES: Differences significant at $p < .05$ Level for all activities.
Table derived from Travel USA Data for 1989 (See Nadkarni and O'Leary 1992).

Table 3. Percent of U.S. adults participating in recreation activities by size of area where they reside - 1989.

Activities	Less than 50,000 (4,812)	50,000-499,999 (3,689)	500,000-1,999,999 (2,952)	2,000,000 and over (6,997)
Swimming*	31.4	34.6	35.0	36.5
Bicycling*	24.3	26.6	29.0	29.5
Freshwater fishing*	26.2	21.7	19.7	15.2
Camping*	19.8	19.5	18.5	16.6
Aerobics*	13.3	14.6	16.8	18.3
Jogging/running*	9.0	10.9	13.5	13.8
Golf*	9.8	12.9	13.7	10.7
Weight lifting*	9.1	10.2	11.5	13.4
Hiking/backpacking*	10.1	10.9	11.2	12.1
Tennis*	6.3	10.0	10.2	10.4
Power boating*	7.6	8.5	9.3	7.9
Hunting*	12.9	8.2	5.1	4.0
Saltwater fishing*	6.1	7.1	6.6	8.3
Birdwatching*	8.4	7.6	7.2	6.0
Downhill skiing*	3.4	5.7	5.8	8.1
Waterskiing*	5.8	6.0	6.6	6.1
Horseback riding*	6.3	4.5	6.0	6.1
Canoeing	5.5	5.4	6.0	5.3
Racquetball*	3.2	5.7	4.7	6.5
Sailing*	2.0	3.8	4.9	5.2
Cross-country skiing*	3.1	3.9	2.7	3.1
Mountain climbing	3.0	2.7	2.8	2.4
Snowmobiling*	2.9	1.8	1.5	2.0
Whitewater rafting	1.3	2.2	1.4	2.0
Scuba diving*	1.6	1.7	1.4	2.6
Wind surfing*	0.3	0.9	0.8	1.0
Hot air ballooning*	0.5	0.6	1.2	0.8
Squash	0.3	0.2	0.3	0.3
Hang gliding*	0.1	0	0	0.3

NOTES: *Differences significant at $p < .05$ level across areas. Table derived from Travel USA Data for 1989 (Nadkarni & O'Leary 1992).

Table 4. Percent change in total number of additional persons projected to be involved in selected outdoor recreation activities in the United States from 1990 - 2025, by race/ethnicity.

	Total Population	Race: White	Race: Black	Race: Other	Ethnic Spanish Origin
			- - - percent - - - -		
Backpacking	-0.3	-6.1	16.2	46.5	43.0
Birdwatching	23.4	13.7	31.1	54.9	50.7
Hunting	11.4	4.8	24.4	49.9	46.5
Day Hiking	10.0	3.8	22.4	50.2	46.6
Camping in a tent	3.2	-4.0	22.6	47.1	45.0
Walking for pleasure	18.3	9.9	27.6	53.0	48.5
Picnicking	16.0	8.0	26.2	52.2	47.6

NOTES: Source- Murdock et. al. (1991).
During the period 1990 - 2025 the U.S. population is projected to increase by 19.7 percent.

Table 5. A decomposition of the projected differences in the rate of participation in selected outdoor recreation activities among residents of the United States, by activity, 1990 - 2025.

	- - - Percent of absolute change in total effect due to - - -		
	Population	Age	Race
Backpacking	1.7	91.2	7.1
Birdwatching	4.5	94.9	0.7
Camping in a Tent	2.5	95.0	2.6
Day Hiking	5.1	84.1	10.8
Hunting	14.2	77.5	0.3
Picnicking	22.8	76.8	0.4
Walking for pleasure	25.3	65.3	9.4

NOTE: Source -- Murdock et. al. (1991)

Projections provided by the cohort-component projection model also suggest changes in the demographic characteristics of participants, with higher ages and larger proportions of minorities among participants in each of the seven activities.

Murdock et. al. (1990) also developed a cohort-component projection model for Texas. With a large and rapidly growing minority component of the Texas population, race/ethnicity plays a more significant role in changing participation in the years ahead than at the national level.

The projections developed by Murdock et. al. (1990, 1991) must be evaluated in light of two key assumptions of their model: (1) Participation rates by age group and racial/ethnic groups will not change over time, and (2) Variables other than age group and race/ethnicity that influence participation are not explicitly considered. For a discussion of these assumptions and their implications for predicting the number of participants in selected activities in the years ahead see Dwyer (1993) who also provides suggestions for improved predictions, including changing participation rates over time for demographic groups.

Implications for Management

If participation rates by age and racial/ethnic groups remain constant over time, projected demographic changes are likely to bring significant changes in recreation participation patterns. While changes will vary significantly across activities, outdoor recreation customers are likely to increase in numbers at a slower rate than in the past, and will be increasingly older, urban, and from racial/ethnic minority groups. Change will be the hallmark of recreation resource management programs even more than in the past, and it will be increasingly important to maintain flexibility and responsiveness.

The projected changes in customers and participation patterns will have wide - ranging implications for recreation resource management programs. These implications will be especially significant for the management and use of resources in or near urban centers which tend to be heavily used by racial/ethnic minorities, urbanites, and older Americans. Particularly significant changes can be expected in areas of the U.S. where there is substantial growth in racial/ethnic minority populations.

The implications of demographic changes and associated changes in use and users may be wide-ranging and include design and management of recreation settings, the focus of visitor programs, information and marketing efforts, and the selection and training of those who work with visitors. It may be necessary to review fee structures in the years ahead, given the increasing proportion of participants that will qualify for "senior citizen rates." The selection of staff and the development of training programs will need to address the needs of increasingly diverse customers. Increased attention will need to be given to communication between managers and planners and the increasingly diverse populations that they will serve.

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MANAGING URBAN OPEN SPACES FOR NATURALNESS: PREFERENCES OF CHICAGO HOUSING AUTHORITY CHILDREN

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This study examines the preferences of inner city children for urban open spaces that are managed at different levels of naturalness. Six-to-nine-year-olds (N= 62) from Chicago Housing Authority residences viewed and rated their preferences for color slides of various urban ecosystems. The slides were selected and scaled by a panel of natural resource professionals to represent varying degrees of naturalness. Analyses in general showed that low levels of naturalness were most preferred, but that for some ecosystem types higher levels of naturalness could be maintained without significantly decreasing preferences. The study results have implications for managing urban open spaces for children who may not be familiar with or feel comfortable in wild landscapes, to encourage enjoyment and learning from nature experiences.

Introduction

Natural landscapes provide habitat for plants and animals, and offer beauty, recreation, and educational experiences for people. In the Chicago region, these common natural landscape types included prairie, savanna, woodland, and wetland ecosystems. But in an evolution typical of most cities, as Chicago became urbanized many of the natural landscapes that once existed were lost to development. Today, the natural ecosystems that remain are greatly reduced in size and biological diversity, and are simplified in ecological structure and function. This is especially true in areas of the central city where development is densest.

An unfortunate consequence of this pattern of development is that shortages in urban nature opportunities disproportionately affect low income groups. Unlike other city dwellers, these groups often lack the time, transportation, and financial resources to reach areas where natural landscapes are more prevalent. Young children (5-to-12 years) are especially affected, for at it is at this stage of development where they begin to learn the meaning and significance of their environment, and the natural environments they experience during this period can shape their perceptions and behavior as adults (Moore 1977; Tanner 1980). If most nature experiences at this stage are limited to school and family visits to the zoo or museums, or if natural environments are experienced only indirectly through books and television, children may not see what relevance or benefits nature has in their lives.

To provide all urbanites with the valued experiences that nature affords, we must make natural landscapes more accessible, not something "out there" and separate from the everyday environment. One important way to increase access is to bring it closer to where urbanites live. "Nearby nature" (Kaplan 1985) can be provided in many places in cities-- in parks, nature centers, along utility and transportation corridors, and in vacant lots. To maximize its values to people, however, natural areas must also be designed so that their intended users find them attractive and comfortable places to be in. In this respect, young children are a critical use group to plan for. Lack of previous experience may cause some children to feel discomfort or fear in natural areas (Metro, Dwyer, & Dreschler 1981). The degree of naturalness or wildness of a place has been shown to be a significant determinant of children's preferences for urban woodland landscapes (Gobster 1992), but little information is available for managing naturalness in urban open spaces. The objectives of this paper are two-fold: (a) to examine inner city children's preferences for different natural ecosystems; and (b) to identify levels of naturalness that are most preferred. It is hoped that the information from this study will aid the managers of urban parks and nature centers to better understand the perception and needs of their visitors, so that they can better target landscape design efforts and environmental education programs to different groups.

Method

Subjects

The children who participated in the study were Chicago Housing Authority residents attending a program at the North Park Village Nature Center, which is operated by the City of Chicago. The program, "A Day with Mother Nature," provides environmental education and nature experiences for young children, many of whom come from low income families and have had little previous interaction with natural landscapes. The 62 boys and girls who participated in the summer, 1991 program ranged in age from 5 to 12 years and were of African-American heritage.

Design and Procedure

As part of the program, the children took park in an "environmental preference assessment" prior to their tour of the nature center. A photo-rating approach (Shuttleworth 1980) commonly used in environmental preference research was adapted for use with young children. In the assessment, the children rated their preferences for color slides of savanna, prairie, woodland, and wetland ecosystems. Each of the four landscape types were shown to the children under five different levels of naturalness. Representative examples of these slides are shown in Figure 1.

Because of the young age of the group, we limited the number of slides to 20, with each slide representing one landscape type under one level of naturalness. We also restricted the preference rating scale to three choices, again to simplify the task for the children. We feel these limitations are justified given the unique information this kind of study can provide, and find that the photo-rating approach as applied here is easy for most young children to understand and is a fun way for them to participate in a research study.

Naturalness Scaling and Reliability. We carefully selected a set of slides so that scenes within each landscape type were similar in composition, photographic quality, and other factors, but varied with respect to the level of naturalness present. We defined five levels of naturalness: At the lowest level, landscapes appeared highly manicured, small in scale and extent, and showed prominent pathways and other signs of human habitation or development such as buildings, fences, or concrete edges (e.g., Figure 1a). At higher levels of naturalness, the landscapes looked less managed, larger in scale and extent, and human influences were less apparent (e.g., Figure 1b and c). The highest level of naturalness depicted a pristine natural landscape, but one at a scale and extent possible within an urban context (e.g., Figure 1d). A preliminary set of slides was judged on a 5-point scale of naturalness by a panel of 6 experts in natural areas design, research, and education. Agreement among the experts was high, with ratings showing a mean observer-to-group correlation of $r = .89$. The mean scores for the slides, however, showed that for two of the landscape types there was an inadequate distribution of scenes across the five levels of naturalness. New slides were substituted in these cases, and the entire set was re-rated, this time by a panel of 10 experts. The revised set had good rating distribution for each landscape type, and group agreement remained high ($r = .90$).

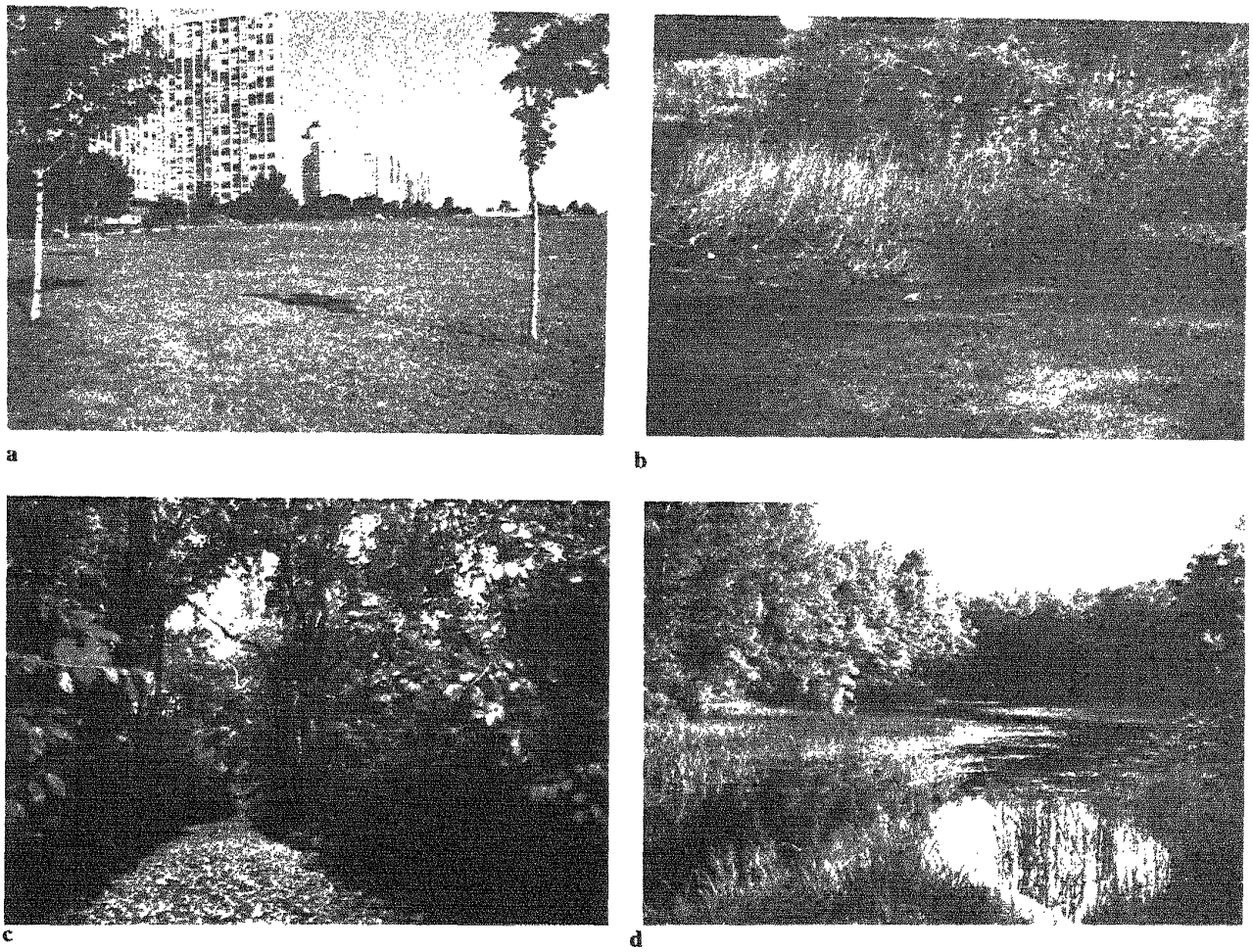

Figure 1. Representative photos used in the study: (a) savanna landscape low in naturalness, rated high in preference; (b) prairie landscape of moderate naturalness, rated low in preference; (c) woodland landscape of moderate naturalness, rated high in preference; (d) wetland landscape high in naturalness, rated low in preference.

Preference Scaling and Reliability. The final slide set was randomized, and the 20 scenes were shown to children in groups of around 20 in size. The children rated the slides according to the question: "How much would you enjoy being in the places pictured?" Ratings were made on a three-point "smiley face" scale like the one shown in Figure 2.

Figure 2. The "smiley face" rating scale.

The children's ratings were examined for internal and group consistency using options available in the RMRATE statistical program (Brown, Daniel, Schroeder, & Brink 1990). This program flags observers whose ratings have excessive missing values, show a poor range in values, or are poorly correlated with the rest of the group. Of the 62 raters, 3 were removed from the analysis because all of their ratings were the same number, and 8 others were removed because their ratings correlated less than $r = .20$ with the rest of the group. For the 51 remaining children, the average observer-to-group correlation was an acceptable $r = .57$.

Results

The children's mean preference ratings were correlated with mean naturalness values across all scenes. The Pearson correlation coefficient was $r(20) = -.70$ ($p = .001$), indicating a moderately strong, negative relationship between preference and level of naturalness. That is to say, as landscapes became more natural or wild appearing, the children found them less preferred.

This generalized relationship is illustrated in Figure 3, where preference scores for all four landscape types are plotted against their respective naturalness scores. The curve fitted to these points[1] is generally downsloping, but two important aspects should be noted. The first is that the curve does not immediately drop with increased levels of naturalness; this indicates that the children in a few cases found scenes with moderate and high levels of naturalness highly preferable. The second point is that the preference ratings rarely dropped below a 2 on the 3-point scale, indicating that at the very least the children felt indifferent about high levels of naturalness.

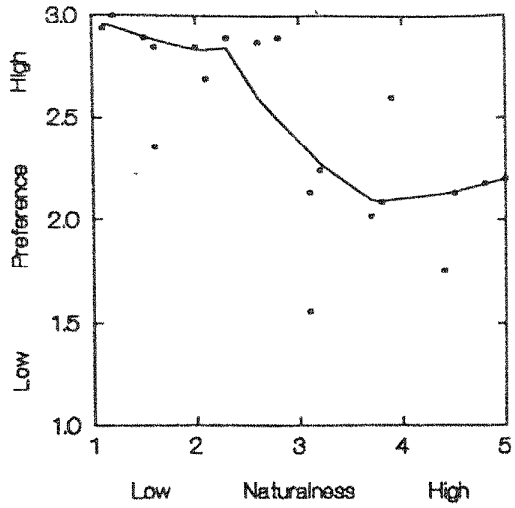

Figure 3. Mean preference ratings as a function of naturalness, all landscape scenes.

The preceding analysis treated all landscape scenes as if they were one generic type, but in examining ratings of the individual photos it looked as if preferences differed depending on the type of landscape viewed. It also looked that for some ecosystems higher levels of naturalness were more acceptable to the children. To answer these questions, we examined preference rating differences in a repeated measures analysis of variance (ANOVA); ecosystem type and naturalness were included in the design as trial factors. For the latter factor, rated mean scores were converted to discrete values to represent five degrees of naturalness.

Figure 4 shows mean preference ratings as a function of landscape naturalness for the savanna, prairie, woodland, and wetland scenes. The ANOVA showed that the main effects for ecosystem type ($F(3, 132) = 15.94$, $p < .001$) and naturalness ($F(4, 176) = 48.79$, $p < .001$) were significant. Visual examination of the graphs, however, failed to reveal a definite pattern that one landscape type was liked over another. Rather, preference for ecosystem type seemed to depend on the level of naturalness in which it was viewed. This was supported by the significant interaction effect between ecosystem type and naturalness level in the ANOVA ($F(12, 528) = 15.07$, $p < .001$).

Figure 4 shows how in some cases preference ratings stayed high or rose with high levels of naturalness. This was

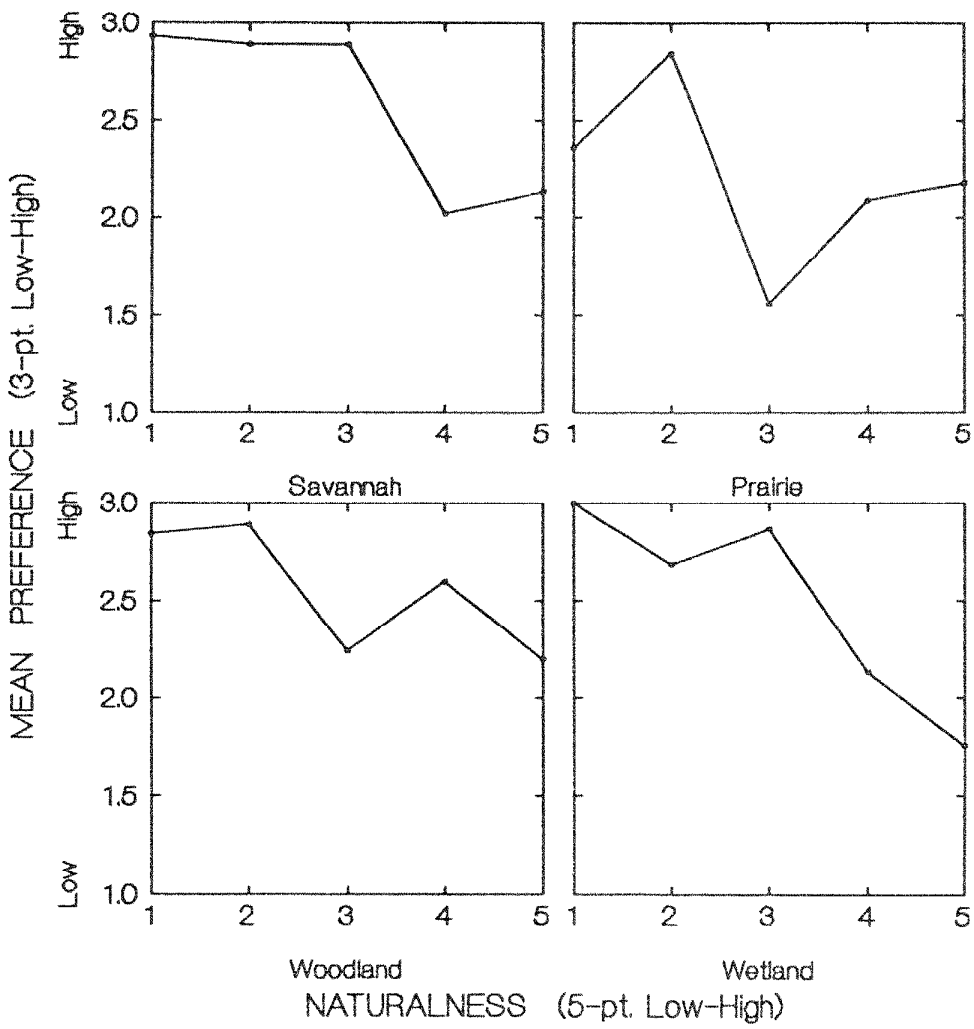

Figure 4. Mean preference ratings as a function of naturalness, by landscape type.

particularly the case for savanna and woodland scenes that had naturalness ratings of around 4 on a 5-point scale. In other cases preference ratings dropped steadily with increases in naturalness (wetland scenes), or dropped significantly at a moderate level (prairie scenes). Because of the small number of scenes these relationships should be interpreted cautiously, but they do give some indications that desired levels of naturalness may depend on the type of landscape under consideration.

In a final test we examined preferences between different subgroups of children in the sample. We divided the children's ratings by sex (N = 23 girls, 28 boys) and by age (N = 23 5-to-7-year-olds, 28 8-to-12-year-olds) but found no significant differences in ratings between the subgroups.

Summary and Implications

The major findings of this research can be summarized as follows:

1. The children found natural landscapes enjoyable to view, but generally preferred those for which the naturalness or wildness of the scene was of a low to moderate level. This finding agrees with the results of a previous study that inner city children enjoy natural landscapes as long as the places are not too wild in character so that they convey unfamiliarity or fear (Gobster 1992). The level of naturalness should be taken into account in the design and management of parks and natural areas for children. Providing settings with moderate levels of naturalness where children feel comfortable might foster greater appreciation and learning, and encourage children to explore wilder settings without trepidation.

2. Based on the small set of landscape views shown to the children, it appears that even the highest levels of landscape naturalness are not strongly disfavored. This finding is encouraging for natural areas managers who may be trying to maximize natural diversity on lands they manage. One management scenario might be to make some areas more or less developed with wide trails, signs, and other elements that make children feel more comfortable, while leaving other areas as wild as possible. In this case children might be encouraged to use the less wild area but would not feel too fearful if wilder areas are also present.

3. All types of natural landscapes are liked by children, but there is some indication that higher levels of naturalness may be more acceptable for some types than for others. Further information is needed before specific recommendations can be made here, but there is some indication that children would find some kinds of highly natural environments enjoyable places to see and visit. Future research should look in more detail at the design and management of particular urban ecosystems, to see how preferences are influenced by specific factors that relate to the perceived naturalness of the setting.

Although this study focuses on a special user group type, namely young children from the inner city, the findings and recommendations may have wider applicability for the design of natural areas and environmental education programs. For example, studies of perceived safety (e.g., Schroeder & Anderson 1984) show that adults feel safer in areas where vegetation is partially cleared and buildings and other people are present. And studies comparing park preferences of black and white adults (e.g., Kaplan & Talbot 1988) have found that though both groups like natural areas, blacks tend to prefer parks that are more formally designed and have higher levels of development and maintenance. The results of this present study tend to complement these related efforts by showing that urban natural areas can be designed so that they are safe and educational as well as enjoyable, and can serve human needs along with others who share this planet.

Acknowledgment

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Note

The curve in Figure 2 was fit to the scatterplot data using the LOWESS smoothing option available in SYGRAPH (Wilkinson 1990). This smoothing method produces a curve by connecting values of the independent variable x with predicted values of the dependent variable y based on a weighted average of nearby observed y values. For further information, see Cleveland (1981).

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THE INFLUENCE OF RURAL EXPERIENCE ON URBANITES' DEFINITION OF RURALITY[1]

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A cognitive mapping experiment revealed that urban residents of Pennsylvania identified rural areas of the Commonwealth in every region of the state. Contextual variables, derived from the maps, indicated that differing thought processes occurred among these respondents. Implications of the findings are advanced with respect to rural tourism marketing.

Introduction

Rural tourism promotion can be enhanced by an understanding of the role of a sense of place in destination selection. According to Downs and Stea (1977), a sense of place is based upon a broad based awareness of an area and its attributes. Since this sense of place is widely held by a local population, it is possible to examine it for group similarities. One procedure for identifying a sense of place is cognitive mapping.

Cognitive maps are representations of the spatial environment (Downs and Stea 1977). They serve as coat hangers for assorted memories, are used for wayfinding activities, and most importantly for tourism research, they store reference information related to an environment (Lloyd and Steinke 1986). Cognitive maps are considered accurate to the extent that they serve as aids - in giving directions to others, navigating trips between places, and finding things that are needed or wanted (Wall et al. 1986). They also are a vehicle for recall, providing an image of *where* to bring back a recollection of who, what, and when.

Cognitive maps develop in two ways. The direct method is associated with existential experience. As people travel through an area, they are exposed to information which is then associated with specific locations. People also gain information indirectly through others or the media, even when not specifically seeking such knowledge (Lloyd and Hooper 1991). Cognitive maps represent a configuration of routes and objects that form a gestalt. Thus, they include knowledge of distances and areas that may have never actually been traversed, and perceptions of these areas even when explicit knowledge is minimal (Moesser 1988).

Peoples cognition of space and spatial relations has a significant effect on their behavior, beliefs, and attitudes regarding places (Gilmartin 1985). This is perhaps best illustrated by considering Lancaster County, Pennsylvania. Lancaster in 1990 was home to almost 423,000 people and had been classified as a major metropolitan area of southeastern Pennsylvania for nearly thirty years (U.S. Bureau of the Census 1990). Despite its size and status, however, Lancaster has been successfully portrayed as a rural Eden and home to the Plain people -- the Amish. This image is further buttressed by the often cited fact that Lancaster produces the greatest net value of agricultural commodities in a nonirrigated county in the entire United States. It is not surprising, then, that most of the typical state, regional, and local promotional literature describes the county as "an area full of traditional farms, still tilled by hand and horse" (Barash Group Inc. 1993:4). The effectiveness of this promotion is reflected in the fact that it ranks third in tourist earnings for all Pennsylvania counties, trailing only Philadelphia and Allegheny counties, home to the two largest cities in the Commonwealth.

Through the efforts of Kevin Lynch, an urban planner, and his seminal work The Image of the City (1960), and his students, a set of comprehensive cognitive maps of urban residents' perceptions of cities and towns has been generated. Much less is known about rural areas, although Shortridge (1985) found that rural images dominated his cognitive mapping survey. This void is addressed here by examining *urban residents' cognitive maps of rural areas*, and determining how their attitudes about these areas, their personal characteristics, and rural experiences influence that definition.

The Survey

During the Fall of 1991 a mail survey following the total design method of Dillman (1978) was conducted seeking information on the perceptions and attitudes about rural people and places held by urban residents of Pennsylvania. The survey form asked respondents for their definition of rural, where they thought such rural areas were in the state, their general perceptions of rural areas and people, and selected personal, social, and demographic characteristics. A total of 3,611 residents of the nine cities in Pennsylvania with a population of 50,000 or more in 1990 were contacted. Completed questionnaires were returned by 1,524 respondents, representing a 42 percent response rate (Willits et al. 1992).

Purposes

One purpose of this study is to determine if urban residents of Pennsylvania can readily identify rural areas on a blank map of the Commonwealth. It is hypothesized that the amount of space indicated on the map can be used to classify respondents into two broad categories - those with loose definitions and those with stringent definitions of rurality. Those with loose definitions are thought to hold anti-rural attitudes and opinions. Such opinions arise from the advantages which accrue in urban life including greater economic activity, numerous and better services, and more social and cultural activity (Willits et al. 1992). Those holding such values are thought to be more likely to indicate greater amounts of rural areas because they view such areas as being homogenous and undifferentiated. Such a response reflects an urban provincialism that suggests all areas outside their city (and experience) are rural. Willits et al. (1992) asserts that this group is small, representing a hard core of urbanites.

On the other hand, those with stringent definitions are expected to hold pro-rural values. Much previous research suggests that the overwhelming majority of people hold positive images of rural life. These images are expected to be reflected in greater knowledge of rural areas. Those espousing stringent definitions are expected to be more precise, and to indicate a higher absolute number of rural areas on the maps. Despite the number of areas, however, the total rural space is expected to be smaller, since they use a more specific definition of rural. For both the loose and stringent response, the respondents' definition of rurality has no a priori meaning imposed by the researchers; it is a true reflection of the respondents' own beliefs about rural space in the Commonwealth (Luloff et al. 1993).

1/ The support for this research was provided by a grant from the intercollege research competitive grant program of the college of agricultural sciences, Penn state university (project 3208). For complete information on this study, contact either author.

Following the research of Shortridge (1985), a spectrum of factors including characteristics, traits, and beliefs related to both a loose and stringent definition of rural space will be determined. Finally, the implications of varying definitions of rurality for rural tourism promotion in Pennsylvania will be discussed.

Methods

One means for studying cognitive maps is to ask people to sketch an area. This sketch is then analyzed for content, locational accuracy, and size and shape distortions (Gilmartin 1985). A criticism of this methodology is that respondents have a broad range of drawing skills and the sketch may be a better indicator of artistic ability than a representation of a cognitive map. Despite these faults, this method is widely used, and usually reveals group similarities in spatial concepts (Gilmartin 1985).

An alternative is the use of the cued spatial response map. Here, a base map containing minimal spatial references is used. This base map reduces the effect of artistic ability while providing a structured framework for a subject's response, thus making the results more comparable for purpose of summary analysis (Gilmartin 1985). Comparability allows for a determination of whether groups sharing knowledge, experiences, and beliefs about places also share similar cognitive maps (Raitz and Ulak 1981). In this study, respondents were given a cued spatial response map which contained an outline of Pennsylvania and were asked to indicate on the map where they expected to find rural areas.

In order to determine the percentage of the state that was indicated as being rural, a Bruning dot grid overlay was used (Avery and Berlin 1985:85-86). This percentage is obtained by simply dividing total indicated area by the total map area. The resulting information was then used as the dependent variable.

As indicated above, two types of respondents were conceptualized - those with a loose definition of rurality; and those with a more stringent definition. Those who indicated more total rural area than that defined by the Census (60.3 percent) were classified as having a loose definition (U.S. Bureau of the Census 1990).

It was hypothesized that those who maintain loose definitions tend to residualize, that is, they considered rural areas as all spaces external to urban centers. Such residualization reflects both the lack of knowledge of rural areas, and the belief that all rural areas are pretty much the same. Those with a more stringent definition display a more discrete response, which reflects both concrete knowledge of rural areas, and the fact that they can identify them (Downs and Stea 1977; Lloyd 1982; 1989; Driever 1983; Gilmartin 1985; Kostinskiy 1990).

Independent variables from four domains (attitudinal, personal/demographic, rural experience and contextual factors) were examined to test this idea. Following Raitz and Ulak (1981), Lloyd (1982), and Shortridge (1985) a broad range of attitudinal items were asked. Responses were scored 1 (strongly disagree) to 4 (strongly agree). These items were factor analyzed and separated into positive and negative domains. The positive items explained 44.3 percent of the variation while the negative items explained 54.8 percent in the factor analysis. The reliability scores for these scales were modest (Armor 1974; .58 and .73 for the positive and negative indices respectively). Two additional items were included which asked the respondents their level of agreement with whether rural areas are pretty much the same and if all rural areas are farm areas. It was hypothesized that agreement with positive connotations of rural life were related to a more stringent definition of rurality. Alternatively, those that agree with items portraying rural areas negatively or homogeneously were hypothesized as having a loose definition of rurality.

Also included in the attitudinal domain was an opened-ended question asking "What phrases or words come to mind when you think of Pennsylvania's rural areas?" A broad variety of responses were given. In this analysis, all those who responded by providing recreational or vacation imagery were coded as one (16 percent), and other responses were coded as zero. Those respondents using either a recreation or vacation imagery were expected to indicate *specific* areas related to such activities, and a stringent definition of rurality.

Following the work of Driever (1983), Gilmartin (1985), and Gärling et al. (1991), the personal/demographic factors of age, income, gender, education, and size of residence were included. These variables assess whether those with similar characteristics produce similar cognitive maps. Age and income were treated as interval level variables. Gender was coded so males were zero and females were one. Education was coded as follows: 1) less than high school graduate, 2) high school graduate, 3) some college, 4) college graduate or more. Size of residence was rank ordered to reflect the city's relative size from smallest to largest: 1) Altoona, 2) Lancaster, 3) Reading, 4) Harrisburg, 5) Erie, 6) Allentown/Bethlehem, 7) Wilkes-Barre/Scranton, 8) Pittsburgh, and 9) Philadelphia.

Rural experience was measured by determining the childhood residence of both the respondent and the respondent's parents. Even if the respondent is an urban resident, rural perceptions may flourish if the parents have a rural background (Willits et al. 1992). Responses reflected whether one parent, both parents, or neither parent spent most of their childhood in rural areas (defined in this case as small towns under 10,000 in population or open country). Respondents were also asked where they had spent most of their childhood. Both variables were used in the analysis.

A contextual domain was developed from the initial analysis of the maps. The tourism region that the respondent resides in was known. By determining what tourism regions the respondent indicated as containing rural areas, it was possible to establish whether this knowledge was based on adjacency status. The hypothesis here was that those indicating regions close to their own residence would exhibit a more stringent definition, while those indicating nonadjacent regions would have a looser definition. It was also hypothesized that respondents are most familiar with their own region of residence and would be able to indicate rural areas therein. The number of discrete rural areas indicated on each map was also utilized as a contextual factor. More circles indicated more specific rural areas, and a more stringent definition of rurality.

Early analysis revealed that a majority of respondents could indicate rural areas, although a sizable minority only indicated urban areas. Since these two response patterns are distinct, a contextual variable indicating response type was created, with those indicating urban areas coded as zero and everyone else coded as one.

Frequency analysis is used to describe the nature of the responses to the cognitive mapping question. Then, to determine the regional distribution of the designated rural areas, a map with the mean percent of rural area indicated is discussed and compared with a census map containing the tourist regions. First the variables in each domain are examined using one-way analysis of variance and t-test statistics. This procedure determines the mean amount of rural area indicated for categories of an individual variable. Finally, a linear regression model is used to examine all domains collectively.

Results

Initial analysis of the cognitive maps revealed five distinct response types: 1) The respondent followed instructions and indicated rural areas on the map (57.3 percent); 2) The respondent, despite the instructions, indicated urban areas on the map (12.6 percent); 3) The respondent wrote location

names or images on or near the map, but did not indicate rural areas on it (8.0 percent); 4) The respondents did not answer the map, but offered a reason (7.0 percent); 5) The respondent omitted the cognitive map question entirely (15.1 percent).

Respondents who wrote name locations or images on or near the map, or only offered reasons for not answering the map, did not yield spatial information data. Similarly, those who skipped the question provided no useful information for analytic purposes. These individuals were excluded from further analysis. As a result, this study focuses upon those who actually indicated rural or urban areas on the map. Those indicating urban areas specified that the remainder of the map was rural. In such maps, rural areas were derived by subtracting the urban areas from the total map area.

A mean area of 46.3 percent of the Commonwealth was considered rural (Figure 1) by these respondents. A total of 60.3 percent of Pennsylvania is defined as rural using the census definition.

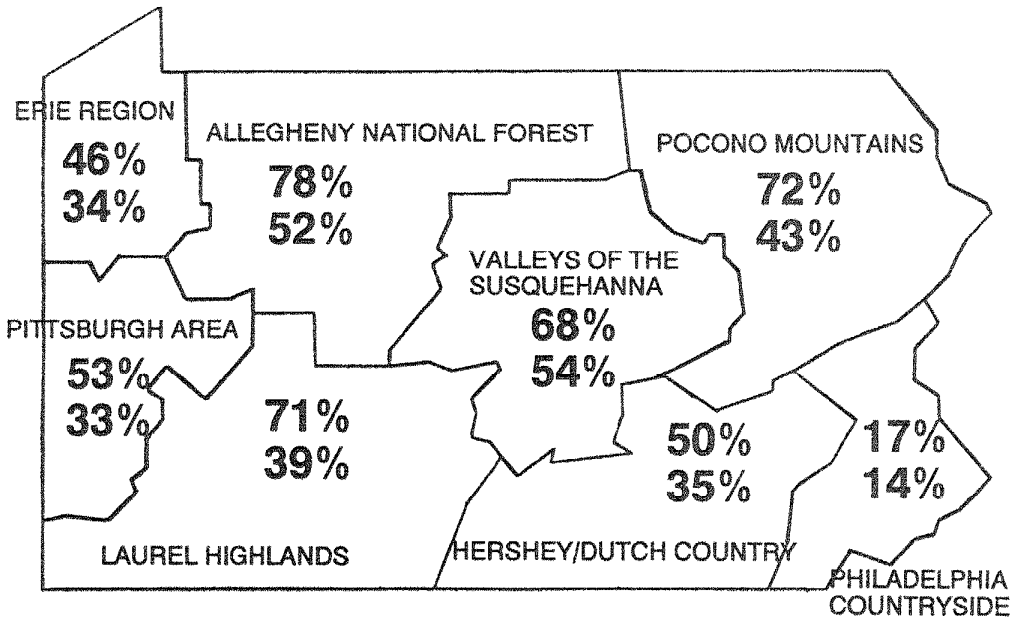

Figure 1. Differences in rural definitions for the eight tourism regions of Pennsylvania (1990 Census figures on top, 1992 Survey figure on bottom).

For all tourism regions, except Philadelphia, there is a substantial underestimation of rural areas. The maps are most congruent for the Commonwealth's major urban tourism regions (Philadelphia and Pittsburgh). Particularly large discrepancies are seen in the Poconos, Allegheny, and Laurel Highland tourism regions. This suggests that most respondents were particularly selective in indicating rural areas.

Bivariate analysis (data not shown) revealed that neither the negative or positive index was significantly related to the amount of rural area indicated. Statistically significant relationships existed for those indicating more rural area and agreement with the statements that rural areas are pretty much the same, and that all rural areas are farm areas. Similarly, those who indicated recreational or vacation imagery were significantly more likely to identify more area as being rural.

All factors in the personal/demographic domain were significantly related to the amount of rural area indicated. In general, older, less educated, higher income people indicated larger amounts of rural areas. Males and residents of the larger cities also were more likely to indicate more area as being rural.

For the domain of rural experience, having two parents who were raised in a rural environment was significantly related to indicating <u>less</u> rural area. Those with only one parent raised in a rural area were the most likely to indicate more area as being rural.

A series of one way analysis of variance procedures (data not shown) were used to examine the bivariate relationships for the contextual variables. These results indicated that those who responded by circling urban areas on the map identified more area of the state as being rural. Similarly, those who indicated their own residential region as being rural indicated more rural area overall. No significant difference for the amount of area indicated as being rural and indicating nonadjacent areas was seen. However, those circling fewer circles on the map tended to indicate more area as being rural.

Multiple regression analysis was used to determine how these domains were related to the amount of area the respondents identified (Table 1). The complete model is presented first. All variables in the contextual domain are statistically significant, and the nature of the bivariate relationships are preserved. Among the personal/demographic characteristics, sex, education, and city size achieved significance as did the negative index from the attitudinal domain. Neither variable in the rural experience domain factor achieved significance. The adjusted R^2 for this model was .53.

To determine the relative strength of each domain, the model was restricted by removing each domain while controlling for the others in four separate models. Model I and Model III excludes the attitudinal and rural experience domains respectively. Exclusion of these domains shows virtually no change from the complete model's effect. Model II excludes the personal/ demographic domain. The effect of this domain is weak as indicated in the small change in the adjusted R^2. Model IV excludes the contextual items, and reveals the dominance of this domain, which accounts for roughly 80 percent of the explained variation.

Table 1. The multivariate relationships of area predicted as rural and the attitudinal, personal/demographic, rural experience, and contextual variables.

	Complete Model	Model I	Model II	Model III	Model IV
Variable	B	B	B	B	B
Attitudinal domain:					
Positive index	-.010		-.012	-.008	-.031
Negative index	.036b		.023	.036a	.014
All rural areas are the same	.010		.016	.013	.025
All rural areas are farms	.010		.018	.010	.013
Recreation or vacation	.029		.035a	.031a	.053a
Personal/demographic domain:					
Age	.000	.001		.001	.001
Sex	-.069c	-.069c		-.070c	-.120c
Income	-.001	.000		.000	-.011
Education	-.035c	-.038c		-.034c	-.035c
City size	.014c	.013c		.014c	.014c
Rural experience domain:					
Parents' childhood residence	-.016	-.017	-.021a		-.027a
Childhood residence	-.032	-.038a	-.020		-.023
Contextual domain:					
Indicated region of residence	.112c	.111c	.102c	.112c	
Indicated nonadjacent region	.392a	.419a	.424a	.382	
Circles	-.033c	-.033c	-.032c	-.033c	
Response type	-.306c	-.308c	-.335c	-.307c	
Constant	.190	-.003	.180	.169	.714
Adjusted R square	.53	.53	.49	.53	.12

a significant at the .05 level
b significant at the .01 level
c significant at the .001 level

Discussion

Responses to a cognitive mapping question about rural areas in Pennsylvania revealed that a majority of respondents (almost 7 of 10) could indicate rural areas on an outline map of Pennsylvania. The results also indicated that the Commonwealth's urban areas are best known and imaged. Among the various domains of variables hypothesized to be related to the identification of rural areas on a cued spatial response map, only the contextual factors are found to support the loose and stringent definition hypothesis. Those residualizing rural areas tend to indicate more area as rural, displaying the loose definition. On the other hand, those who circled more areas on the map, indicated less total areas and had a more stringent definition. The variables dealing with the proximity of the respondent to the location of rural areas indicated on the map did not offer any clear evidence for or against this hypothesis.

There is only weak evidence that the loose definition is related to anti-rural attitudes and opinions. Those harboring negative attitudes towards rural areas were found to be more likely to indicate larger areas as being rural. Other anticipated relationships that would have bolstered this hypothesis were not found. There was a tendency for the respondents who mentioned vacation or recreation imagery to indicate more area as rural. This was unexpected, and did not support the stringent definition hypothesis. What it does suggest, however, is that such images are not related to actual recreation or vacation experiences. Rather, their employment as a response may reflect a vague reaction used when concrete images are not available to the respondent.

These results suggest that childhood residence has little effect on respondents' definition of rurality. Further, it appears that secondary knowledge is not enough to leave a spatial cue. For a concrete response, direct real-time experiences may well be needed. Other variables should be explored for inclusion in this domain. Behavioral items could be of particular use, as rural visitation is clearly related to rural experience. Analysis of the personal/demographic items suggests that there are a number of lower educated, male respondents from larger cities who exhibit a loose definition of rurality.

The contextual variables indicated that a differing thought process occurred among those utilizing loose and stringent definitions. Further research in cognitive mapping should try to clearly establish the factors related to these differing thought processes among both urban and rural residents. When groups with these thought processes are known, more effective marketing strategies can be designed.

The cognitive maps yielded potentially useful marketing information about Pennsylvania's rural areas. Tourism is a growth industry in rural Pennsylvania. The fact that urban Pennsylvanians indicated rural areas in every tourism region, especially their own regions of residence, is important for state, county, and local tourism agencies. As vacation travelers stay closer to home, those rural areas proximate to neighboring cities stand to benefit most. Information from this study indicates that current marketing efforts can be targeted at increasing *the desire* to visit rural areas, as Pennsylvania's urbanites displayed an awareness of and appreciation for the diversity of rural areas within the Commonwealth.

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UPDATING COMMUNITY OPEN SPACE PLANS: LESSONS LEARNED FROM THE FIELD

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This paper identifies the methods required to update community open space and recreation plans, and the problems encountered in the field. Findings of the study show increased loss of farmland and the need for more recreational areas. Specific recommendations to solve the open space problems are presented.

Introduction

Due to budget constraints, many communities are seeking technical assistance from planning departments at local colleges. In this way students learn practical applications to solve planning problems, while the community benefits from volunteer technical assistance. Under the direction of Dr. Stephanie B. Kelly, Coordinator of Regional Planning, Westfield State College, Westfield, MA, students in a Special Topics class in the fall semester of 1992 revised the 1986 Agawam Open Space & Recreation Plan. This paper describes the planning process that was involved in developing the open space plan.

Specifically, the first step involves the updating of land use, zoning and natural resource inventory maps. Data gathering to identify changes in zoning, Agricultural Preservation Restriction Program parcels, city-owned and conservation lands was accomplished by reviewing current assessor's maps. The second step involves conducting a survey of town residents in order to measure the attitudes about recreational use and acquisition of lands for open space preservation. The third step involves the development of an analysis of needs and five-year action plan in order to accomplish the objectives of increasing recreational needs and preserving specific prioritized parcels.

Several problems developed during the process of creating this open space plan. One problem that developed was the lack of time and data to complete the required map overlays for the open space plan. In this case the professor bartered with the Mass GIS state program to receive maps in return for data. The updated data was compiled by reviewing town assessor's maps. Another problem involved the amount of time it would take to survey a scientifically sound sample size. This problem was solved by using senior volunteers from the Agawam Senior Volunteer program. Several students trained the seniors to conduct a telephone survey. The seniors gathered data from a sample of 352 residents. Two students worked with the professor to design the program, type in the data and analyze the survey results.

The final problem involved the accessibility of graphics and landscape drawings to supplement recommendations made by the students. One student, who had worked in a printing firm, reviewed and created the graphics for the plan. Another student created a site plan to illustrate a playscape recommendation.

Community Overview

Agawam, Massachusetts is located on the southern edge of the Pioneer Valley region in southern New England. Agawam is approximately 16,000 acres (24 square miles) and lies just north of the Connecticut and Massachusetts state line. Provin Mountain, which is located along the western edge of town, is the highest point in Agawam at 640 feet. Agawam is a residential community for those who commute to Springfield, as well as neighboring Connecticut. It is also at the hub of major transportation corridors, including important north-south and east-west routes.

The Westfield River flows along the northern border of Agawam, while the Connecticut River flows along the eastern boundary. A total of 1600 acres of floodplain lies along the Westfield and Connecticut Rivers (Dachos 1992). Of this floodplain, what is left undeveloped must be kept as valuable flood prevention, and a natural storage area for flood waters.

Agawam purchases 98% of its drinking water supply from the Springfield Regional Supply System. This supply system consists of water from Cobble Mountain Reservoir and Ludlow Reservoir. On site wells provide the remaining 2% of the town's need for drinking water. There are no contract limitations on the amount of water Agawam may draw from the Springfield systems. However, the town's distribution system is presently inadequate to meet peak pressure demands in the Feeding Hills section of town. This situation may worsen with continual population growth in this particular area (Dachos 1986).

Agawam's population grew by 4% between 1980 and 1990, and is projected to decrease slightly for the next ten years, according to the Massachusetts Municipal Profile 1991-92. The current population of the town is approximately 28,000, with a population density of 1200 persons per square mile.

Agawam's population characteristics have changed during the last decade, including an increase in the number of older residents. Among persons 65 years of age and older there has been an increase from 2993 in 1980 to 4133 in 1990, an increase from 12-18% of the population. This increase in Agawam is indicative of the current national trend of an aging population. Since the highest percent of the population is between ages 22-24 years, it is conceivable that the birth rate may increase. This could create a greater need for recreational facilities for children. In those areas where the population is most concentrated, tot lots could be designed in nearby available open space (Regional Data Center 1992).

Agawam thrived as a farming community even after the diffusion of the Industrial Revolution in the mid 1800s. Numerous grist mills peppered the landscape, where the Connecticut and Agawam (now Westfield) Rivers separate the land into three areas. Residents who lived on one side of the Connecticut or Westfield Rivers, and owned land on the other side, needed access to their farm property. One of the ways that the farmers gained access was via a ferry system that crossed both rivers. This system was used until the South End Bridge was opened in 1979. Agawam was established during this period of increased development in the surrounding lands in the mid 1800s (Dunn 1955).

The changes that occurred between 1902 and 1936 were only a hint of what was to come. The emergence of the suburban life style and the flight of the middle classes from Springfield during the mid-twentieth century irrevocably changed both the landscape appearance and the economic character of Agawam (Brown 1976).

Methodological Issues

The methodology involved in this open space study included data gathering in several primary areas. The areas emphasized are land classification mapping, farmland preservation, tot lot recommendations, recreational/sports needs, regional park and the survey. In each case current data was collected and analyzed in terms of population trends and land ownership changes in Agawam.

Land Classification Mapping

The first step involved reviewing and updating the required maps as listed in the 1990 Open Space and Recreation Plan Requirements, administered by the Executive Office of Environmental Affairs, Division of Conservation Services. The inventory revealed that the geology, soils, topography, landscape character, water resources, vegetation, fisheries and wildlife, scenic resources, and unique environments maps all met the criteria for the Open Space Plan. It was determined that the agricultural, open space, tot lots, and a regional park should be the focus of the update of the revised Agawam Open Space Plan. In the process of planning how to map the agricultural and open space parcels in the most efficient way, Dr. Kelly contacted the Mass GIS in Boston to investigate the availability of GIS data overlays for Agawam. It was discovered that Mass GIS lacked the updated data for Agawam. Mass GIS agreed to digitize the open space map for Agawam, if the students provided updated parcel information.

Farmland Preservation

Urban encroachment on the agricultural landscape has been cited in the literature as an increasing threat (Fishel 1985). The decline in farming activity brought about by high urban taxes, the anticipation of urbanization, and other urban related factors has become so widespread that it is now possible to see ring-like zonation of agricultural uses around a city. The sprawl of cities over agricultural land has generated a wealth of proposals for the holding of the choicest acreage for farming (American Farmland Trust 1991). Restrictive zoning is thought to be the best solution to this problem. The problem with this type of zoning regulation is how to decide whether a piece of land should remain agricultural or be zoned urban. Economists have devised a cost-benefit analysis plan in which alternative areas available for development are evaluated on the basis of which would be the least costly to the community (Sergeant 1976). The costs would include the net agricultural zoning values versus cost of essential improvements.

According to Muller (1976), agricultural zoning is no longer strong enough to protect farmlands and he suggests that the need for national efforts is imperative. He recommends that the federal government acquire title to agricultural land and reserve it for that use. It would then be sold or leased to operators, and the restrictions on its use would be stipulated in the deeds. This would create exclusive agricultural land preservation.

Farmland acreage in Agawam has declined from approximately 7,500 acres in 1950, to 3,800 acres in 1970, to 2,500 acres in 1982. By 1994, another slight decline of farmland is predicted. Significant acreage of farmland has been lost to residential and commercial development, and much farmland has been lost simply because of the poor economic setting for farming in the Commonwealth (American Farmland Trust 1992). Of note, also, is that the current figures do not include losses that will be incurred due to the expansion of Route 57.

Farmland decline generally began in eastern Agawam, and there is evidence that it was a factor even in the 1930s. Declines continued along established transportation accesses through the south and west boundaries of Agawam. Central Agawam is no longer an agricultural entity, only western areas of Agawam and adjacent areas of Southwick and Suffield have significant areas for viable farming.

The methodology for creating a matrix of farmland, conservation, and forestry lands for Agawam included reviewing district valuation reports. These reports were obtained for the tax break programs of Chapters 61, 61A, and 61B, along with a list of properties falling under the Agawam's Agricultural Preservation Restriction Program. These lists were verified or corrected using town maps of each lot. This information was then transferred into map and matrix form for addition to Agawam's revised Open Space and Recreation Plan.

In sum, zoning has not been effective in keeping productive agricultural land in active farming, as zoning is subject to change when economic forces are sufficiently strong. Those who would profit by zoning changes from agriculture to development usually succeed in obtaining zone changes. To solve this problem, we must look for methods which satisfy the conditions of being acceptable to the voters, taxpayers, and farmland owners. Agricultural land must be protected from the threat of development on as permanent a basis as possible under our land control institutions.

Tot Lot Recommendations

The methodology followed to determine the number of tot lots for Agawam involved the Department of Interior standards for playfields. This standard recommends 2.5 acres of playfield for every 1,000 population. The list of areas which lacked adequate playfields from the 1976 Agawam Master Plan was updated. The process involved superimposing the subdivisions which have been developed in Agawam since 1976 onto a neighborhood map of Agawam. Based of the 2.5 acres criteria, it was determined which neighborhoods lacked a playfield. It was found that Agawam has a deficiency in the amount of playfields, or tot lots, for its youth.

Tot lots are defined as play areas that are designed and built for use by elementary school aged children. The data show where the addition of several new tot lots should be developed throughout Agawam. These tot lots would provide safe areas for children to play. The data also indicate that another idea that should be considered for recreational use is playscapes. Basically, playscapes are very elaborate tot lots on a large scale. These playscapes can be built in a weekend without cost to the taxpayer. This concept is becoming a very popular and widespread idea in many communities in the Commonwealth. Playscapes are usually built on public land such as an elementary school. The supplies are sometimes donated or paid for through fund-raisers.

The labor to build playscapes consists of volunteers from the community, who are supervised by volunteer construction professionals. It is cost effective because it only takes a weekend to build, which is why people usually don't mind volunteering their time. It takes about a year of planning and fundraising for the work weekend. This is a benefit to the community because all the preparation that goes into the project tends to bring the community together. Also the children help out in the whole process, supporting the theory that if you build something yourself and take pride in it, the less likely you are to vandalize it. All in all, the playscapes are an excellent community development project that should be considered for Agawam.

Recreational/Sports Needs

Several interviews were conducted with officials from the recreational programs in Agawam. Findings from these interviews indicate that there is a great need for fields for various sports. The greatest amount of need is within the Soccer Association. The director of the Soccer Association expects that about 1,000 players will be involved in the soccer program next season. This means approximately 84 teams will need access to the current 20 soccer fields for practice and games. The use of the soccer fields is also limited due to the fact that three of these fields overlap baseball fields. There is also a soccer tournament that takes place in Agawam every

year and more available fields are needed to accommodate the growing numbers of players and teams.

Sport officials also indicate a deficiency in the number of available basketball courts to accommodate the numbers of players involved. Between all of the different age groups there are a total of 50 basketball teams this year. The Basketball Association has access to only 4 basketball courts. This limits each team to only one practice a week.

There are eleven areas of recreation across Agawam. Of the eleven areas, only one area has soccer fields that do not overlap baseball fields. Due to the growing interest in the sport of soccer there is a need to acquire more land for soccer fields. The Soccer Association has recommended possible locations for soccer fields. After examining open space parcels across Agawam, several site analysis and access problems arose. These problems include: (1) these parcels are heavily forested, making them costly to develop; (2) in some cases development of the land could cause drainage problems; (3) ownership of parcels could restrict park development; and (4) buffers are often necessary to protect residences from noise and other nuisance problems related to nearness to active playfields.

Regional Park

Perry Lane Park should be considered as a separate recreational site. This 33 acre park is located in central Agawam and has a tremendous amount of potential for providing town residents with enjoyable active recreational activities, and passive recreational trails. This park already has a preschool on its premises, as well as; two basketball courts, a pavilion, a pool, three tennis courts, a volleyball pit, a new jungle gym, a tot lot, and parking. However, approximately one third of the park is in use at this time. The town would benefit greatly from the use of its existing acreage.

Minimal construction projects would be needed to improve Perry Lane Park. Widening the existing entrance on Perry Lane with the addition of separate exits and entrances would enhance traffic flow. The addition of at least 50 new parking spaces on the western end of the park is also necessary. The entrance from Leland Avenue, on the eastern edge of the park, would also need an additional 50 parking spaces. The main objective is to preserve the natural beauty of the park, but at the same time provide the public with a desirable place to recreate. In order to meet these objectives, several types of trails could be constructed throughout the park, such as: mountain (pedal) bike paths, pedestrian paths for summer use, as well as cross-country ski paths for winter use. A stocked stream could provide the popular pastime of fishing in the area. A pedal bike path is another consideration. A remote control outdoor track could also be built. This sport could be professionally organized. Charging fees to use this track would help bring in money for park upkeep and at the same time provide the town with some exciting entertainment which could make Agawam unique.

Agawam Open Space and Recreation Survey

The purpose of the Open Space and Recreation Survey is to measure the attitudes of residents in Agawam about recreational use and acquisition of lands for open space preservation. The analysis of the results of the survey help to determine the needs of the community and the parcels that should be recommended for acquisition. The Agawam telephone directory was used to achieve a representative sample from the Agawam population. Working through phone directory listings of residential numbers, every ninth name listed was selected for the survey. Senior volunteers were then trained by students to conduct the survey. Due to time constraints their service was necessary to gather the data needed to qualify the survey as representing a significant percentage of the population. After the initial period of interviewing by the volunteers in the fall of 1992, the Town Planner of Agawam supervised other survey sessions. The data from these interviews will later be compiled in the computer program. The first step in analyzing the survey data involves encoding the responses into the Statistical Package for Social Scientists (SPSS). After initial data entry, the next step is to organize the survey data by running frequencies on SPSS. Frequencies were run for demographics, issue preferences, recreational needs, and willingness to support open space preservation measures. The following overall findings were compiled from the primary analysis of frequencies.

Fifty percent of the people responding to this survey have lived in Agawam 20 years or less. Out of the 183 survey respondents, 53 of the respondents (29%) had at least one member of their household between the ages of 5-17. One hundred and eighteen households indicated members in the 18-44 year range (64.5%). These population statistics help to determine what type of recreational needs the Town will have in the future. The needs, in turn, are the basis for the recommendations of the study.

Very few respondents rated Agawam's residential services and conditions as poor. Because more respondents were satisfied with the current status of the Town's services, allocation of funds for open space preservation would be a favorable measure to the citizens of Agawam. To support this statement, 83% of respondents favored open space and conservation areas as important to them. Ninety-five percent of those interviewed believe that farmland preservation is of importance. Also, 80% of the respondents rated recreation areas of importance. Due to the fact that respondents rate services as adequate, the support for acquisition of lands for public uses should be high.

Approximately a little more than half of the respondents (53%) have used facilities in neighboring communities. The majority of respondents stated that it is equally important to maintain current recreation areas and facilities as it is to acquire more conservation land. According to the majority of respondents, Agawam needs to expand or develop its nature trails, bike trails, and teen centers. Almost half of the respondents (46%) stated that Agawam needs to develop more children's playgrounds (tot lots). The most popular recreational facilities in Agawam among residents who responded to the survey are Westfield River Island, Robinson State Park, Pynchon Point, and Ridgeview Park. Because of the fact that current residents of Agawam travel to other communities for recreation, it is clear that improving Agawam's recreational areas would be supported by the community.

At least 80% of the respondents believe that the preservation of open space and conservation areas, farmland, and recreation areas are of importance to them. Eighty-one percent of the respondents would vote for city-supported land acquisition, 88% would vote to place restrictions on wetlands and floodplains, and 90% would preserve open spaces in Agawam by voting to strengthen zoning versus development. This trend of support for preservation shows that protection techniques should be recommended and implemented.

The next step in analyzing the survey involved cross-tabulation of questions. For example, cross-tabulations were run for the members of household with the type of recreation they prefer. Another example involved the members of household with the type of facilities they feel should be expanded. Finally, a cross-tabulation was run for respondents who reported they have teenage children in the home with the type of sports that the teenagers participate in. Areas of recreation, concerns over development, preservation of open space, and appraisals of the current facilities were all cross-tabulated to find areas of the most concern to the respondents. The results emphasized the need for recreational areas for children oriented households, the importance of preserving the community's character through open space preservation, and the support for projects which would accomplish these goals.

In sum, the survey conclusions represent the attitudes of the community in prioritizing open space parcels in Agawam. Since the results show that residents support acquisition of lands for open space preservation, it can be interpreted that expansion of recreational areas is important to the community. Of note, here, is the fact that historically the residents of Agawam support Town acquisitions, if federal or state monies are allocated. They do not support higher taxes to purchase properties. Therefore, land preservation techniques would be supported overall, if funding was granted. After completion of the revised Open Space and Recreation Plan, Agawam will be eligible for state and federal funds which could accomplish these goals. Since Agawam residents responded favorably to land preservation measures, it seems that protection measures would win a majority of support from the community.

Recommendations for Five Year Action Plan

Based on the results of the research the following recommendations for the five year action plan were submitted to the Town Planner of Agawam:

- Several specified parcels for open space conservation should be acquired.
- Playfield improvements and expansion are advocated for several areas.
- Perry Lane development should begin in the first year of the action plan.
- APR proposals should be encouraged and followed up by a Farmland Advisory Committee.
- Farmland district zoning bylaws should be drafted.
- The Town should purchase sensitive wetlands & floodplain areas.
- The Town should implement a comprehensive program to design a greenbelt adjacent to water bodies.

The Town of Agawam is currently developing the five-year action plan based on the data analysis and findings from the Special Topics class project.

Conclusions

According to demographic statistics, which show growth in Agawam's elderly, as well as child-bearing age residents, Agawam should increase recreational facilities and acquire specified open space parcels. These improvements would serve both sectors of the population. If development pressures continue as they have over the past ten years, Agawam will not be able to meet the recommended recreational needs of its residents. Therefore zoning changes, agricultural preservation, and acquisition of open space are imperative.

Tot lots are one way of meeting the community's needs. They are designed and built for the use of children and they would create safe havens for children to play. Playfields for organized sports should be expanded to meet the needs of older children in the community. Finally, the development of the regional Perry Lane Park would provide comprehensive recreational services for the public.

The farmland in Agawam is being subdivided at an alarming rate. Farms are being isolated by current development trends. One way to slow this development would be to establish a farmland district through the town's bylaws. A new expansion of the current Agricultural Preservation Restriction programs could also slow development and encourage the owners of such lands to resist selling. The Town of Agawam could also begin acquisition of parcels for open space conservation either through public participation or private donation.

With the Westfield and Connecticut Rivers comprising a high percentage of its borders, Agawam should implement a comprehensive program to preserve a greenbelt adjacent to these rivers. This greenbelt plan would epitomize the concerns of this study by offering environmental and recreational planning solutions.

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Landscape and Visual Perceptions

NATURAL RESOURCE INVENTORY AND MANAGEMENT: FOREST FIRE MANAGEMENT AND THE STEAMTOWN NATIONAL HISTORIC SITE

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A fire management plan was developed for the National Park Service at Steamtown National Historic Site in accordance with National Park Service requirements. A Geographic Information System (GIS) was used to identify areas at risk from fires resulting from the use of steam locomotives along the 32 mile mainline excursion route associated with Steamtown. The GIS allowed for identification of areas at high risk of fire and allowed for the production of detailed maps for use by fire control organizations. Further implications of GIS in tourism and recreation management is discussed.

Introduction

Recreation and tourism planning often involves identifying potential threats to the environment. Impacts of tourism to the physical environment have been discussed by several authors (Cohen 1978; Pearce, 1985). One way to meet potential threats is to monitor the physical environment during the course of the activity or event. Another way to address potential impacts is to develop planning strategies that identify resources that are at risk from the activity as well as contingency plans that serve as response strategies should environmental damage occur.

Planning and development of tourist attractions often requires detailed information concerning the surrounding physical environment. Such information is often of a spatial nature and available in different scales of measurement. The different scales of the information may prove problematic in terms of developing a composite form of the total data base. Use of Geographic Information Systems (GIS) allow for the inclusion of spatial data at different levels of scale and provide for the compilation of different visual compositions of the data.

Project Description

Steamtown National Historic Site is a restoration of an historic steam engine railroad. The site consists of 25 steam locomotives, a rail yard with roundhouse and visitor center, and a 32 mile mainline excursion rail line over which visitors will be able to ride on an excursion train powered by a steam locomotive. The use of the steam locomotives involves a risk of fires resulting from hot cinders from the locomotive's stack and from sparks from the train's wheels.

The purpose of this project was to provide the Steamtown National Historic Site with a fire plan that would detail those sections of the mainline excursion rail line at risk from fires resulting from the use of the steam locomotives. In order to assess the risk of fire to the surrounding area, it was determined that a Geographic Information System (GIS) would best serve the need to assimilate multiple sources of information into a usable composite. A Geographic Information System is a computer management tool that treats spatial information as a series of lines (vectors) or cells (rastors). There are essentially two types of GIS, a vector-based system consisting of a series of lines, polygons or points, and a rastor-based system consisting of a composite of homogeneous cells (Burroughs 1987).

The Geographic Information System chosen for this project was ARC/INFO 3.0. ARC/INFO is a vector-based GIS and allows for accurate representation of linear features. As many of the physical features in this project were of a linear nature (e.g. rail line, streams, roads), the use of this vector-based GIS was desired.

To develop the GIS, data from different sources had to be digitized and incorporated into the ARC/INFO data base. Infrastructure data were obtained from 7.5 minute topographic maps from the U.S. Geologic Survey. Vegetation cover types were discerned from aerial photographs at 1:12,000 scale. Understory vegetation and emergent grasses adjacent to the rail line were delineated through the use of a video film taken from a helicopter flown approximately 400 feet above the rail line. All data were field checked for accuracy.

Data were digitized according to coverage layer. A coverage layer refers to those features that will be examined as a complete unit. For example, the rail line was treated as one coverage layer. A total of eleven coverages were used for this project. These coverages included three linear coverages: rail line, roads, streams; six polygonal coverages: lakes and wetlands, residential developments, municipal boundaries, forest cover, areas of steep terrain, and natural fire breaks; and two point coverages: stations for volunteer fire companies, and access points along the rail line.

As this project was concerned with delineating fire hazards, special attention was directed to areas having high fuel loads and steep terrain. Oaks and conifers are especially vulnerable to fire. The dry, curled nature of oak leaves and the dry, resinous characteristics of conifer needles and branches make these trees particularly hazardous when considering fire threats. Steep terrain is another feature to consider, as fire will tend to travel more rapidly uphill than downhill (Albini 1976). Both forest vegetation type and terrain were predominant factors when determining areas at high risk to fire.

Consideration was also given to response from fire fighting crews. The point location of volunteer fire companies and their radius of jurisdiction was included in the assessment of overall fire fighting response. Available surface water (streams and lakes) were also analyzed as these waters serve as sources of water for fire fighting efforts.

Description of Project Site

This project was undertaken on the rail line from Scranton to Pocono Summit in the Pocono Mountain region of Pennsylvania. The rail line runs in a general southeasterly direction from Scranton to Pocono Summit. The Pocono Mountains are characterized by rolling mountains and plateaus that were covered during the Wisconsin glacial period. As a result of the glacial action, this region contains many wetlands and small lakes.

The forests in the project site are predominantly mixed mesophytic, with maples, hemlock and beech the dominant species. Mixed oaks and white pines occur on the slopes and plateau portions of the area. Birch and aspen are common near the rail line, as are large areas of emergent grasses of various species.

Results

The radius of response for each volunteer fire company was used to create six different fire zones along the mainline excursion route (figure 1). Areas of high fire risk were then determined for each fire zone based on vegetation, steep terrain and proximity to developed areas. After determining the high risk areas, nearest water sources and access points were then identified. The final composite allows the local fire company to note the areas of high risk within their district, the closest access points and availability of water.

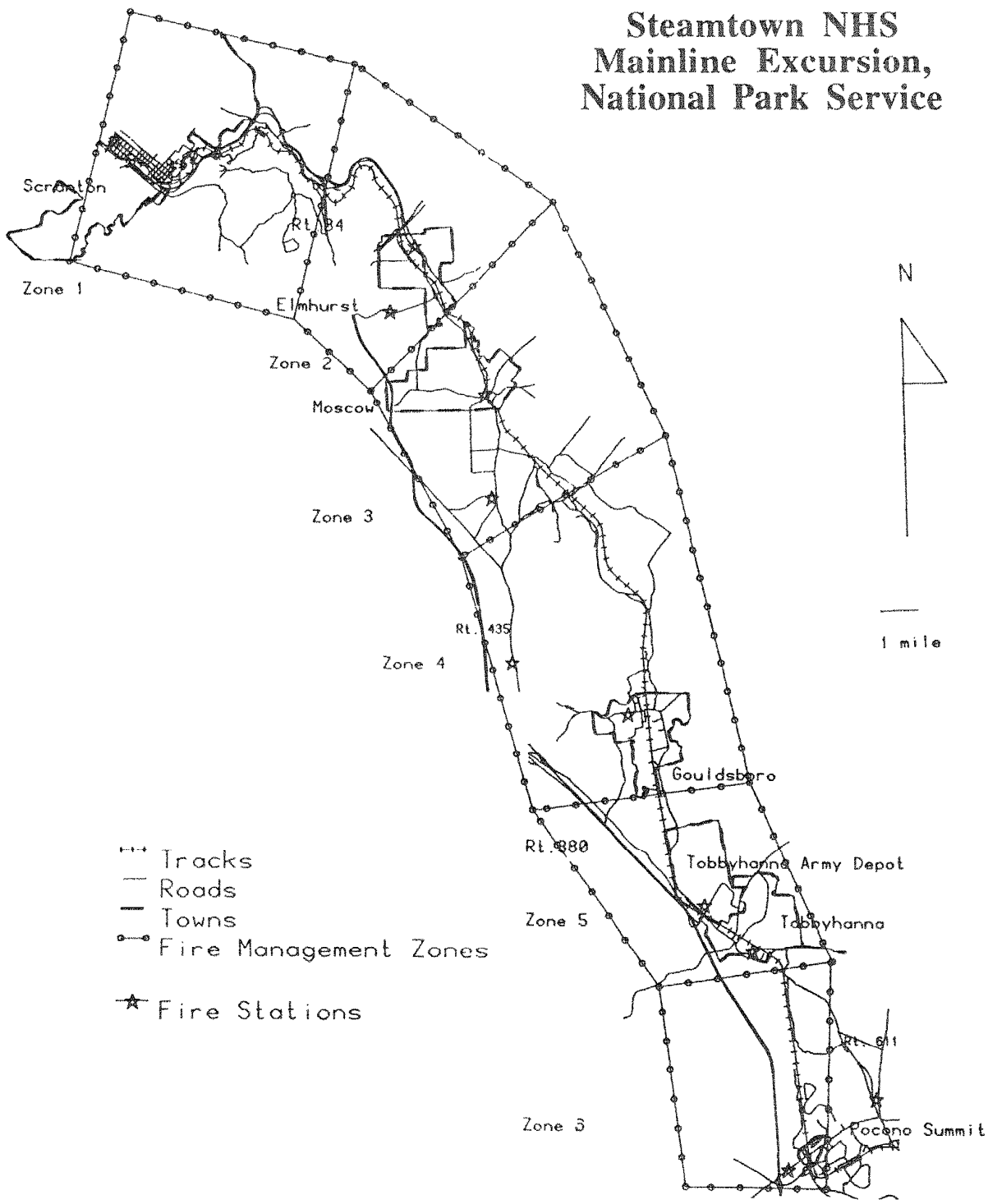

Figure 1. Six fire risk zones for Steamtown National Historic Site.

Discussion

Development of tourist attractions requires planning to reduce or eliminate potential environmental impacts. Special consideration must be given to develop response strategies to address potential catastrophic events such as forest fire, flooding or land subsidence. Geographic Information Systems can be a useful tool in delineating areas of potential hazard. Geographic Information Systems allow for comparisons of multiple layers of spatial information that would be difficult to represent in any other manner. The use of GIS also permits the production of composite maps depicting coverages in any combinations required of the resource manager.

Future resource management planning involving spatially referenced data necessitate data systems able to utilize spatial information, store and retrieve the information and provide visual reproductions without losing the spatial context of the data. Geographic Information Systems able to meet the demands of local managers are now available for personal computers. These systems allow for smaller data sets originating with easily obtained data, and are designed for users having little training in GIS. Individuals involved in recreation and tourism planning are becoming more aware of the advances in planning tools available and make use of these devices. Geographic Information Systems are among the advanced instruments available to the planner. It was the intent of this project to highlight the versatility of GIS for recreation and tourism planning so that more managers and planners will seek to use GIS in planning for recreation and tourism.

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LONG TERM VISUAL EFFECTS OF ALTERNATIVE CLEARCUTTING INTENSITIES AND PATTERNS [1]

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This study evaluates the scenic impacts of simulated alternative clearcutting management systems for the White Mountain National Forest. Alternatives represented removal of 1, 2, 3, 4 and 5 percent of the timber in two viewsheds every 12 years using either scattered or concentrated clearcut units of 5, 15 and 30 acres. Significant differences in scenic value exists among these alternatives.

Introduction

Since the politically charged controversy at the Monongahela National Forest in the 1960s and 1970s, the practice of clear-cutting has changed significantly. While the public still thinks of whole mountain-sides denuded of trees, significant regulations control the use of clearcutting on Federal lands. For instance, the current practice in the White Mountain National Forest is to limit individual clearcut units to under 30 acres. However, there is still significant concern about clear-cutting among the public, and much of it can be attributed to its appearance.

Political pressures to restrict cutting in parts of the Pacific Northwest and Southeast may increase pressure to maintain cutting activity in Eastern National Forests, such as the White Mountains, at the limits of sustainable yield. However, the White Mountain National Forest is also a very popular recreation area for the northeastern megalopolis. Forest managers in the White Mountains are therefore concerned about the potential cumulative impacts of clearcutting activity on the viewing and recreation experience of forest visitors. Scenic impacts are particularly sensitive since they are apparent from such great distances.

A common solution proposed by many is the reduction in size of clearcut units. The forest landscape architects and other managers became concerned that reductions below the current 10 to 15 acre average size might create a checker board or moth-eaten appearance across forested slopes. As a result of their concern, a study was developed to visually simulate a series of realistic forest management scenarios in order to assess their scenic value.

Methods

Viewpoint Selection

The viewpoints selected for this study are from Middle Sugarloaf Mountain and Welch Ledge, in the White Mountain National Forest. Both are vistas accessible from popular and high use hiking trails. Both views are predominately in the middleground, a zone 1 to 3 miles from the viewer, and lack a visible foreground. Each view was photographed with Kodacolor 35 mm film on a clear August day. A 50 mm lens was used to replicate the viewer's normal cone of vision and to keep optical distortion to a minimum. Additional middleground photographs were taken of other areas representing the types of regeneration described by the alternative management scenarios. These would provide information about the patterns and textures necessary to create accurate visual simulations.

Management Scenarios

While many forest studies simulating environmental factors are reasonably based on checkerboard patterns (e.g. Li, et al. 1993), this simplification is inappropriate for a visual study. It was decided that the most realistic approach would imitate the way cutting areas were actually allocated and designed by the forest landscape architect. Cutting periods are normally between 10 and 12 years apart on the White Mountain National Forest. Therefore, it was decided to simulate three entries showing clearcut opening representing approximately 1 year, 12 years and 24 years of regeneration growth. It was decided that showing more than three entries was not necessary, since at this distance the visual effect of the original clearcut readily disappeared after 30 to 35 years. Three additional variables were identified as being important to consider in creating the alternative scenarios: cutting intensity, cutting pattern, and cutting unit size.

Cutting intensity is the *percent* of a viewshed to be clearcut each entry. The guidelines in the Forest Plan (White Mountain National Forest, 1986) for the current 10-year planning period allow for up to 7 percent of a viewshed to be in new openings. However, when the forest landscape architect actually began to layout and design the scenarios over three cutting cycles, it was determined that cutting 7 percent of a viewshed per decade would exceed a comfortable level of disturbance, and could therefore not be sustained. After some trial and error, the team from the White Mountain National Forest felt that cutting 5 percent of the viewshed per decade represented a reasonable upper limit of activity. The other simulated cutting intensities were for 0, 1, 2, 3 and 4 percent.

Two design concepts or *patterns* were used. The first scattered the cutting units through out the viewshed; the second concentrated the units for each entry into a different third of the viewshed. The Forest Plan assumes that cutting would be scattered randomly throughout a view. However, to implement projects it is common for sale units to be concentrated into a smaller portion of a viewshed. When this occurs, the percent of the view effected around the sale is substantially higher, but it will be lower in other parts of the viewshed.

The *size* of the cutting units is based on the current guideline in the Forest Plan (White Mountain National Forest, 1986), which provides for 10 or fewer observable acres per unit. Since some portion of a unit may not be seen, this translates to an average unit size between 10 and 14 acres. The maximum unit size allowed in the Forest Plan is 30 acres. This establishes an upper range in size for units from 20 to 30 acres. The minimum unit size for the simulations was set at 4 to 5 acres.

Several appropriate units were designed and located for each possible combination of viewpoint, pattern and size. These units were then digitized as a line file and combined with a

1/ This project was supported in part by funds from the White Mountain National Forest and the North Central Experiment Station, Chicago, IL.

digital elevation model using New Perspective software. For each simulated alternative, the appropriate units were selected that would produce the required acreage for each entry period and that would present an acceptable design, both for that individual entry and for the cumulative effect. In designing the concentrated pattern scenarios for the Sugarloaf view the oldest entries were nearest the viewer and the most recent entries were farthest from the viewer. The design for the Welch Ledge scenarios' concentrated pattern proceeded in the opposite direction, with the most recent entries closest to the viewer.

A master overlay of the units for both viewpoints was created for each pattern and size variation. These were plotted in perspective to match the camera view of the original two photographs. The drawings included outlines of each unit, with a ring of trees to show the scale of the surrounding vegetation, and control points for registering the drawings. Using these drawings, the areas to be cut at each entry for each alternative can be located within the view.

Visual Simulations

Original 3.5-by-5 inch photographs from the two viewpoints were scanned at 400 dots per inch to create full color (24-bit) digital images. The scanner was a Microtek ScanMaker 600ZS that had been color calibrated to the computer monitor using Savatar ScanMatch software. These digital images were edited using Adobe Photoshop version 2.0.1 software running on a Macintosh IIfx computer with 20 megabytes of RAM, a Macintosh Display Card 8•24 , and a 400 megabyte hard disk.

The existing scenes were first edited to simulate mature revegetation in areas where harvesting was apparent. Natural openings were left unchanged. This process is relatively simple using the rubberstamp tool to sample nearby areas of mature forest in the photograph and use their texture to paint over the clearings. The color balance, hue, and saturation of the images were further adjusted in Photoshop to create the control images on which the other simulations are based.

The New Perspective overlays locating the harvest units for each alternative were also scanned. Several control points were used to register these drawings with the control image or the appropriate viewpoint. The cutting units were isolated and cut from a drawing, and then pasted into the digital image to serve as guides for locating the clearcut areas. The appropriate regrowth was digitally painted into the clearcut areas using image material scanned from additional photographs. Care was taken to match the appropriate tones and textures that highlight the visual contrast between the old and new vegetation. Particular attention was paid to light and shadow patterns. A site visit to the White Mountain National Forest was made at the time that the first simulations were being created to field check the quality of the simulation techniques. The final images were therefore of a consistent high quality.

The resulting 64 scenes, [2 views x 2 patterns x 5 percents x 3 sizes = 60 scenarios, plus the 2 revegetated and 2 original scenes], ranged in size between 2.5 and 4 megabytes. The Sugarloaf images measured 1185-by-767 pixels, and the Welsh Ledge images measured 1378-by-969. They were all printed to 35 mm slide film with a resolution of 4,000 dots per inch and 24-bit color using a Montague FR1 film recorder.

Scenic Evaluation

The series of slides for each viewpoint were randomized, and then placed in a slide tray alternating between viewpoints. Students were recruited from two junior level classes at the College of Environmental Science and Forestry to evaluate the scenic quality of the scenes. They were told:

> You are going to be shown, one at a time, some color slides of forest vistas. These slides represent actual forest scenes and you are asked to evaluate these forest scenes rather than the quality of the slides themselves. You are to evaluate the scenic quality of each forest vista by assigning it a rating number between one and ten. Those forest scenes judged very low in scenic quality are assigned a rating of one, while those judged very high in scenic quality are assigned a rating of ten. Please use the full range of numbers if you possibly can and please respond to each slide.

They were then shown the last 10 slides in the series to familiarize them with the variety in scenic quality represented by the slides. The researcher indicated the first slide to be evaluated, and identified each subsequent slide. Each slide was shown for 10 seconds, or as long as was necessary for everyone to finish their evaluation. Respondents also provided some basic information about themselves.

Results

The 87 evaluators of these scenes were students majoring in landscape architecture (55%), environmental studies (24%), or natural resource management (21%). Nearly every one was in their early 20's, 75 percent are male and 81 percent have lived in a rural area or small town with a rural setting.

The mean scenic values and their standard errors are shown in Table 1 for the attributes that determined the management scenarios and their visual simulations: viewpoint, pattern of cutting units, percent of viewshed cut, and size of cutting units. The 95 percent confidence intervals defined by the standard errors indicate that within each of the four attributes, the mean scenic values are significantly different from each other. The Sugarloaf simulations are more scenic overall than the Welch Ledge simulations. This does not seem to be due to landform characteristics, since the revegetated scenes are not significantly different from each other. It is likely that the difference is because the most recent entries are nearer the viewer in the Welch Ledge simulations.

Scattering the units randomly throughout the view produced more scenic views than concentrating them. While a scattered random design pattern may be more scenicly desirable, it is also thought to causes greater forest fragmentation over time and may be less desirable from a biological perspective (Li, et al. 1993).

The public has lobbied for smaller and smaller sized cutting units, anticipating that they would have less of a scenic impact. This study was initiated, in part, because forest landscape architect was concerned that the large number of smaller units would create a checker board pattern, making the forest appear moth-eaten. The results suggest that the smaller unit size is less scenic than the unit size typically used on the White Mountain National Forest. However, the results indicate that larger units are also less scenic. This may place visual objectives in conflict with biological objectives, since Li et al. (1993) found larger units to reduce forest fragmentation.

There is a consistently linear decrease in scenic value as the percent of the viewshed being cut increases. The 95 percent confidence intervals indicate that this change is significant at every level, though the actual difference in scenic value between 4 and 5 percent is relatively small.

The results of the analysis of variance shown in Table 2 indicates that there are significant differences among the means for all of the attributes that were used to define the alternative scenarios. The ANOVA further shows that all the second order interactions are also significant. These relationships are shown graphically in Figure 2.

Table 1. Mean scenic value and standard error of the mean for management scenario variables.

	Mean	Std. Error
Viewpoint		
Sugarloaf	6.28	.039
Welsh Ledge	5.60	.042
Pattern of cutting units		
scattered	6.07	.040
concentrated	5.81	.042
Size of cutting units		
4 to 5 acres	5.78	.052
10 to 14 acres	6.14	.049
20 to 30 acres	5.90	.048
Percent viewshed cut		
0	8.09	.058 †
1	6.64	.059
2	6.11	.059
3	5.34	.059
4	4.83	.061
5	4.64	.065
existing scene *	5.51	.066 †

* The ratings for the existing view are not included elsewhere in this table.

† The sample size used to calculate these standard error of the means was 1044, the same as for the other percent levels.

The three graphs to the left compare the two viewpoints. The first shows that there is little difference between the viewpoints when the scattered pattern is used to locate cutting units. However, the difference between the concentrated pattern scenarios is quite large. It is thought that this reflects rater reactions to the more recently cut areas being farther from the viewer at Sugarloaf and nearer at Welch Ledge.

The next graph clearly shows the scenic impact of increasing the amount of the forest cut. The most severe change is from no cutting to 1 percent removal, while the least severe impact is the difference between 4 and 5 percent. The views where the most recently cut areas were closest to the viewer (Welch Ledge) had nearly the same scenic value as the Sugarloaf views that sustained a 1 percent greater removal. The scenic value for the existing viewpoints is also shown on this graph.

The last graph on the left indicates that the current practice of making cutting units between 10 and 14 acres has less of a scenic impact than would either smaller (4 to 5 acre) or larger (20 to 30 acre) cutting units. This tendency is much more pronounced in the Sugarloaf view, where the most recently cut areas were farthest from the viewer.

The top graph in the right column indicates that initially scattered cutting units have less scenic impact than concentrated ones. However, as the cutting intensity increases the difference between the two patterns seems to disappear. The next graph shows a similar tendency. Smaller scattered cutting units have less scenic impact than smaller concentrated units. However, the difference between the two patterns seems to disappear as cutting intensity increases.

The final graph indicates that the cutting units of 10 to 14 acres have higher scenic value at all intensities of removal than if either smaller or larger sized cutting units are used.

Table 2. Analysis of variance for the effects of viewpoint, cutting pattern, percent of area cut, cutting guidelines, and their second order interactions on scenic value.

Source	df	Sum of Squares	Mean Square	F-ratio	Prob
Constant	1	221086.0	221086.0	62365.0	≤0.0001
viewpoint	1	641.2	641.2	180.9	≤0.0001
pattern	1	136.9	136.9	38.6	≤0.0001
percent	5	9048.5	1809.7	510.5	≤0.0001
size	2	78.8	39.4	11.1	≤0.0001
view*pattern	1	318.8	318.8	89.9	≤0.0001
view*percent	5	132.4	26.5	7.5	≤0.0001
view*size	2	107.3	53.6	15.1	≤0.0001
pattern*percent	5	54.8	11.0	3.1	0.0086
pattern*size	2	38.5	19.2	5.4	0.0044
percent*size	10	144.7	14.5	4.1	≤0.0001
Error	6229	22082.2	3.5		
Total	6263	32550.1			

Conclusions

Considerable care was taken to make the design of these scenarios as realistic as possible. Forest landscape architects used the same procedures to specify and locate cutting areas for these scenarios that they normally use on the forest. These procedures included the use of a geographic information computer program to draw the cutting units in accurate perspective. The research landscape architects creating the simulations made several site visits to photographically document the scenes and to validate the colors and textures being used to simulate the clearcut and revegetated areas. Again, the computer techniques provided the control necessary for consistently high quality across the creation of 62 simulations. These computer assisted techniques used both on the forest and in the digital darkroom seem to provide effective tools to assessing the scenic affects of alternative forest management scenarios.

The results of this study suggest several implications for the visual management of forest areas.

1. The optimal unit size for clearcut areas seen in the middleground is 10 to 14 acres. Both larger and smaller units had lower scenic value when seen at this distance.
2. Increased cutting intensity is associated with increased scenic impacts. Vistas of the middleground without any cutting areas are more scenic than those with cutting areas.
3. Recently clearcut areas in the middleground are less scenic than clearcuts with substantial young regeneration. The researchers could not simulate visual differences between mature forest and 35 year-old regeneration.
4. Recently clearcut areas in the middleground have less scenic impact the farther they are from the viewer.

5. The strategy of scattering cutting units throughout a middleground viewshed has substantially less scenic impact that concentrating the units nearer the viewer. Concentrating the units has approximately the same scenic value as scattering the units only when the most recently cut areas are farthest from the viewer.

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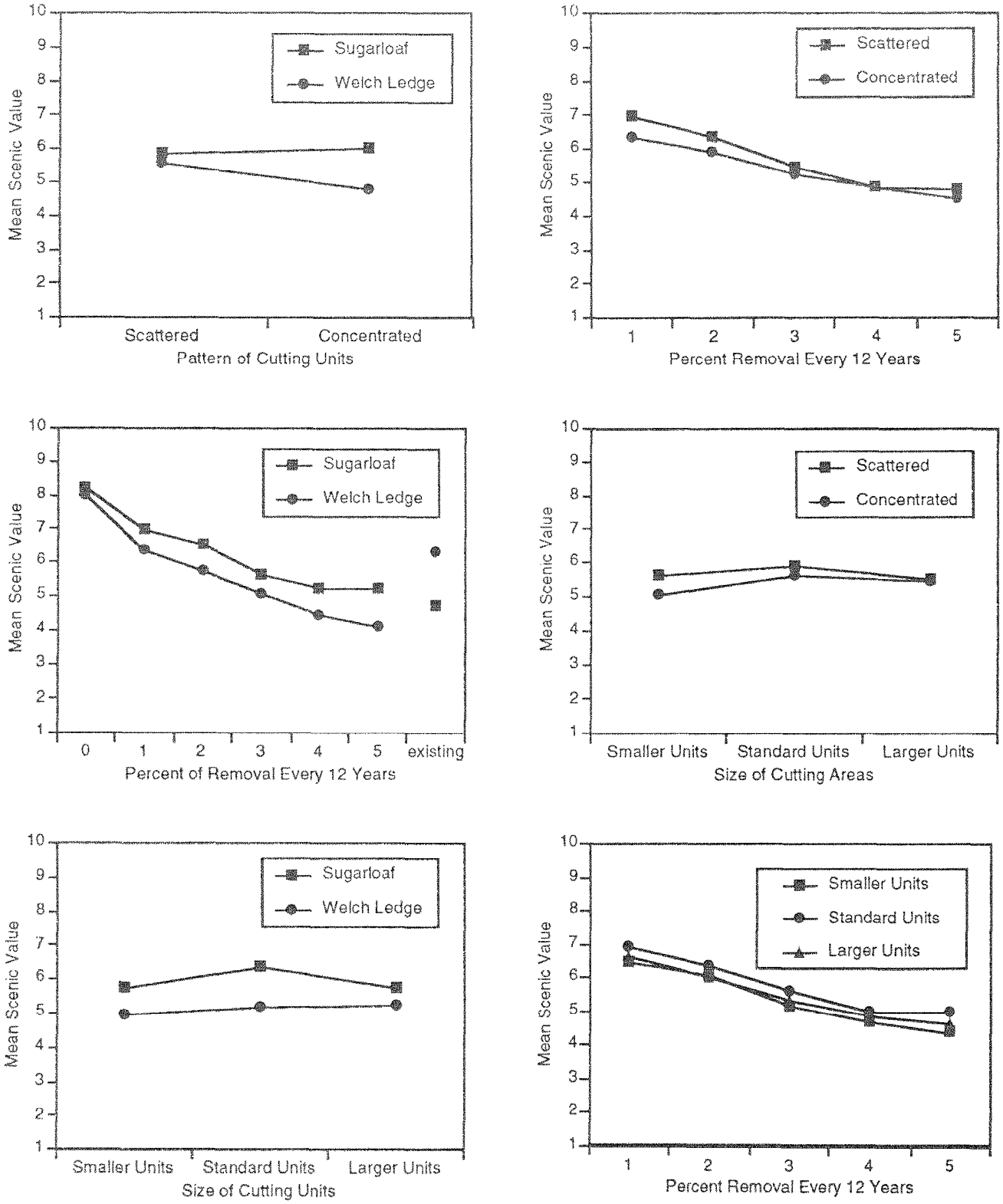

Figure 1. Plots of the relation between mean scenic value and the two-way interactions among viewpoint, pattern of cutting units, percent of viewshed removed, and size of cutting units.

MANAGING EASTERN HARDWOOD FORESTS FOR VISUAL QUALITY

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Respondents (n=503) rated the visual quality of seven silviculture systems as the forest regenerates over approximately 25 years. Of the sites rated, the non-managed mature forest is most visually pleasing, with crop tree release second. Clearcutting, on the average, has the lowest visual quality. A scenic beauty prediction model is presented. Although the twenty-five year regeneration time is not an effective visual management tool, other efforts such as retaining over 50% residual overstory or controlling the amount of slash that remains on the site may help.

Introduction

The need to integrate recreation and aesthetics values into multiple-use land management planning in the Forest Service became evident with the passage of the Multiple Use Sustained Yield Act of 1960, the National Environmental Policy Act of 1969, the Renewable Resources Planning Act of 1974, and the National Forest Management Act of 1976. The Visual Management System (VMS) and the Scenic Beauty Estimation Method (SBE) have since emerged as methods to quantify visual quality.

The VMS was developed in the 1970's by the Forest Service, using the expert opinion of landscape architects to describe the visual quality, sensitive areas, and appropriate site specific management prescriptions (USDA Forest Service 1974). Currently, all 190 million acres of Forest Service lands have been assessed using the VMS approach (Tlusty and Bacon 1989). About the same time, psychophysics (the study of relationships between the physical characteristics of an environment and human perceptions/judgments of that environment) was used to scientifically measure the perception of the general public to determine scenic beauty. This goal was attained through the development of the SBE by Daniel and Boster (1976).

However, to produce results that can be applied by forest resource managers, aesthetic perception must be modeled with standard forest mensuration data. To accomplish this, the SBE method is emerging as the most useful scenic beauty management method. Most past aesthetics research has been conducted in the west (Benson and Ullrich 1981) the arid southwest (Brown and Daniel 1984), the north central region (Ribe 1991), or in the southeast loblolly pine stands (Hull and Buhyoff 1986), and cannot be assumed to generalize to northeast hardwood stands. In the eastern hardwoods, Brush (1979) looked at landowner perceptions but did not link those with mensuration data. Vodak and others (1985) limited the planning horizon to six years since a cut in eastern hardwoods. Long term effects of alternative management methods began to be studied by Hull and Buhyoff (1986), who pioneered the "Scenic Beauty Temporal Distribution" (SBTD), focusing on pine stands. Palmer (1990) assessed the effects of time since harvest in the northeastern forests, but controlled the cutting level to leave a residual 70 sf/acre basal area.

The North East Decision Model (NED) is currently being developed by the U.S. Forest Service to respond to these needs of understanding future consequences of management decisions. Given the goals of the landowner/manager (timber, watershed, recreation/aesthetics, wildlife, ecology, or a combination of these), this "expert system" will make recommendations of the appropriate management systems and produce a prediction of the resulting property or forest stand in terms of timber production, visual quality, etc. (Marquis 1991). NED is to be accessible to all landowners. This study is a portion of the research and development process for the aesthetic module of NED, and will determine and predict the visual impacts of various silviculture systems as the northeast hardwood forest regenerates over time.

Silviculture Systems

This study explores the visual quality of various silviculture systems as they regenerate. Therefore, it is necessary to understand basic forest management terminology.

Silviculture is the art of producing and tending a forest to create and maintain the kind of forest that will fulfill the objectives of the owner. These objectives may include any combination of the following: timber, wildlife, water, ecological considerations, recreation and aesthetics (Smith 1986). There are a number of different silviculture systems. This study looked at seven systems, which are very briefly defined below, and are listed in the order of the amount of overstory (residual trees) left standing after a cut.

A Clearcut involves removal of the entire stand in one cutting. A Deferment Cut leaves up to 30% residual trees, with the cut of the residuals deferred at least 15 years up to two rotations later. The Crop Tree Release is a thinning to select certain "crop" trees, such as those that meet the timber, wildlife, and/or aesthetic goals. Openings are made around those trees to allow their efficient growth and to allow for regeneration. A Shelterwood is used to regenerate seedlings of shade tolerant species by removing the old stand in a series of cuttings, providing shade under the seed trees. Area-wide Thinning involves removing any trees necessary to open up the forest canopy enough to accelerate growth of the overall forest. A Single Tree Selection is a removal of scattered mature trees to meet the stand structure goal. However, no openings greater than 0.1 acre are normally allowed. Finally, a No Cut system allows only natural change of the stand structure. It is basically an undisturbed, mature forest.

Objectives of the Study

The objectives of this study are to:

1) determine the relationship between the quantitative characteristics of eastern hardwood forests and scenic beauty,
2) develop a prediction model for scenic beauty using forest stand variables that can be manipulated by managers, and
3) compare the visual quality ratings of the various silviculture systems.

Methods

Site Selection

Within-stand color slides were collected according to a matrix of residual overstory densities (or stocking level) by height of regeneration. The 20 cells in the matrix represent seven silviculture systems and up to 25 years of regeneration since cut (Table 1).

Table 1. Silviculture systems within the slide collection matrix.

Height of Regeneration OR Years Since Cut	Stocking Level				
	0-9%	10-25%	26-50%	51-80%	81-100%
0'-3' OR 0-2 years	Clearcut	Crop Tree Deferment	Crop Tree	Crop Tree Selection Thinning Shelterwood	Selection No Cut
3'-10' OR 2-7 years	Clearcut	Crop Tree Deferment	Crop Tree Shelterwood-2nd cut	Crop Tree Selection Thinning	Selection No Cut
10'-20' OR 7-15 years	Clearcut	Crop Tree Deferment	Crop Tree Shelterwood	Crop Tree Selection Thinning	Selection No Cut
20'-30' OR 15-25 years	Clearcut Shelterwood-final cut	Crop Tree Deferment	Crop Tree	Crop Tree Selection Thinning	Selection No Cut

Four slides representing each cell in the matrix were collected during the summer months of 1991 and 1992 from 34 forested sites in the Allegheny Plateau, for a total of 80 slides. Slides were rated by 503 college students on a "scenic beauty" Likert scale of one (low) to ten (high) during the fall of 1992.

Subjects

While 66% of the respondents were United States citizens, 34% were international students, with 25% of those from Asia. There were 69% males and 32% females surveyed. Only 7% of the sample were forest management students. The average age was 22. Most (78%) had permanent residence in small to medium communities of under 150,000 population. While there may be some significance between this demographic data and scenic beauty perceptions, the sample was instead treated as a whole in the analysis for this paper.

Stand Variables

For each site, or stand, forest managers provided mensurational data, adjusted to the date of the photograph. Stand data is commonly used, easily measured, and controllable by forest managers, making it useful for prediction modeling. These variables shall be referred to here as "stand variables" (Table 2).

Basal area is a commonly used measure of stand "density" and is the total diameter breast height (dbh) cross-sectional area of the trees in the stand, measured in square feet per acre. It is indicative of the volume of wood on the stand. The stocking level is another commonly used measure of density. It is the ratio of the amount of timber currently on the land in relation to what the land could carry according to timber production norms, and is based on site quality, tree species, trees per acre, and basal area. There are a number of obvious interrelationships that occur between these stand variables. For example, as basal area increases, stocking increases. As trees per acre increases, seedlings per acre decrease.

Years since cut may represent the stand age in cases of clearcuts. Otherwise, for partial cuts, it represents the age of the regenerating forest growth, and is closely related to the height of the understory regeneration. Silviculture system is a class variable that includes seven systems, arranged on a continuum of ascending levels of residual overstory, as listed above.

Slide Variables

It was hypothesized that respondents' ratings may be affected by within-slide variability. We were interested in looking at the possible correlations between these variables and scenic beauty. Each slide was assessed for the following visual factors, referred to here as "slide variables."

The number of large trees visible were simply counted in each slide. Slash was estimated from the slides by imagining a 6' diameter circle in the center of the slide and estimating the percent coverage, by tens, of slash. Height of slash was under 18 inches in all 17 of the 80 slides in which slash was present except for three slides, where slash was under 36 inches. Sites were specifically chosen that had little or no slash present (21% of the slides had an average of 50% slash visible). The large tree effect and slash has been shown to be significantly correlated with scenic beauty in past research (Schroeder and Daniel 1981).

The percent, by tens, of sky visible in the slide was estimated, as was the percent of ground cover, or herbaceous plants below 18 inches. It was noted whether there were large, decaying, old logs visible in the slides, and if the vantage point of the photo was from within the stand or adjacent to the stand. The depth of visual penetration into the slide at eye level was estimated to the nearest 25' to the longest distance of >150'. Conversely, the percent of screening, by tens, of foliage and stems at eye level was estimated. Additional slide variables such as the length of a grass or fern foreground visible in the slide, and the presence of light shadows were assessed, but correlations were not significant.

Analysis

Correlations and scatter plots assisted in initial model development. A prediction model was developed through the use of stepwise regression and general linear modeling. Finally, silviculture systems were compared using the pairwise t-test.

Results and Discussion

Correlations

Correlations were calculated between the mean SB rating for each slide and all stand and slide variables to determine the most significant scenic beauty predictors. The scatter plots revealed a nonlinear relationship between scenic beauty and the variables basal area, trees per acre, and visual penetration. Thus, the quadratic terms (variable^2) were created as additional potential predictor variables (Table 2).

Table 2. Potential scenic beauty predictors and correlations with mean scenic beauty rating[a].

Predictor Variable	Correlation[b]	*p*
Stand		
Basal area (>1" dbh)	0.689	.0001
Basal area^2	0.576	.0001
Stocking level	0.672	.0001
Silviculture system	0.675	.0001
Years since cut	0.579	.0001
Trees per acre (>1" dbh)	0.235	.036
Trees per acre^2	0.404	.0002
Seedlings per acre (<1" dbh)	-0.235	.069
Slide		
Large trees	0.584	.0001
Slash	-0.544	.0001
Sky visibility	-0.460	.0001
Old logs	0.432	.0001
Ground cover	0.266	.017
Vantage point	0.167	.139
Visual penetration	-0.134	.236
Visual penetration^2	-0.279	.012
Screening	0.077	.497

a/ N=80
b/ Pearson Correlation Coefficients

In discussing the stand variables, it was expected, and found, that as the density variables (basal area, stocking, and trees per acre) and time since cut increased, so would the scenic beauty ratings, as evidenced by the positive correlations. The negative correlation of seedlings per acre indicates less appreciation of a regenerating stand in its early years.

Positive correlations were expected, and found, between scenic beauty and the number of large trees pictured in the slide, as well as the presence of old logs. It was also no surprise that an increase in the amount of slash visible detracted from the visual quality of the slide. People preferred to see green herbaceous growth rather than leaf litter, which is consistent with past research (Echelberger 1979, Brown and Daniel 1984). From the perspective of vantage point, ratings were higher when people felt they were within the stand rather than viewing from just outside the stand. Perhaps a sense of being immersed in the scene contributed to the rating.

Not significant were visual penetration and screening. It was hypothesized that responses would be greatly affected by the amount of screening of the view. The scatter plot for visual penetration revealed a symmetrical curve. The high scenic beauty ratings were those that allowed visual penetration of approximately 75-100' into the site. This finding concurs with Brush (1979) in that generally an open park-like setting under a tree overstory is preferred.

Regression Model

Further analysis to determine the impact of potential scenic beauty predictor variables on visual quality included stepwise regression and general linear modeling. Only those variables that could be manipulated by managers were included in the modeling process. Basal area was a better fit than stocking level. Both stocking level and trees per acre dropped out as insignificant when run along with basal area. It was surprising that even with a lack of emphasis on slash in site selection, its effect was still a significant part of the model. Notably, basal area and slash alone accounted for 64% of the variability in scenic beauty responses (Table 3).

Table 3. Scenic beauty prediction model for silviculture systems in eastern hardwood forests[a].

Independent Variable	Estimate	T-value	Partial R^2	Model R^2	C(p)	F-value
Basal area	0.024	5.69[b]	0.4744	0.4744	39.22	70.40[b]
Slash	-0.013	-4.56[b]	0.1234	0.5978	14.17	23.63[b]
Basal area^2	-0.0001	-3.72[b]	0.0405	0.6383	7.29	8.51[c]
Years since cut	0.01	2.24[c]	0.0226	0.6610	4.33	5.01[c]
Intercept	5.166	31.79[b]				

a/ R^2=.66, P<.0001
b/ P<.001
c/ P<.05

The final model explained 66% of the variation in mean scenic beauty and was statistically significant at 0.0001. All terms were significant at <.03. The model is presented as follows:

Scenic Beauty = 5.1664 + 0.024 BA - 0.0001 BA^2 + 0.0097 Years - 0.0133 Slash

Using this prediction model, the visual quality of silviculture systems as they regenerate can be predicted. To calculate the equation, slash is held at a constant level of 0, with the assumption that managers will remove slash to lessen the visual effects of harvesting. Mean basal area and mean years since cut for each silviculture system represented in the slides were computed and plugged into the equation. The results in matrix form are displayed in Table 4.

Table 4. Scenic beauty predictions for regenerating silviculture systems[a].

Height of Regeneration	Silviculture System						
	Clearcut	Deferment	Crop Tree	Shelterwood	Thinning	Selection	No Cut
0'-3'	5.176	5.811	6.167	6.358	NA	NA	7.170
3'-10'	5.203	5.784	6.222	6.654	6.450	6.556	7.344
10'-20'	5.456	5.813	NA	6.494	6.394	6.404	7.306
20'-30'	5.862	5.867	NA	6.525	6.316	6.661	7.128

a/ Predictions are based on average scenic beauty ratings using a scale of 1 (low) - 10 (high).

Silviculture Systems Compared

Each of the seven silviculture systems was compared for similarities by performing Fisher's least-significant-difference (LSD) statistic on the mean scenic beauty ratings (Table 5). On the average, the Clearcut had the lowest visual quality, while the No Cut mature forests were rated highest, concurring with findings by Hull and Buhyoff (1986). Surprisingly, the Crop Tree Release, a newly developed forestry system currently being researched, was given the second highest scenic beauty rating. This may come as good news to forest managers, but should also be looked at cautiously as the full range of their aesthetic impact over years of regeneration has not been explored in this study.

Table 5. Comparison of silviculture systems by mean scenic beauty rating[a].

Variable	Rating
No Cut	7.17
Crop Tree	6.35 *
Thinning	6.28 *
Selection	6.26 *
Shelterwood	6.22 *
Deferment	5.55
Clearcut	5.12

a/ Fisher's least-significant-difference. Mean ratings not significantly different at the 0.05 level are indicated by *.

Crop Tree Release, Thinning, Selection, and Shelterwood showed no significant difference in their scenic beauty ratings. It might be suggested that these systems would be considered visually acceptable to the public, for the average regeneration period. All remaining systems (No Cut, Deferment, and Clearcut) were distinctive in their scenic beauty ratings, and should be considered to have separate visual effects on the forest.

The density of residual trees seems to have more of an effect on scenic beauty than does the time factor. This is evidenced by the high F-statistic in Table 3 for basal area, compared to the low value for years since cut. Years is the least significant variable, suggesting that the twenty-five year time frame used in the study has little effect on visual recovery. The parameter estimate indicates that for every year since the cut, scenic beauty (SB) will increase by only 0.01 units on the 1-10 Likert scale. At this rate, referring to Table 5, for a clearcut to recover to the average shelterwood cut will take 110 years [(6.22 Shelterwood SB - 5.12 Clearcut SB) / .01 SB units/year].

Implications and Recommendations

As evidenced by the comparison of the silviculture systems, all timber harvesting activity in hardwood forests will have a negative impact on visual quality. Each system that involved a timber cut resulted in a significant loss of aesthetic quality, averaged out over approximately 25 years. However, these impacts on recreation values can be minimized with silviculture and site manipulation. Some silviculture systems are more visually pleasing than others. These include the traditional Area-wide Thinnings, Selection Cuts, Shelterwood, and the innovative Crop Tree Release methods.

Visual recovery after harvest is extremely slow, and beyond normal planning time frames. Foresters often manage their hardwood forests for timber on a long-term 60-80 year planning horizon, with intermediate thinnings in the interim. In this case, forest efficiency, not visual quality, might be the priority. However, the private woodlot owner may have goals other than timber production. Recreation, aesthetics, and wildlife are all common goals to be met in their lifetime, or within 10-20 years. Recreation managers may have the additional public pressure to maintain visual quality, and must prioritize the short term goals of visitor satisfaction and aesthetics.

Because time has been shown to be an ineffective method of achieving desired visual conditions, emphasis should be placed on the silviculture methods used and short-term conditions created. Clearcuts and other heavy cuts should only occur where recreation and aesthetic values are not a concern. While the No Cut method is best, acceptable visual conditions may be achieved with partial cuts, without reducing the stocking below 50%. This level of cutting has also been previously confirmed by Echelberger (1979) and Vodak and others (1985).

If these cuts must be made, management should focus on mitigating the short-term visual effects of forest disturbances through such measures as retaining some large (>17" dbh) trees and some dead logs, slash removal, and road re-seeding. The site should be assisted in returning to a "natural" appearance as quickly as possible.

There are some unanswered questions to be raised. What is a visually acceptable recovery? How long after a cut before the recovery looks good and is generally accepted by the public? How does the recreationist's knowledge of timbering practices affect their level of acceptance of forest disturbance? How does the pursuit of various recreational activities affect the perception of aesthetics? Are certain types of recreation users more tolerant of forest disturbance than others?

General philosophical questions also arise. What portion of the forests should be managed for aesthetics? Conversely, how much should forest managers rely on educating visitors about timbering methods as a tool to improve aesthetic appreciation and acceptance of forest disturbances? How can a land manager be sure an aesthetic experience is being provided to the visitor? Will our concern to please the average person result in a boring, monotonous landscape? These are all concerns that a professional must consider in the decision-making process.

In conclusion, a quality recreational experience is dependent upon the environmental condition of the setting, combined with the social context and personal cognition brought with the participant. This research responds to the one variable most controllable by the land manager: the quality of the natural setting. In this day of public participation and involvement in land planning, intelligent decisions based on solid scientific

research rather than intuition may be the best defense for forest managers. This paper recommends appropriate decisions in managing a forest for aesthetic goals.

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