

"Use of Measurement Techniques and Management Standards to Define Acceptable Conditions in Backcountry Campsites at Pictured Rocks National Lakeshore, Michigan" is the eighth Pictured Rocks Resource Report. Ms. Torrey has an interest in long-term management of backcountry resources. The study provides a protocol for quantifying and understanding the overall impacts of visitors to the Lakeshore backcountry. As a result of her work at Pictured Rocks, Ms. Torrey was accorded a masters degree in Landscape Architecture at the University of Wisconsin - Madison. Readers' comments on this Report are invited.

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Pictured Rocks

RESOURCE

Report



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USE OF MEASUREMENT TECHNIQUES AND MANAGEMENT STANDARDS TO DEFINE ACCEPTABLE CONDITIONS IN BACKCOUNTRY CAMPSITES AT PICTURED ROCKS NATIONAL LAKESHORE, MICHIGAN

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INTRODUCTION

In managing for long-term stewardship, federal land management agencies must be concerned about adverse recreational impacts. They have continued to search for ways to mitigate impacts and still provide enjoyable recreational settings. Before impacts can be mitigated, current conditions must be known.

The primary purpose of this study was to develop a resource monitoring program for Pictured Rocks National Lakeshore (PRNL) that documents the changing natural and social conditions of backcountry campsites over time and serves as a means of assessing the effectiveness of the National Park Service (NPS) management program. To determine the most suitable monitoring program for the backcountry at PRNL, this study implemented and evaluated several methods.

The second purpose of this study was to determine the preferences of PRNL backcountry users for recreational settings, in order to integrate their preferences into monitoring and management of the backcountry campsites. This was accomplished via a questionnaire given out with backcountry camping permits. Information obtained from the survey responses of backcountry users can be helpful to managers to determine acceptable standards for the physical, biological and social characteristics of backcountry campsites.

The third purpose of this study was to determine if a relationship exists between the physical and biological measures taken on campsites and the user's perceptions of campsite condition. The analyzed data from this study have been used to propose management standards for acceptable backcountry campsite conditions.

This report is a condensed version of a masters thesis submitted to the Landscape Architecture Department at the University of Wisconsin - Madison.

METHODS OF CAMPSITE ASSESSMENT

Data were collected from one-third of the backcountry campsites (n=26) within each backcountry campground (n=13) in the park and from one undisturbed control site randomly located within each backcountry campground. Each site was inventoried using three different methods of impact assessment.

The **Quadrat Method (QM)** measures are taken within 16 strategically placed quadrats for each campsite. The **Visual Survey Method (VSM)** is a "quick and dirty" method based on visual observation, developed by Frissell (1978). The **Modified Visual Survey Method (MVSM)** is also a "quick and dirty" method based on visual observation, developed by Torrey (1994). Table 1 (page 2) shows the indicators measured using each of the three methods.

RESULTS

Amount of Change on Campsites

The differences between measures on campsites and control sites were determined for each indicator. The Wilcoxon signed-rank test formula was used to determine if differences were significant (Snedecor and Cochran, 1989). Differences between campsites and control sites were found to be significant for bare ground, natural litter cover, vegetative cover, exotic species, tree damage, sapling damage, social trails, human litter, and visibility of other campsites. Differences in presence of native species between campsites and control sites were found not to be significant. Table 2 (page 2) shows the results of this analysis.

Differences between campsite area/radii and control site area/radii were not tested because control sites do not have a true radius. Also, dead and downed wood was not included in this comparison because this measure was not taken within control sites. Campsite measures of dead and downed wood extended out 70 meters from the campsite center. This distance included areas where control sites were located.

Comparison of Methods

The similarity between campsite conditions measured using both visual methods and conditions using the QM was determined. Non-parametric tests were chosen

Table 1: Indicators Used in Each of the Methods

Indicator	QM	VSM	MVSM
Campsite size/radius	X		X
Amount of bare ground	X	X	X
Amount of vegetative cover	X	X	X
Amount of natural litter cover	X		X
Percent of native species	X		
Percent of exotic species	X		
Percent of trees damaged	X	X	X
Percent of saplings damaged	X		
Number/width of social trails	X		
Amount of dead/down wood	X		
Amount of human litter	X		*
Other campsites visible	X		*

* Indicators not included in data collection in 1994 but recommended to be included in future monitoring of campsites using this method.

Table 2: Differences Between Campsite Conditions and Control Site

Indicator	"Z" Score	p-Value*
Percent of bare ground	4.45	<0.0002
Percent of natural litter cover	3.09	0.0001
Percent of vegetative cover	4.45	<0.0002
Percent of exotic species	1.77	0.038
Percent of native species	0.61	0.271
Percent of tree damage	4.05	<0.0002
Percent of sapling damage	4.45	<0.0002
Number of social trails	4.33	<0.0002
Amount of human litter	4.45	<0.0002
Visibility of other campsites	3.94	<0.0002

* Differences are considered to be significant at 0.05.

because of a small sample size. From this comparative analysis between methods, the strengths and weaknesses of each and its applicability to backcountry planning and management at PRNL was determined.

Campsites were ranked according to measures for each indicator using the QM. Bare ground, natural litter cover, exotic species, tree damage, sapling damage, social trails, human litter, and visibility of other campsites were all ranked in ascending order because small amounts for these indicators were intuitively considered to be more ideal. Vegetative cover, native species, and dead and downed wood were ranked in descending order because large amounts of these indicators were intuitively considered to be more ideal.

After ranking campsites according to each of the indicators, weights were applied to the indicators to formulate a composite score for each of the three methods of assessing impact for each campsite. Weights for indicators used in the QM and the MVSM were determined after examining the frequency of use of the indicators

in other studies. A weight of one (considered to be important), two (two times as important) or three (three times as important) was assigned to each indicator used in determining campsite conditions by the QM and the MVSM.

The weights assigned to indicators represent natural groupings of frequencies of use found in the other studies that were reviewed. The VSM, which was a single composite score, was assigned a weight of one. See Table 3 (page 3) for the weights applied to the specific indicators.

A composite score was determined for each method by multiplying the campsite rank for an indicator by its assigned weight and adding that sum to the sums determined for all the indicators. The total sum for each campsite was then divided by the total of the weights for the indicators to obtain the composite score. The composite scores for each of the three methods were then ranked. At this point, the composite score differences were calculated between the QM and VSM and between the QM and the MVSM.

CONCLUSIONS

Amount of Change on Campsites

The campground found to have the least amount of change relative to the control site conditions was Beaver Lake. The campground with the greatest amount of change relative to control site conditions was Mosquito River. All 13 campgrounds were ranked from those with the least amount of change (impact) to those with the greatest amount of change (impact).

This was done by computing a composite score for each campground based on its classification (class one, two, or three) according to the five indicators considered to be most critical in defining impact. The campgrounds in order of least impacted to most impacted are: Beaver Lake, Potato Patch, Masse Homestead, Au Sable Point East, Trappers Lake, Cliffs and Benchmark, Pine Bluff, Sevenmile Creek, Chapel Beach, Coves, Beaver Creek, and Mosquito River.

Campsites and control sites differed the most in percent of vegetative cover, followed by percent of tree damage, and bare

Table 3: Application of Weights to Indicators of Campsite Condition

Indicator Weights	bg	nlc	veg	es	ns	td	sd	ddw	st	hl	vc	cs
From literature	2	1	2	2	2	3	-	1	1	-	-	3
This study	2	1	2	1	1	3	2	1	1	2	3	3

Key: **bg**=bare ground, **nlc**=natural litter cover, **veg**=vegetative cover, **es**=exotic species, **ns**=native species, **td**=tree damage, **sd**=sapling damage, **ddw**=dead and downed wood, **st**=social trails, **hl**=human litter, **vc**=visibility of other campsites, and **cs**=campsite size/radius

Table 4: Importance and Desired Amount of Impact Indicators

Indicator	Level of Importance (users/managers)	Ideal Amount (users/managers)
Bare Ground	important/very important	very little/very little
Vegetative Cover	very important/important	abundant/abundant
Natural Litter Cover	important/very important	abundant/little
Native Species	important/very important	very abundant
Exotic Species	important/very important	none
Tree Damage	very important	very little/none
Sapling Damage	important/very important	none
Dead/Downed Wood	important	little/abundant
Social Trails	important	very little/none

ground. There was more variability in amount of tree damage and vegetative cover among campsites than between campsites and control sites.

There were no specific plant species that appeared to be greatly impacted (reduced) in relation to their presence in control sites versus campsites. Some campgrounds had more species "disappear" than others. Mosquito River, Chapel Beach, and Seven-mile Creek campgrounds did not have any species in the control sites that were not also found in the campsites. Measures indicate the greatest impact to species in Potato Patch campground.

Seven species "disappeared" from the Potato Patch campsite sampled. Cliffs campground had six species "disappear." The numbers of species that "disappeared" were similar for Beaver Lake campground (four); Pine Bluff, Benchmark, and Masse Homestead campgrounds (three). Small amounts of impact to species were found

in Coves, Beaver Creek, Trappers Lake, and Au Sable Point East campgrounds. These campgrounds only "lost" one or two species.

Comparison of Methods

The differences between methods were tested using Spearman Correlation Coefficients (Loether and McTavish, 1988) and a t-test of significance was done (Grimm and Wozniak, 1990). The MVSM had a stronger, more positive association with the QM (63 percent correlation) than did the VSM (27 percent correlation). This demonstrated that MVSM measures were a better predictor of the measures of QM than were the measures obtained by VSM.

The difference between the composite scores for QM and the composite scores for both of the quicker methods (VSM and MVSM) was significant. From the strong correlation and the level of significance, MVSM was found to be a good method

for monitoring. The accuracy of the VSM in relation to the QM was questionable due to the weak correlation between the two.

The correlation between the QM and the MVSM, although strong, could be improved by incorporating social indicators in the MVSM. It would be easy to include visibility of other campsites and amount of human litter as condition class ratings. These additions would greatly enhance a monitoring program utilizing the MVSM.

MANAGEMENT IMPLICATIONS/RECOMMENDATIONS

Management Objectives

NPS backcountry objectives are to avoid unacceptable impacts on park resources and adverse effects on visitor enjoyment of appropriate recreational experiences (USDI NPS, 1993). NPS objectives for natural zones, the zone in which the backcountry at PRNL is found, are to conserve natural resources, ecological processes, provide for appropriate types of enjoyment, and ensure their availability to future generations (USDI NPS, 1988).

Importance of Campsite Impact Rating

In order for managers to identify the degree of impact and determine where action is needed, the level of importance placed on individual indicators by both managers and backcountry users needs to be known. Priority for site management must be given to the most heavily impacted campsites, with consideration given to the importance placed on the specific indicator.

Table 4 shows the level of importance placed on the indicators used in this study by both backcountry users and managers.

Standards and Acceptable Levels of Impact

Once the current conditions of the indicators have been quantitatively identified and the importance of each indicator is understood, standards can be set to determine where management action is needed.

According to Cole (1989) standards are statements of the minimum conditions to be provided. Standards must be established by park resource managers based on quantifiable information about on-site conditions of the chosen indicators (e.g.

the number of social trails, amount of bare ground). Standards can be expressed as that percent of change from control site considered to be acceptable. These standards reflect the acceptable level of impacts for the indicators as determined by agency policy, visitor preferences, and management discretion. These standards can be modified or revised at any time if management objectives or opportunity class designations change.

Management Actions

The indicators found to have the greatest frequency of high levels of change were vegetative cover, natural litter cover, tree damage, and campsite radius. Dead and downed wood, social trails, and exotic species were at high levels in nearly half of the sampled campsites. The number of indicators showing high levels of impact varied within campgrounds. Park resource managers have several options for corrective action where they determine that on-site conditions exceed acceptable levels.

Camp radius can be addressed by limiting party size or by appropriate site management (Cole, 1989). Some rehabilitation may be desirable to speed recovery in reducing the campsite radius. Rehabilitation techniques may also be necessary in areas where vegetative cover is below the acceptable standard.

As shown by studies done in California, closing a site for two to three years allows for a great recovery in the camp area beyond the bare radius of the site, but not within the bare radius (Stohlgren and Parsons, 1986). Increases in plant cover, species diversity, and reduction of soil compaction were all measured improvements (Stohlgren and Parsons, 1986). Temporary closure of some campsites with severe impacts to vegetative cover and large campsite radii may be necessary.

Exotic species may need to be reduced in a few campsites. Exotic species were not found to be dominant in the summer of 1994. It would be helpful to determine if each of the exotic species is aggressive/invasive or not. If an exotic species is not aggressive and does not pose a threat to the existing native vegetation (by out-competing native species) it does not need to be addressed by management.

Tree damage (root exposure) and sapling damage (from trampling) can be reduced if campers are persuasively encouraged to set up camp within the "regulated" 15 feet of the campsite post. Bringing about changes in damage to trees is best achieved by education, according to Cole (1989). Perhaps more time can be spent discussing minimum-impact camping techniques with backcountry campers when they pick up their permits (Cole, 1982).

If amounts of dead and downed wood are not at or above the acceptable standard, limiting or prohibiting campfires may be necessary. Regulations prohibiting campfires in certain areas during the peak camping season (July and August) are one management possibility. Campfires are currently prohibited (at all times) within the Mosquito River and Chapel Beach campgrounds, but many of the other campgrounds are equally denuded of "firewood."

Social trails can be blocked off with fallen logs and revegetated. Clear circulation on desired trails would help to reduce the great numbers of social trails. Many campgrounds have so much bare ground it is easy to accidentally get off the trail and cause greater natural resource impact. Placement of fallen logs along the edges of the trail would help guide campers and speed recovery of vegetation along the trail.

SUMMARY

This study was able to identify the resource and social conditions important to both managers and backcountry users. The study found a useful method to monitor trends in these conditions in backcountry campsites.

The MVSM was found to be a relatively quick and accurate method of assessing campsite conditions. The visual ratings (1 through 5) for each of the indicators used provide a sound means to monitor impacts to campsites.

The results of this study will enable park resource managers to quantitatively evaluate current levels of impacts in backcountry campgrounds using indicators of resource and social conditions, develop standards for these conditions, institute a monitoring plan for detecting changes in

the conditions, and prescribe appropriate management actions to bring unacceptable conditions within the established standards.

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