A PROGRESS REPORT ON THE CONDITION OF NEWLY ESTABLISHED CAMPSITES IN THE BOUNDARY WATERS CANOE AREA

L. C. Merriam, Jr., Kent Goeckermann, J. A. Bloemendal and T. M. Costello

Introduction

Minnesota's Boundary Waters Canoe Area (BWCA) of some 1,000,000 acres in the heart of the Superior National Forest had over 1,000,000 visitor days use in 1970. It is one of the most heavily used wilderness areas in the United States. Increasing visitation has caused congestion on many lakes and heavy use of designated campsites. Consequently, information on visitor campsite impact is of value to Forest Service land managers.

In 1968, a five year study of deterioration of 33 newly established BWCA campsites was started as a part of a research project on problems of campsite management (5). These study campsites established late in 1967, are being studied to determine how visitor use affects sites with different vegetation and soil types, varying locations, slopes and aspects. Campsite use data is now being obtained. The study is unique in that it deals primarily with campsites that were not used prior to 1968, and nearly all use has been recorded.

Past Research

Many past studies of campsites have indicated increasing soil compaction and decreasing tree diameter growth with increasing use intensity (4, 6). La Page (3) indicated that campsite ground cover vegetation loss in an Allegheny National Forest campground was associated with table location, loose abrasive gravel from roads or tent pads and shading from ground cloths or tents. Cieslinski and Wagar (1) studying durability of recreation sites in northern Utah using simulated trampling methods, for one season, tentatively indicated that end of season vegetation stocking may be an effective durability indicator.

Studies in the BWCA and Quetico Provincial Park by Frissell and Duncan (2) and in the BWCA by McCool et al (5) have indicated site deterioration in the form of diminished litter and humus depths and root exposure on campsites having unknown amounts of total

1/This research was financed through a cooperative-aid grant to the University of Minnesota, College of Forestry from the U. S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. Helpful assistance also has been received from personnel of the Superior National Forest.

2/Professor, graduate Research Assistant and former graduate Research Assistants, respectively, College of Forestry, University of Minnesota.
use. Their study indicated a visitor preference for sites in pine types. McCool's study covered a random sample of 119 sites throughout the BWCA in 1966 and 1967 to determine general campsite conditions. Methods used were similar to those in the present study and provided background for present efforts.

Methods

To obtain data on newly established sites, it was necessary to study sites created by the Forest Service in 1967. These are located in the eastern portion of the BWCA and include 28 locations in motor and paddle zones and five on paddle only (canoe routes). Aspect, soil type and slope vary. Nine sites are on islands, two are on rivers and 22 are on the mainland. Thirty sites have a Forest Service grill, all but three have latrines, 24 have tables and all have designated tent sites. The number of sites in various cover types is given in the Table.

There is a self-registration box at each site where visitors are asked to fill out cards indicating date of arrival, number of people in the party, means of travel, number of nights or hours on site, and number of tents used. Since 1969, registrants have been asked why the site was selected and what is least satisfactory about the site. Since 1970, they have been asked how BWCA sites could be improved.

Each site is a permanent study plot on which measurements are taken twice a year, once in the early summer and once at the end of the summer. The boundaries, initially mapped in 1968 as Forest Service cleared space, are remapped at each measurement period. Condition of vegetation and improvements are noted. Soil compaction is tested by penetrometer, and polaroid photographs are taken of the area from permanent photo points on and off site. Registration cards are collected on each visit as well as in the spring and fall. Calibration checks are made of non-registration.

In 1969 Don Prettyman, soil scientist of the Superior National Forest, and staff made a detailed study of soil characteristics and condition on 20 sites. Dr. Arnett Mace, forest hydrologist at the University of Minnesota, and research assistants in 1970 studied nine sites and nine controls as to lake water quality at and adjoining the site.

Six sites were found to have had use prior to 1967. They were retained in the study for comparison with other new areas.

In this study it is hypothesized that area expansion, soil loss and compaction, declining tree vigor, loss of ground cover and increased use are related to deterioration. From the visitor's viewpoint, quality may be related to site appearance and condition as reflected in his comments concerning the site.

Results

The Table shows changes in study site characteristics over the 1968-1970 period by cover type. Based on registration data, average total use for site is shown. Highest use was in the aspen-birch, fir-birch sites on a major access route (Moose Lake Chain). As might be expected, sites easily visible from the water and located on heavily used routes had greater use than closed canopy or remote route sites. Visitor days use ranged from 2.5 to 1364.8.

Through 1970 there was very little increase in percent of bare soil. The jack pine, cedar, aspen-birch, and fir-birch types, in order, show the greatest increase in spring soil compaction on heavy use (near tables or grill) zones of sites. As to percent trees with exposed roots and dead or missing trees, the greatest changes were in the aspen-birch, fir-birch and spruce sites. These types also show the greatest average percentage change in site size.
The site expansion may be partly due to the closed canopy of the birch and spruce stands with associated dense understory, whereas the red and white pine sites, for example, usually are open. Also, the group size and number of tents affects the site size, and once a site is expanded, other parties, even with fewer people, use the expanded space. Our photographic record indicates cases of user redesign of sites, expanding completely away from the original location.

There are six sites which Prettyman found to have potential soil B horizon cementation problems with little possibility of remedy. Soil compaction has approached the upper limit of penetrometer measurements on some sites.

In their 1970 study of water quality, Mace and associates found that coliform bacteria populations of water at camp sites were significantly higher than at control points. This was particularly noticeable at medium to high use sites.

It may be possible to combine the characteristics shown in the Table in relation to amounts of use and thus develop stages of deterioration for these sites. Major questions include the importance of each characteristic or indicator and the effect of soil type, slope and aspect. Appearance of the sites and user reaction are also inputs. It would seem that some fixed combination of physical changes in sites should be established as criteria for designating a site to be closed or rehabilitated.

As to the visitor registration on the sites, calibration indicates over 85% of campers register. Through 1970, the most common response is satisfaction with the sites, but it is only 25% of the total response. Others indicate the tent site (13%), insects (11%), appearance (10%), landing (6%) and latrine (4%) as unsatisfactory. Paddle canoeists accounted for 64% of study site use.

Table

<table>
<thead>
<tr>
<th>Cover Type</th>
<th>Number of Sites</th>
<th>Average Visitor Days Per Site</th>
<th>Percent Bare Soil&lt;sup&gt;2&lt;/sup&gt;/ Soil Compaction&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Mean Heavy Use Soil Compaction&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Percent Trees Dead or with Exposed Roots&lt;sup&gt;3&lt;/sup&gt;/ in Site Size</th>
<th>Percent Increase in Site Size&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Percent Trees Dead or with Exposed Roots on Original Site&lt;sup&gt;3&lt;/sup&gt;/ in Site Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red &amp; White Pine</td>
<td>6</td>
<td>426.7</td>
<td>16.9</td>
<td>2.16</td>
<td>26.4</td>
<td>61.5</td>
<td>1.6</td>
</tr>
<tr>
<td>Jack Pine &amp; Assoc.</td>
<td>6</td>
<td>448.2</td>
<td>3.6</td>
<td>1.27</td>
<td>15.0</td>
<td>49.0</td>
<td>12.1</td>
</tr>
<tr>
<td>White Cedar &amp; Assoc.</td>
<td>4</td>
<td>261.3</td>
<td>0.0</td>
<td>0.81</td>
<td>4.0</td>
<td>38.4</td>
<td>6.4</td>
</tr>
<tr>
<td>Spruce &amp; Assoc</td>
<td>5</td>
<td>227.9</td>
<td>8.4</td>
<td>1.72</td>
<td>19.8</td>
<td>58.4</td>
<td>21.7</td>
</tr>
<tr>
<td>Aspen-Birch, Fir Birch</td>
<td>8</td>
<td>454.1</td>
<td>4.6</td>
<td>1.54</td>
<td>12.9</td>
<td>61.4</td>
<td>16.1</td>
</tr>
</tbody>
</table>

1/ Based on visitor day of 12 hours for overnight visit per person plus number of hours of day-use divided by 12 per person. Figure includes estimates of missing registration caused by vandalism or non-registration.

2/ Includes bare soil on expansion areas but compared only to original site size for percent.

3/ Includes all trees from 1968 original site survey d.b.h. 1"+ which are dead, missing, or have exposed roots.
Motor users and paddle canoeists differed on question responses. On motor routes only, responses to the question, "Why did you select this site," were grouped into categories. The five most common response categories for canoeists were: time, distance, hunger; availability; proximity to portage or route; appearance; and facilities, in that order. Categories for motor users were: appearance; proximity; time, distance, hunger; availability; and facilities, in that order. Response differences between canoeists and motor users are significant statistically ($X^2 = 21.56$, d.f. = 4 at .001 level).

The first ranking of "time, distance, hunger" suggests that many paddle canoeists stay at study sites because they can go no further and do not have the flexibility of the motor user to move to another site. Canoeists might use the sites regardless of condition out of necessity. Motor users can pick and choose more easily, though they are also limited in peak use periods.

Summary

This research note is a third year progress report in a five year study of BWCA newly established campsites. With increasing use, differences are developing between cover types in amounts of: bare soil, soil compaction, number of dead and damaged trees, and site area expansion. It may now be possible to develop a deterioration stage classification useful to managers. So far visitors are generally satisfied with study sites, though there are also complaints. Motor users and canoeists differ in reasons for site selection.

References


