

**HUMAN PREFERENCE FOR ECOLOGICAL  
UNITS: PATTERNS OF DISPERSED CAMPSITES  
WITHIN LANDTYPE ASSOCIATIONS ON THE  
CHIPPEWA NATIONAL FOREST**

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**Abstract:** Forest Service landscape architects sought a method for determining if people showed a preference for certain landscape-scale ecosystems and if ecological classification units could be used in visual resource management. A study was conducted on the Chippewa National Forest to test whether there was a systematic relationship between dispersed campsite locations and landtype associations (LTA) (most National Forests allow "free-choice" camping; sites with repeated use are inventoried and monitored as "dispersed campsites"). A statistically significant pattern exists in dispersed campsite locations as a function of LTAs. End moraine and sand plain LTAs contain the most campsites, while people apparently show little inclination to pitch their tents in the peatlands and ancient lakeplains. The test reinforces many conclusions from existing landscape preference research, such as people's preference for water bodies (Kaplan & Kaplan, 1989; Herzog, 1985; USDA, 1974; Ellsworth, 1982). The findings also indicate that landscape scale management of visual resources using Ecological Classification and Inventory units may be appropriate and that LTAs could be used as a forest planning unit that "links" the social and natural environment.

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**Introduction**

Patterns in human preference for different landscapes in the Forest Service *Scenery Management* and *Visual Management Systems* are established through criteria of landform, rock-form, vegetation types, and bodies of water. Although descriptions or analysis of characteristic succession or disturbance patterns, and associated visual changes to the landscape, are not discussed at length in the systems, the criteria used to identify the most visually scenic landscapes are very similar to the criteria used to

inventory and classify ecological units in the Ecological Classification and Inventory System (USDA, 1974; 1996).

Predictable Human Adaptation to Environments

Anthropologists have long recognized a connection between human cultural adaptations and the biophysical environment. In 1911, for example, Church described the vast area of steppes and deserts extending across Europe and Asia and the associated diverse ethnic groups of Negroes, Hamites, Semites, Indo-Europeans, and Mongolians, who all developed the behavioral adaptation for nomadic herding as their main occupation. People tend to take customs, social organization structures, and economic tendencies with them when migrating (Church, 1911) and, as described by Alfred Crosby in his description of the European Colonial invasion of the Americas, they will modify the composition, structure and function of a newly encountered ecosystem to create landscapes with which they are familiar (1992). Those ecosystems in the Eastern United States which failed to support the European, agrarian model fell into public ownership; hence most eastern National Forests share common features of non-arable land such as steep topography, infertile soils, cold climate, or a high proportion of wetlands.

Studies in visual perception by environmental psychologists such as Steve and Rachel Kaplan, also indicate that human response may be psychologically or physiologically affected by adaptation to the environment (1989). Humans tend to prefer the environments in which their survival is most likely or those that include features or characteristics that meet certain psychological needs, such as "making sense, stimulation, and complexity". They believe that the more "regular" and predictable patterns in human visual preference are the psychological perceptions of landscapes they have identified through their research (Kaplan, 1979).

The Purpose for a Dispersed Campsite Analysis  
on the Chippewa National Forest

Land management agencies are increasingly adopting ecologically based methods for planning and carrying out management activities such as timber harvesting. But how well do systems developed for the biophysical environment relate to forest resources such as recreation and scenery, which are more human-focused and perceptual in nature? Landscape architects, recreation planners, and other personnel within these agencies who address people-forest interactions face the question of how to best incorporate ecological classification systems into existing recreational and visual planning systems, like the Scenery Management System. Research and past planning experience as described above supports the relationship between people's preferences for landscapes and the presence of certain biophysical features. If this relationship could be shown to occur in patterns, and extended to ecological classification units like landtype associations, then landscape architects and recreation planners could link their planning systems with ecological classification systems to provide a common foundation and language for resource planning.

Forest Plan revision efforts for the Chippewa National Forest adopted landtype associations as planning units for new management prescriptions. Landscape architects involved in the project decided to inventory, analyze, and set draft visual management goals for the forest using landtype associations as the planning unit to improve consistency and integration with other resources. After completing the inventory stage of the process, they wanted to "test" whether or not they might be "on the right track," in terms of whether or not people show a preference for landscape scale areas on the Chippewa Forest. The following statistical analysis of dispersed campsite locations by landtype associations was conducted to determine whether or not a pattern existed in campsite locations (indicating a preference of some landtype associations over others) or if people preferred all landtype associations equally for dispersed camping.

## Methods and Materials

### Why Use Dispersed Campsite Locations?

USDA Forest Service camping regulations allow "free choice" camping outside designated, developed campgrounds. People may choose where they would like to camp, within specified distances from roads, trails, rivers and lakes, unless the management prescription for an area (e.g., a Research Natural Area) specifically prohibits camping. This activity is called "dispersed camping." Forest Service personnel monitor where people choose to camp, and sometimes, like on the Chippewa Forest, they will note the locations where repeated use occurs. Since the general public, or at least those that engage in dispersed camping, choose where they want to camp based on their own likes and dislikes, the locations of the dispersed campsites give some indication of environmental preference. As managers, Forest Service personnel do not know whether or not the choice is based on visual, access (closeness to road, etc.), activity association, or some other factor; however, the locations, and any *patterns* in the locations, do give some indication of the landscapes in which people like to camp.

### Gathering Data and Setting Up the Test

The boundaries of the Chippewa Forest landtype associations (LTAs) were established prior to the dispersed campsite test by a team of ecologists, soil scientists, and other personnel in cooperation with scientists from other agencies and forests. 405 dispersed campsites were located on the Chippewa National Forest using a global positioning system. Two of the dispersed campsites occurred next to Leech Lake and fell within the Leech Lake LTA. Given the extreme size of Leech Lake (87,644 acres) and that the lake comprises almost the entire landtype association, the Leech Lake LTA (and the two dispersed campsites) were excluded from further analysis. The Cass Lake (15,900 acres) and Lake Winnibigoshish (56,764 acres) were also excluded from the test, again, due to the extreme sizes of the lakes and that the LTA boundaries followed the lakeshore boundaries and did not include dry land on which dispersed camping could occur.

## Results

The Kolmogorov-Smirnov Goodness of Fit test was used to determine whether or not a pattern existed in dispersed campsite locations.  $H_0$ , the null hypothesis, was that people prefer all landtype associations equally; the number of dispersed campsites within a LTA related to the percent area of the forest the LTA comprised. For example, if a LTA comprised fifty percent of the forest area under consideration, then fifty percent of the dispersed campsites were found within the LTA.  $H_a$ , the suggested alternative hypothesis, was that the number of dispersed campsites within an LTA did not relate to the proportional area of the Forest an LTA comprises and people do not prefer all ecosystems equally for dispersed camping. Table 1 shows the data used in the test and Table 2 indicates the results of the test.

The largest value in  $|S_x - F_x|$  (16.72) is greater than T.95 (7.2) and therefore  $H_0$  is rejected; people do not prefer all landtype associations equally for dispersed camping and some sort of pattern exists in the locations. The bar graph in Figure 1 illustrates the differences between the actual and expected number of dispersed campsites. The Bemidji sand Plain shows the greatest difference between expected and actual numbers of dispersed campsites. The Marcell Moraine shows the next highest difference between expected and actual numbers with *more* than the expected number of dispersed campsites. The Black Duck Till Plain and Bena Dunes and Peatlands also have high differences with *less* than expected numbers of dispersed campsites. The Itasca and Sugar Hills moraines have slightly more than the expected number of sites while the other Till Plains (Hill City and Guthrie) have slightly less than expected. Far less than the expected number of campsites also occur within the Deer River Peatland and Agassiz Lake Plain.

## Discussion

The patterns in dispersed campsite locations, and the characteristics of the associated LTAs, are generally consistent with what could be expected based on results from existing research in visual preference and perception. The landtype associations with more than the expected number of dispersed campsites have characteristic hydrologic patterns and vegetation that people typically rate highly in visual preference and perception studies. LTAs with both rolling and nearly level terrain have more than the expected number of campsites, which mirrors the mixed results for topographic preference in several studies. And, while some studies that indicate preference for characteristic community structure and disturbance patterns do exist, Forest Service management techniques, such as harvesting timber and wildfire prevention, make connections between the study results and existing research problematic. Ultimately, however, the results of the dispersed campsite analysis generally support the use of landtype associations as a planning unit for scenery management and encourage the use of multiple scales of ecological classification units in land management planning for both the natural and social environment.

**Table 1. Data for Kolmogorov-Smirnov Goodness of Fit Test  
for Dispersed Campsite Locations  
on the Chippewa National Forest by Landtype Association**

**H<sub>0</sub>:** People prefer all ecosystems equally;  
the number of dispersed camping sites relates to the percent area of a forest an LTA comprises.

**H<sub>1</sub>:** People do not prefer all ecosystems equally;  
the number of dispersed sites does not relate to the area of a forest and LTA comprises.

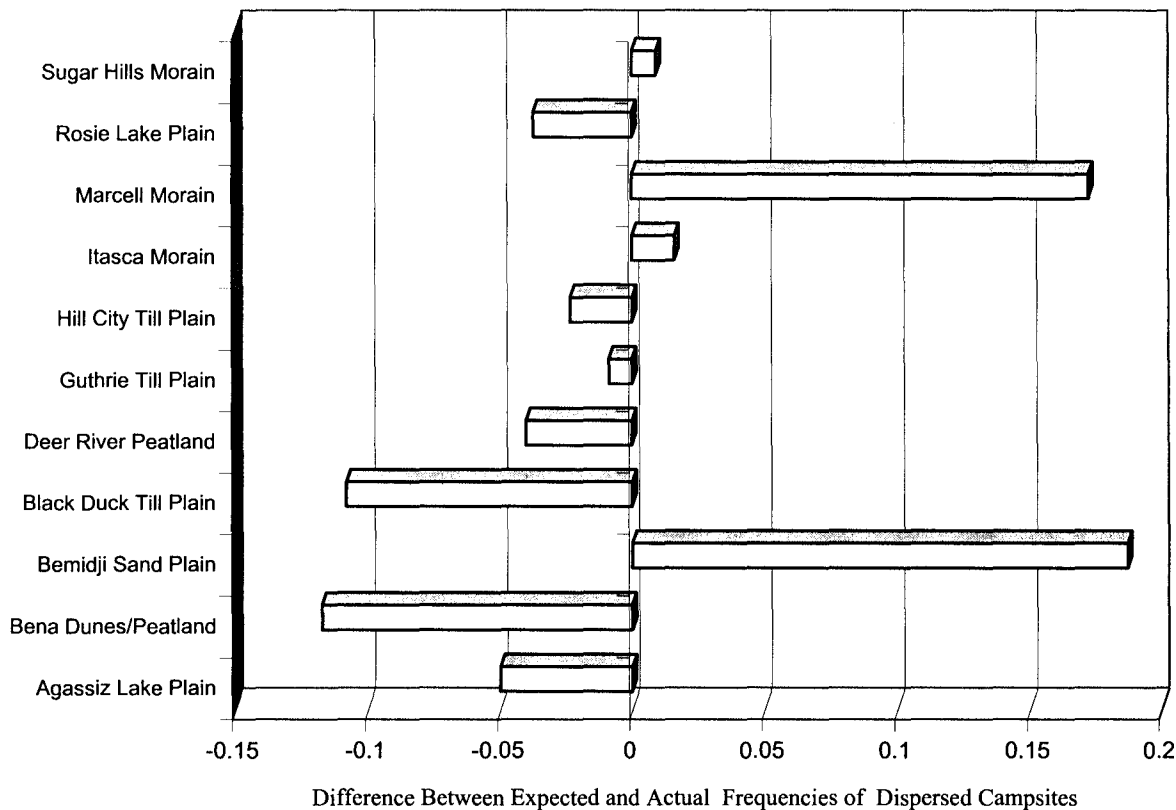
Landtype Association	Acres	% Land Base	No. Dispersed Sites	Expected % (FX)	Sample % (SX)	/Sx-Fx/
Agassiz Lake Plain	75,295	5.24%	1	0.25	5.24	4.99
Bena Dunes/Peatland	200,413	13.95%	9	2.47	19.19	16.72
Bemidji Sand Plain	93,009	6.47%	102	27.65	25.66	-1.99
Black Duck Till Plain	283,018	19.70%	36	36.54	45.36	8.81
Deer River Peatland	57,660	4.01%	0	36.54	49.37	12.83
Guthrie Till Plain	72,874	5.07%	17	40.74	54.44	13.70
Hill City Till Plain	47,892	3.33%	4	41.73	57.77	16.05
Itasca Morain	186,142	12.95%	59	56.30	70.73	14.43
Marcell Morain	142,450	9.91%	110	83.46	80.64	-2.81
Rosie Lake Plain	227,368	15.82%	49	95.56	96.47	0.91
Sugar Hills Morain	50,776	3.53%	18	100.0	100.0	0.0
Total No. of Sites			405			

$TO = 16.72 > T95 = 7.2$

Reject H<sub>0</sub>

**Table 2. Actual vs. Expected Numbers of Dispersed Campsites  
on the Chippewa National Forest by Landtype Association**

Landtype Association	Expected No. of Campsites	Actual No. of Campsites	Difference
Agassiz Lake Plain	0.05240111	0.002469136	-0.049931976
Bena Dunes/Peatland	0.13947625	0.022222222	-0.117254024
Bemidji Sand Plain	0.06472907	0.251851852	0.187122786
Black Duck Till Plain	0.19696471	0.088888889	-0.10807582
Deer River Peatland	0.04012814	0	-0.040128137
Guthrie Till Plain	0.05071623	0.041975309	-0.008740922
Hill City Till Plain	0.03333016	0.009876543	-0.023453612
Itasca Morain	0.12954443	0.145679012	0.016134584
Marcell Morain	0.09913724	0.271604938	0.1724677
Rosie Lake Plain	0.15823542	0.120987654	-0.037247765
Sugar Hills Morain	0.03533726	0.044444444	0.009107186



**Figure 1. Expected vs. Actual Dispersed Campsite Locations on the Chippewa National Forest by Landtype Association**

Hydrologic Features

The results of the dispersed campsite location analysis on the Chippewa National Forest indicate that the single largest determinant in campsite locations may be the “recreation quality,” quantity, and distribution of hydrologic features. Kaplan and Kaplan (1989) state that, from their experience with visual perception research, the presence of water so greatly influences visual preference and perception studies, that images with hydrologic features are not used unless the study focuses specifically on water bodies. People show such an overwhelming desire to look at, and possibly be near, water, that the use of images with hydrologic features skews research results unless *all* the images in the study include water features. The results of the dispersed campsite study support the Kaplan’s assertion given that the campsite distances from hydrologic features range between 4 meters to 20 meters.

In addition, the results of the dispersed campsite study, and the patterns in campsite locations, also support existing research on the types of hydrologic features people prefer. Herzog found that people most preferred hydrologic features in mountainous settings followed by large lakes, rivers and then swamps (in Kaplan & Kaplan, 1989). Ellsworth and Hammit looked at differences in preference for rivers, marshes, and bogs, and found that images of

open water bodies with clear, reflective surfaces rated highly (in Kaplan & Kaplan, 1989). Characteristic hydrologic features occur in patterns and vary between landtype associations on the Chippewa Forest. For example, very large, clear lakes that are distributed widely across the landscape are more common in the end moraine, sand plain, and till plain landtype associations. Sand plains also tend to have sandy beaches and lake bottoms that people could find more favorable for swimming and sun bathing. Sport fisheries for walleye and other species are also best in these lakes. Lakes occur less frequently in peatlands and lake plains and are more likely to have “encroaching” wetland vegetation surrounding the perimeter and mucky bottoms. These characteristics could discourage swimming, sun bathing, and other recreation activities along the lakeshore.

Generally, those LTAs with more than the expected number of campsites (Bemidji Sand Plain and Marcell Moraine) contain hydrologic features that provide great fishing and shoreline recreation opportunities. Those LTAs with less than the expected number of campsites, like the Black Duck Till Plain and Bena Dunes and Peatlands, have relatively fewer lakes, lakes with less favorable fishing opportunities, and larger scale wetlands and forested wetlands. Dispersed campsites in these LTAs tend to occur along rivers.

### Topographic and Geologic Features

The conclusions from studies in visual preference and perception of landforms appear somewhat variable. Brush (1981) found that people prefer more mountainous landscapes. In 1987, Herzog found that people prefer mountains, canyons, and desert rock formations equally (in Kaplan & Kaplan, 1989). The results of the dispersed campsite analysis also show preference for different terrain and geologic features. The Chippewa Forest is relatively flat. More than the expected number of dispersed campsites occurred in the more rolling terrain of the Marcell Moraine and the more level terrain of the Bemidji Sand Plain.

### Characteristic Flora

Forest composition may affect preference ratings due to people's expectations for what should occur in the landscape (Yarrow, 1966 in Ribe, 1989). Several studies indicate a higher preference for hardwood species over conifers (e.g., Ribe, 1989.) Klukas and Duncan in 1967 found that people in Minnesota prefer mature pines to a deciduous forest (in Ribe, 1989). During the development of the current Forest Land and Resource Management Plan for the Chippewa Forest, people voiced a concern for maintaining and promoting the "North Woods" character of the landscape. This character was defined, in part, by the presence of large white pine, red pine, and northern hardwood forests (USDA, 1986).

Overstory and ground flora composition also occurs in patterns between different landtype associations (LTAs). Red and white pine forests, with large diameter "character trees," characterize the Bemidji Sand Plain landtype association. Northern hardwoods forests are typical for the end moraine LTAs, such as the Marcell, Itasca, and Sugar Hills associations. In general, the results of the dispersed campsite study are consistent with existing research and public comments during the development of the current Forest Plan; those LTAs with more than the expected number of campsites have characteristic vegetation patterns that coincide with what people describe as the desired "North Woods" character for the landscape.

### Community Structure

Community structure, in the following discussion, refers to both the vertical structure of a forest and the age structure of the community. Several studies indicate that people prefer mature forests with large diameter trees (e.g., Brush, 1979). Kaplan and Kaplan (1989) attribute the apparent dislike of younger forests to a "blocked" appearance. They assert that people like to feel as if they can negotiate freely throughout a space and the multitude of stems in a young stand appears restricting and possibly dangerous. Timber management activities within the National Forest and cutover logging make correlations between the results of the dispersed campsite analysis and community structure somewhat problematic. Characteristically, without management by people, some forest communities may have a more "blocked" appearance than others. For example, jack pine trees tend to have relatively small diameter trunks and grow in dense "thickets" following catastrophic crown

fires. In Michigan expansive outwash plains covered by primarily jack pine forests are classified as one landtype association (USDA, 1993). Cedar, tamarack, or other forested wetland areas on the Chippewa Forest currently have the dense or "visually impenetrable" appearance that people may not like due to logging practices early in the last century; these areas are not typically managed for timber currently, however they have not developed the "large tree character" people prefer. Forested wetlands are characteristic of several landtype associations that have less than the expected number of campsites, such as the Deer River Peatland and Rosy Lake Plain. Over time, the community structure of these landtype associations, and their appearance, may change.

### Disturbance Patterns

Fire repression efforts and timber harvesting practices make any connections between dispersed campsite locations and characteristic disturbance patterns difficult. Regardless of the type of disturbance causing the event, the presence of downed woody debris negatively affects visual preference ratings (Ribe, 1989). People do not like the appearance of a burned landscape (e.g., Brush, 1979, and Ribe, 1989). However, studies also show that people like the appearance of some landscapes after ground cover recovery (USDA, 1994). Studies by Buhyoff and Leuschner (1978), Buyoff, Wellman, and Daniel (1982), and Buyoff, Leuscher, and Wellman (1979) found that the visual results of insect infestations decreased visual preference.

The Bemidji Sand Plain, with more than the expected number of dispersed campsites, is a fire-dependent community, although large-scale, catastrophic crown fires may not be common. Currently wildfires are suppressed and the timber is managed for conifer saw logs (USDA, 1986). Many of the landtype associations with less than the expected number of campsites, like the Deer River Peatland and Agassiz Lake Plain, are primarily forested and open wetlands that could experience flooding, insect infestations, windthrow, and possibly some fires. These areas are typically not managed for timber production due to their wetland character.

### Conclusion

The landtype associations on the Chippewa National Forest with more than the expected number of dispersed campsites (end moraines and sand plains) have characteristic hydrologic and vegetation patterns that typically rate highly in visual preference and perception studies. Those landtype associations with less than the expected number of dispersed sites are characterized by large-scale wetlands and relatively few lakes. Systems like the Forest Service Scenery Management System use similar criteria to evaluate landscapes as those used in ecological classification systems (ECS). Human uses occur in patterns, such as dispersed campsite locations, that relate to ecological boundaries like landtype associations. Ecological classification can be used to inventory, analyze, and manage social environment factors and provide a "link" between humans and other species.

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