Identification of Scenically Preferred Forest Landscapes[1]

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Abstract: This study identified manipulated forest landscapes with a low understory shrub density as being esthetically preferred over non-manipulated, dense understory landscapes. This landscape pattern was identified both qualitatively, by preference ratings of respondents, and quantitatively, by measuring the physical components of each landscape. Forest sites were selected to show physically and vegetatively similar landscapes differing only by the presence or absence of a vegetation manipulation treatment. Color slides of these landscapes rated by groups of respondents revealed a consistent preference for manipulated scenes. Examination of the physical characteristics of the preferred scenes revealed reduced shrub density to be the major differing factor.

INTRODUCTION

A major problem facing scenic resource managers is identifying the types of forest landscapes which the public prefers. Once preferred landscape patterns are identified, guidelines can be developed and incorporated into management of scenic areas, campgrounds, road right-of-ways and other forested areas. This study was undertaken to provide land managers in Eastern Tennessee with practical objectives for attaining esthetically preferable forest landscapes.

Too often in the past, public input in natural resource management policies has been ignored, at times resulting in inaccurate management objectives. A study by Klukas and Duncan (1967) revealed that after surveying vegetational preferences among visitors to Itaska Park, Minnesota, it became apparent that there was a strong preference for old growth red pines (*Pines resinosa* Alt.). Yet, the existing park policy of fire repression was eliminating the reproduction of the preferred red pines which were the most scenically preferred vegetation. Without assessment of public preferences, park managers would have continued operating toward a less desirable forest management objective.

Another difficulty in identifying policies and objectives with regard to esthetics is incorporating them into existing land management practices. In making scenic assessments, it would be advantageous if scenic factors could be quantitatively identified as well as preferentially rated. It would be easier to incorporate quantitative esthetic assessments into existing management policies since other aspects of forest management are based on quantitative input. As Arthur (1977) has stated, "Resource managers are unlikely to turn to novel decision models solely to give equal consideration of nonpecuniary resources." Thus, the quantification of esthetic components would make them more readily adaptable to existing management plans.

In determining preferred landscapes, this study utilized a dual approach that combined both qualitative evaluation of the public's esthetic preferences for selected landscapes and quantitative assessment of the physical components of those landscapes. Color slides of selected forest sites were presented to groups of

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respondents who rated the sites on the basis of their perceived esthetic quality. These sites were also measured using established forest inventory procedures which recorded overstory, understory, and ground-cover size and density. This combination approach resulted in public selection of esthetically preferred landscapes and a quantitative record of the physical characteristics of preferred sites which can be easily understood and adapted to forest management practices.

LANDSCAPE ASSESSMENT PROCEDURES

Selecting Study Sites

The study sites were restricted to naturally vegetated forest landscapes in the eastern Tennessee region. No structures or man-made objects were present which might obscure the evaluation of the existing vegetation patterns. In keeping with the study's objective of incorporating esthetic preferences with practical management policies, sites were selected to show esthetic effect of established forest management practices. These practices focused on different means of vegetation manipulation and included burning, grazing and mechanical removal of vegetation. These manipulation practices alter the pattern of vegetation. In order to evaluate whether manipulated or non-manipulated patterns were preferable on the basis of esthetics, the selected sites were paired to show physically similar landscapes differing only by the presence or absence of a vegetation manipulation treatment. Thus, each pair of sites included one manipulated landscape which had received treatment within the previous two years and a corresponding non-manipulated control. The treatments primarily affected density of the understory vegetation in existing forest landscapes.

Time limitations for this study did not allow for the treatment and evaluation of predetermined sites. Instead, sites were selected which had received prior treatments so that an existing manipulation effect could be assessed. Each pair of sites was similar in topography, aspect, slope, stand composition, density and size of overstory vegetation. Treated and untreated paired sites were located in close proximity, often contiguous, to facilitate control of variances between sites. In addition to being classified by manipulation treatment, sites were also identified by forest type (i.e., hardwoods or pines). This meant that, when attainable, sites with a predominantly pine overstory as well as a predominantly hardwood overstory were selected for each treatment.

The research paradigm in figure 1 diagrams the sampling framework of the study and the number of replications attainable for each of the differing treatments. A total of 26 individual sites or 13 pairs of sites were selected. Due to difficulties in locating previously manipulated sites, the burning treatment was the only one that had an equal number of replications for hardwoods and pines. Only one pair of sites was located that represented grazed pine stands, and no acceptable mechanically treated pine stands could be located.

Photographing Selected Sites

Previous studies by Daniel and Boster (1976), Shafer and Richards (1974), and Zube (1974)

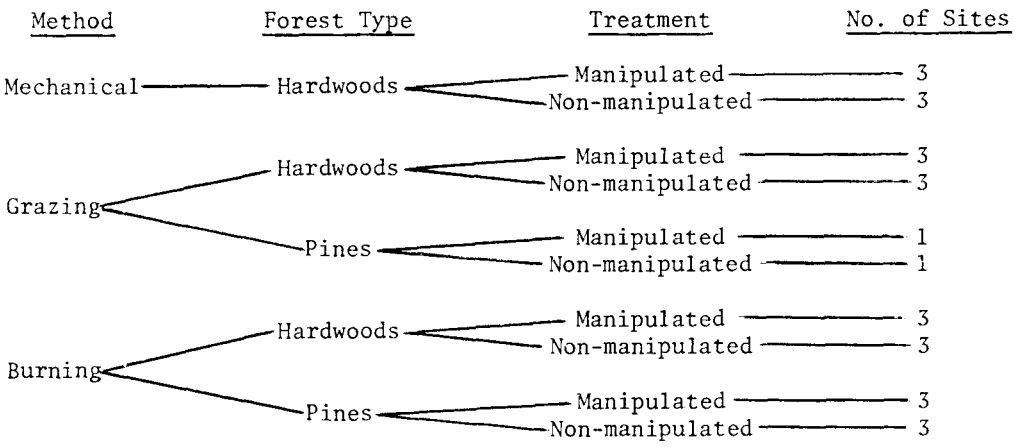

Figure 1--*Research paradigm for sampling of forest landscapes.*

have shown that color slides can accurately depict the actual landscape, and that a close relationship exists between preference responses to slides and to actual sites.

Following the selection of specific treatment and control sites, one-fifth acre plots were located within each site, photographed, and measured. The sites were photographed during June, July, August and September 1977, using a 35 mm camera and a 28 mm 1:2.5 automatic wide angle lens at an eye vantage point 50 feet from plot center. Paired sites were photographed at the same time of day from the same compass bearing to keep light levels constant and to duplicate shadow patterns. Photographing was restricted to sunny days between 10:00 a.m. and 4:00 p.m. and each camera setting was bracketed to assure slides of comparable lighting and photographic quality. Figure 2 presents selected sample pairs of slides for each manipulation by forest type treatment.

MECHANICALLY MANIPULATED HARDWOODS

Manipulated Non-manipulated

GRAZING MANIPULATED HARDWOODS

Manipulated Non-manipulated

GRAZING MANIPULATED PINES

Manipulated Non-manipulated

Figure 2-- *Sample of photographs of each manipulation by forest type landscape pair.*

BURNING MANIPULATED HARDWOODS

Manipulated

Non-manipulated

BURNING MANIPULATED PINES

Manipulated

Non-manipulated

Figure 2-- *Continued*

Site Measurements

Measurements were taken at each site to quantify the vegetation composition and possibly provide a reference to aid in developing management guidelines for achieving preferred landscapes. The method for data collection was based on a Continuous Forest Inventory (CFI) system, a widely accepted method for measuring forest stands and easily understood and applied by professional land managers. Information recorded on each site gave a quantitative description of the timber and pulpwood in basal area per acre, shrub cover in number of stems per acre, and herbaceous ground cover in percent coverage per acre. Basal areas of timber and pulpwood trees were determined according to the CFI guidelines used by MacDonald (1964). Shrub cover was obtained by counting the number of stems measuring 3 feet tall to 5 inches dbh on one-hundredth acre plots (11.78-foot radius). Herbaceous ground cover was calculated by running a 50-foot transect line on a radius from plot center and tallying the number of herbaceous plants at one-foot intervals along the transect (Phillips 1959).

Preference Survey

Color slides were presented to groups of respondents who rated the slides on the basis of the "scenic beauty" of the represented areas following guidelines and terminology used by Daniel and Boster (1976). Rutherford and Shafer's (1969) techniques were also used in projecting the slide pairs simultaneously on side-by-side screens. Respondents were given no advance information about the nature of the study. Manipulated and non-manipulated landscapes were randomly assigned to left and right positions for each projected pair. Pairs, themselves, were randomized before each group presentation.

Respondents rated both the left and right positions slides for each projected pair on a 1-to-5 scale with 1 representing low scenic beauty and 5 representing high scenic beauty. Standardized instructions were read to the respondents prior to rating the slides. An example pair of slides was projected on the screens following the instructions so that respondents would fully understand the rating process and

be familiar with the type of slides to expect. Slides were projected for 20 seconds per pair as in a similar study by Rutherford and Shafer (1969). Following the slide rating, respondents were asked to complete a questionnaire which provided additional background on the respondents' age, sex, education, occupation, and tested their knowledge of the use or effects of vegetation manipulation methods portrayed in the slides.

Sampling, as noted earlier, was conducted on a group basis similar to the grouping used by Daniel and Boster (1976). Respondents were restricted to persons in the eastern Tennessee area, and a total of 9 groups (or 176 individuals were sampled.

In an attempt to categorize preference responses into a more usable form by land managers, the groups selected to participate were classified into those knowledgeable and trained in assessing natural resources ("experts") and those who by their group affiliation may or may not have any training or special interest in environmental concerns ("non-experts"), again similar to Daniel and Boster (1976). Classification was not completely arbitrary and was aided by information attained from the questionnaires. The groups classified as experts included conservation and wildlife societies and university students in forestry and landscape design classes. Non-expert groups included private and civic organizations such as a garden club and a Sunday school class.

ANALYSIS

Data analysis in this study focused on examining respondents' preferences for the manipulated and non-manipulated landscape pairs and determining whether group affiliation (specifically "expertise" and knowledge in the field of natural resources) affects preference responses.

The effects of manipulation (MNP), pairs (PAIR), individuals (IND) and their classification into groups (GROUP), and the interaction of these factors on respondents' preferences were examined using analysis of variance (table 1). Analyses were conducted on a within treatment/forest type basis which resulted in five separate analyses: (1) mechanical/hardwoods, (2) grazing/hardwoods, (3) grazing/pines, (4) burning/hardwoods, and (5) burning/pines. Since complete replications of forest types and manipulation techniques could not be obtained, valid comparisons could only be made on the ratings for the manipulated and non-manipulated landscapes in each pair of sites. Therefore, inferences are not made regarding specific treatments or forest types.

Differences among groups were examined by partitioning the GROUP x MNP interaction into component comparisons by means of orthogonal contrasts (Steel and Torrie 1960).

Table 1--*ANOVA models for preferences within treatment/forest type.*

		MEAN SQUARES				
SOURCE	D.F.	MECHANICAL/HDW	GRAZED/HDWDS	GRAZED/PINES	BURNED/HDWDS	BURNED/PINES
MNP	1	96.3645**[A]	14.0947**	35.0028**	90.4176**	18.8267**
PAIR	2	10.5237	43.9858	-------	6.2112	5.8419
MNP x PAIR	2	9.5407	26.0862	-------	21.0767	3.4858
ALL IND	175	2.1005	2.3397	1.1996	2.3512	2.2233
GROUPS	8	2.6445[B]	4.4123	1.4613	4.1318	4.5392
IND (GROUPS)	167	2.0744	2.2405	1.1871	2.2659	2.1124
MNP x ALL IND	175	1.5589	1.4147	0.8600	2.0462	2.1581
GROUPS x MNP	8	3.2226*[A]	1.1401	1.1644	1.7133	5.6683**
IND x MNP (GROUPS)	167	1.4792	1.4279	0.8454	2.0621	1.9900
RESIDUAL	700	0.5370	0.7569	-------	0.6335	0.6000

[A]NOTE: INTERACTION OF IND x MNP (GROUPS) DEEMED APPROPRIATE FOR TESTING SIGNIFICANCE OF MNP AND GROUPS x MNP.

[B]NOTE: INTERACTION OF IND (GROUPS) DEEMED APPROPRIATE FOR TESTING SIGNIFICANCE OF GROUP.

*STATISTICALLY SIGNIFICANT AT 0.05 PROBABILITY LEVEL.

**STATISTICALLY SIGNIFICANT AT 0.01 PROBABILITY LEVEL.

RESULTS

Analysis of the preference ratings indicated a significant preference for manipulated landscapes. This preference was consistent across all groups. In all 9 groups, the average ratings were higher for the manipulated landscapes (table 2). Overall mean rating was 3.52 (on a 5-point scale) for manipulated landscapes and 3.06 for non-manipulated landscapes.

Table 2--*Mean preference ratings* by groups for manipulated and non-manipulated landscapes within each pair of slides.*

GROUP	MEAN PREFERENCE RATINGS	
	MANIPULATED	NON-MANIPULATED
WILDLIFE SOCIETY	3.40	3.23
SOUTHERN HIGHLAND CONSERVANCY	3.62	3.13
FOREST RECREATION CLASS	3.52	2.97
LANDSCAPE DESIGN CLASS	3.62	3.29
HORTICULTURE CLASS	3.72	3.33
SUNDAY SCHOOL CLASS	3.49	3.00
ARBORETUM SOCIETY	3.13	2.80
GARDEN CLUB	3.20	2.94
ROTARY CLUB	3.59	2.79

*PREFERENCE RATINGS WERE BASED ON 1 TO 5 SCALE WITH 1 REPRESENTING LOW SCENIC BEAUTY AND 5 REPRESENTING HIGH SCENIC BEAUTY.

The orthogonal contrasts (among groups) revealed few significant differences and specifically no significant difference in preferences between the "expert" and "non-expert" categories. These findings correspond to studies by Daniel and Boster (1976) and Zube et al. (1975) which found an overall high agreement between experts and non-experts on landscape evaluation and description.

The only recurring significant difference was a contrast involving the wildlife society group. Although all groups preferred manipulated landscapes, (as indicated in table 2), the wildlife society had a lower degree of preference than the other groups, possibly due to the special interests of this group which indicated a concern for wildlife habitats and a preference for landscapes with enough shrub cover to support wildlife species. Although this may suggest that special interests of groups may affect the degree of preference, the magnitude of special interest effects relative to overall preference for manipulated landscapes was extremely small.

Physical measurements describing both the manipulated and non-manipulated sites as well as the corresponding mean preference ratings are presented in table 3. In viewing the landscape pairs (fig, 2), there is an apparent visual

Table 3--*Summary of descriptive physical components of landscape study sites.*

PAIR	TREATMFNT	METHOD	FOREST TYPE	TIMBER (BASAL AREA PER ACRE)	PULPWOOD (BASAL AREA PER ACRE)	SHRUB COVER (NUMBER STEMS/ACRE)	HERBACEOUS GROUND COVER (PERCENT/ACRE)	PREFERENCE RATING (MEAN)
1	MANIPULATED	MECHANICAL	HARDWOOD	87.60	27.00	600	92 %	3.91
	NON-MANIPULATED	MECHANICAL	HARDWOOD	81.60	33.40	3200	60 %	3.62
2	MANIPULATED	MECHANICAL	HARDWOOD	55.05	33.00	300	100 %	3.89
	NON-MANIPULATED	MECHANICAL	HARDWOOD	54.05	17.70	2900	64 %	2.94
3	MANIPULATED	MECHANICAL	HARDWOOD	81.10	69.20	0	92 %	3.89
	NON-MANIPULATED	MECHANICAL	HARDWOOD	58.65	21.00	3000	62 %	3.34
4	MANIPULATED	GRAZING	PINE	91.85	38.90	200	100 %	3.58
	NON-MANIPULATED	GRAZING	PINE	112.35	49.80	2700	36 %	2.84
5	MANIPULATED	GRAZING	HARDWOOD	70.95	55.00	200	88 %	3.89
	NON-MANIPULATED	GRAZING	HARDWOOD	120.20	18.00	1000	22 %	3.54
6	MANIPULATED	GRAZING	HARDWOOD	97.30	37.90	0	100 %	2.86
	NON-MANIPULATED	GRAZING	HARDWOOD	112.40	30.50	1100	70 %	3.21
7	MANIPULATED	GRAZING	HARDWOOD	105.45	26.50	300	46 %	3.56
	NON-MANIPULATED	GRAZING	HARDWOOD	86.35	32.00	2400	70 %	2.94
8	MANIPULATED	BURNING	HARDWOOD	17.05	25.60	0	82 %	3.42
	NON-MANIPULATED	BURNING	HARDWOOD	10.70	37.80	3300	76 %	2.97
9	MANIPULATED	BURNING	HARDWOOD	31.45	25.10	200	76 %	3.57
	NON-MANIPULATED	BURNING	HARDWOOD	17.30	15.50	3400	28 %	2.48
10	MANIPULATED	BURNING	HARDWOOD	33.45	1.50	0	92 %	3.37
	NON-MANIPULATED	BURNING	HARDWOOD	45.95	17.50	2400	20 %	3.19
11	MANIPULATED	BURNING	PINE	78.25	40.80	600	84 %	3.19
	NON-MANIPULATED	BURNING	PINE	73.80	79.10	600	84 %	2.68
12	MANIPULATED	BURNING	PINE	113.05	43.20	400	80 %	3.20
	NON-MANIPULATED	BURNING	PINE	104.70	18.80	1200	82 %	2.12
13	MANIPULATED	BURNING	PINE	99.05	19.60	200	86 %	3.38
	NON-MANIPULATED	BURNING	PINE	111.90	10.30	700	78 %	3.10

difference in density of vegetation between manipulated and non-manipulated sites. This observation is supported by data in table 3. Shrub density averaged 230.77 stems per acre on manipulated sites and 2145.15 stems per acre on non-manipulated sites. This decrease in shrub cover on preferred sites corresponds to an accompanying increase in herbaceous cover. The average herbaceous cover was 86.0 percent for manipulated sites and 77.8 percent for non-manipulated sites. A composite of landscape preference ratings and landscape site data indicates that on the basis of scenic beauty, respondents preferred landscapes with less dense woody shrub cover and a higher percent of herbaceous ground cover.

CONCLUSIONS

The most apparent result of this study was the strong preference for landscapes with a low density of woody shrub cover. As indicated in table 3, this was the site measurement that showed the greatest variation between manipulated and non-manipulated sites. The number of stems per acre appears to be the physical site component responsible for the preferred manipulation pattern. It thus appears that the visually preferable forest landscape is open and park-like in appearance with a low density of understory shrubs. The objective of reducing understory shrub density to improve the esthetic quality of forest landscapes gives scenic resource managers a goal that is easily understood, realistically achieved through established management practices, and readily incorporated into existing management policies.

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