

Aesthetic values of forests: measuring the visual impact of forestry operations

C. Young and M. Wesner

Public perceptions of the impact of various industrial forest operations on the aesthetic qualities of the landscape were assessed by measuring people's responses to variations in pattern and colour.

Sustainable forest management – as defined and measured by internationally accepted categories of criteria and indicators – gives due attention to economic, biological, cultural, social and spiritual values. Thus consideration of sociocultural values is a basic part of sustainable forest management in Canada. Public participation in sustainable forest management programmes is a recognized prerequisite for obtaining acceptance of national forestry policies, and support for forest management programmes and policies may best be achieved by integrating public values into the content of policies. In Canada, public perceptions of the value of temperate and boreal forests are normally measured in three ways: through criteria and indicators related to cultural, social and spiritual values; through the social impact assessment (SIA) process for timber management; or through the observed impact of certification measures.

In public surveys and stakeholder meetings, people are often said to value the aesthetic qualities of forests. Although some scientific research has been carried out on “scenic beauty” as a social value (Hodgson and Thayer, 1980; Hull, Buhyoff and Daniel, 1984; Patsfall *et al.*, 1984), no formal process for measuring perceptions of the aesthetic values of forests has ever been prescribed before. There is no measure specifying how or why a scenic quality contributes positively or negatively to human, social, economic, cultural and spiritual values.

This article presents the results of a study developed to measure public perceptions of the effect of industrial forest operations on the aesthetic qualities of the landscape, based on perceived variations in pattern and colour. A similar technique has been used by the advertising industry to assess which pack-

age design will stand out and capture consumers' attention in a commercial environment, and by military researchers to design areas of camouflage (e.g. Carter and Carter, 1981). Yet this type of study has never been carried out before in applied forestry research.

The study measured the aesthetic acceptability of three types of industrial forest operations: a checkerboard pattern of clear-cutting; irregular patches of clear-cutting; and a logging roadway.

STUDY METHODOLOGY

The experiment used 80 volunteers, undergraduate students from Lakehead University, ranging in age from 19 to 35 years. All of the participants were tested for potential colour-vision deficiencies using the Ishihara colour plate test.

Each of the volunteers was presented with 84 randomized landscape images from a total of 420 forest images (three spatial patterns × five randomized backgrounds × seven chromatic variations × four quadrant locations), presented on a 17-inch, high-resolution red-green-blue (RGB) monitor.

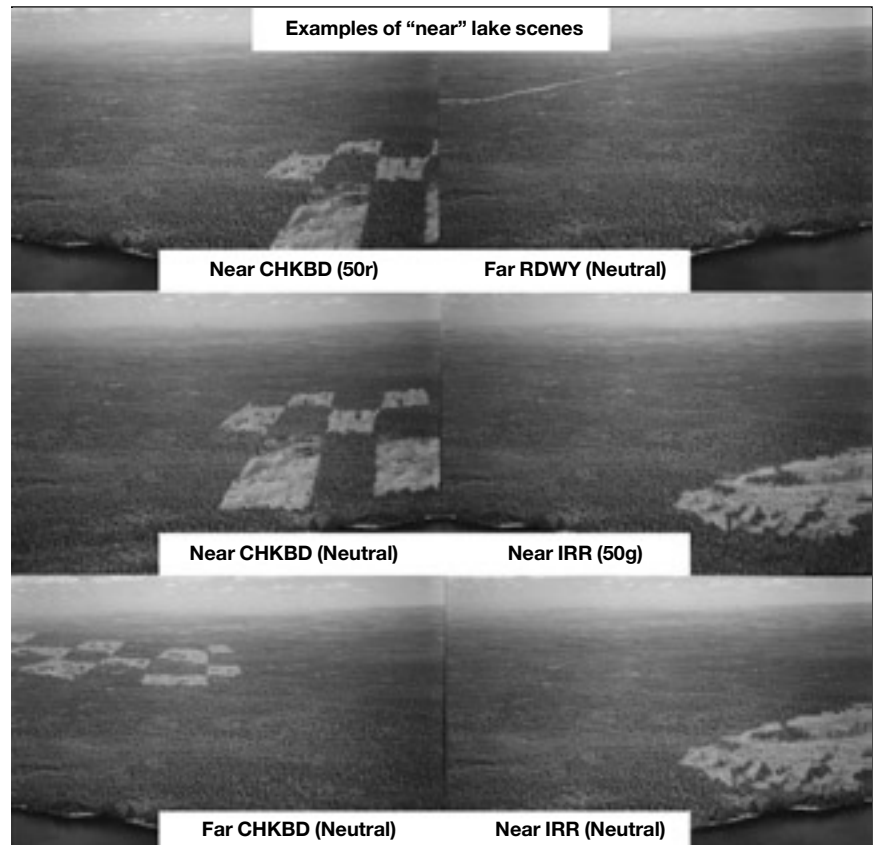
The 420 images were created by using Adobe® Photoshop® (1991 version) to present each of the three target forest operation patterns – checkerboard clearing, irregular clearing and logging road – in different positions in five background templates, each depicting an aerial photograph of a boreal forest. Four of the backgrounds included a lake, positioned in a different quadrant in each (two “near lakes” and two “far lakes”). The fifth had no lake. Samples of these images are shown in Figures 1 and 2.

The three target forest operation patterns were positioned in each of the different quadrants to measure the effects of distance (foreground versus horizon) and left versus right location on the viewers' preferences.

Charlotte Young works with Policy, Planning and International Affairs, Canadian Forest Service, Natural Resources Canada, Ottawa, Canada. **Mike Wesner** is in the Department of Psychology, Lakehead University, Thunder Bay, Ontario, Canada.

This article is adapted from a voluntary paper submitted to the XII World Forestry Congress under the title “Measuring public perceptions of forest industry operations: a method for bridging socio-cultural values”. The abstract of that paper will be included in the Proceedings of the Congress.

1
 Examples of landscape images
 with "near" lake images;
 CHKBD = checkerboard clear-cut;
 RDWY = logging roadway;
 IRR = irregular clear-cut;
 50r and 50g indicate level of
 red/green chromatic modulation



The colour of each pattern was modulated in three incrementally increasing and three decreasing steps along the red-green axis, for a total of seven chromatic steps (as defined by the International Commission on Illumination [CIE], 1931).

The highlights and shadows of the patterns and background were kept constant, as was their overall luminance, in order to measure only the effects of location and colour of the forestry operations on the perceived aesthetics.

Prior to entering the laboratory, the observers were told that they would rate the beauty of forests as if they were viewing them from a low-flying aircraft. The background templates with and without the lake (with no industry presence) were first presented to all observers. Each ob-

server was then asked to rate 84 scenes for one background only. Thus only the spatial and chromatic properties of the forestry operation varied, against a constant background. The observers rated all randomly presented configurations during a single session. The ratings were made along an unmarked vertical 100 mm scale.

The 80 volunteers produced a total of 6 720 public perception observations. Data interpretation was conducted using a four-way multifactor design (spatial pattern, background, colour variation, quadrant location) with repeated measures on three factors.

Following previous researchers' recommendations (Owens, 1988; Schroeder, 1991), in order to identify values that were consistently important

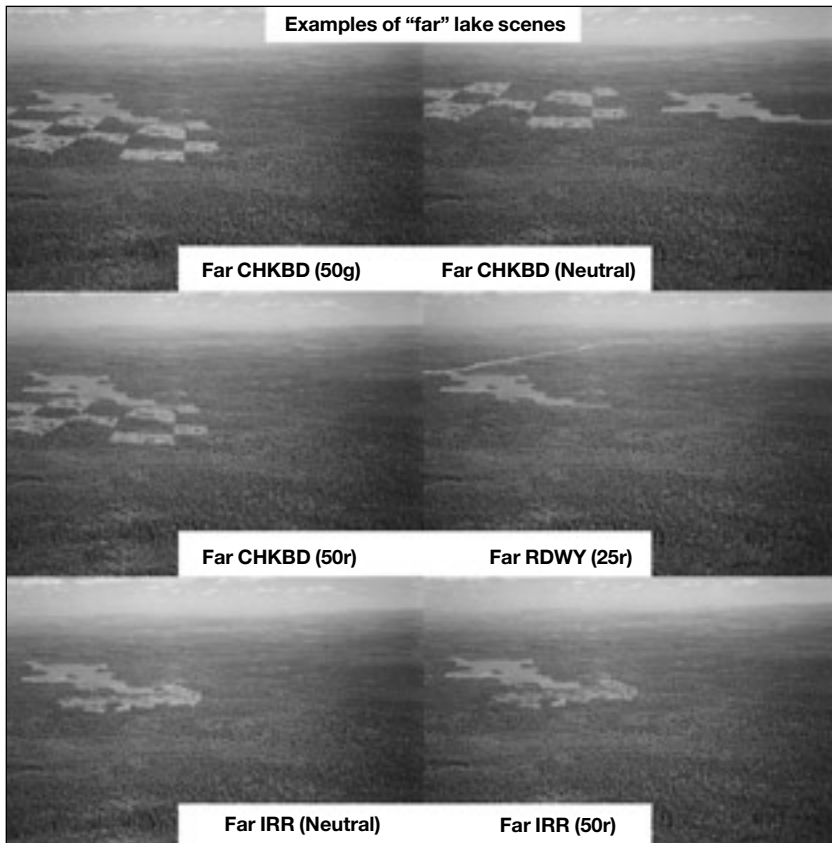
to the participants, the study allowed the observers to make qualifying statements at the end of the rating session so they could describe their strategies for rating the scenes as they did.

RESULTS

Distant roads are the least disturbing

Varying the placement and chromatic properties of the industrial operation significantly influenced the viewers' perception of this activity as aesthetically acceptable or not.

Logging roads were rated as the most acceptable landscape interruption. Irregular harvesting cuts were rated as significantly more acceptable than checkerboard cuts, when perceived from a distance. Statements made by



2
Same as Figure 1, except that images have "far" lake backgrounds;
CHKBD = checkerboard clear-cut;
RDWY = logging roadway;
IRR = irregular clear-cut;
50r and 50g indicate level of red/green chromatic modulation

the volunteers after the test supported these results.

Figure 3 shows the main results of the experiment. Overall, the pattern of the industrial activity was found to have a significant influence on ratings [$F(1.18, 88.47) = 108.19, p < 0.01; \epsilon = 0.589$]. The scenes with roadways were rated the most visually attractive. The checkerboard-pattern clear-cuttings were rated less favourably than the irregular clear-cuttings (Figure 3a). The preferences (means) for the roadways were found to be significantly higher than means for the irregular and checkerboard patterns.

Forests should be green

The effects of low-level visual processing of colour contrasts on the overall

perception of landscapes had never been researched before. A significant difference in colour preferences was found [$F(4.96, 372.20) = 29.11, p < 0.001; \epsilon = 0.827$]. The greener patterns were rated more beautiful than the redder patterns (Figure 3b). The trends can be seen with standard error of the means (SEMs); the overlapping SEMs indicate areas where there are small differences between the chromatic levels.

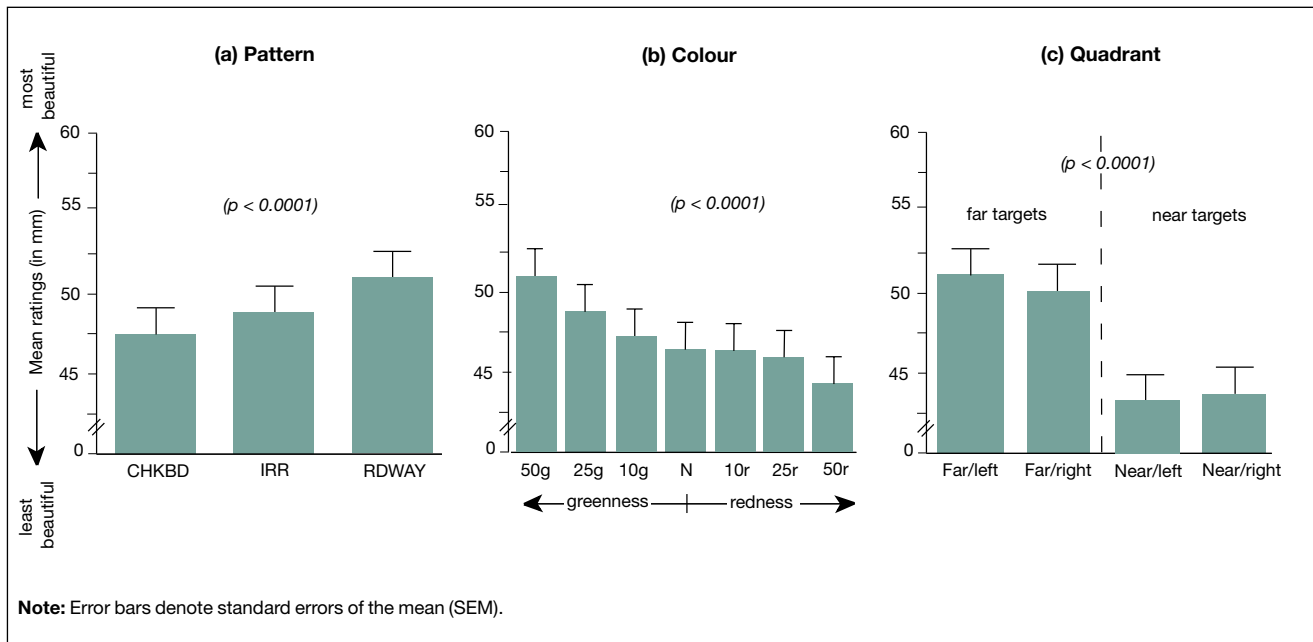
The distance of the industrial operation from the public observer was found to be an important factor in landscape beauty.

Forest operations located in the "far" (upper) quadrants were rated significantly more beautiful than the "near" operations (lower quadrants) (Figure 3c) [$F(1.91, 140.99) = 108.56, p < 0.001;$

$\epsilon = 0.636$]. The left and right did not differ significantly (Helmut: $t0.05 = -1.60, p = 0.11$).

The interactions of colour and pattern, pattern and quadrant, and colour and quadrant are shown in Figure 4. The interaction between colour and shape was found to be significant [$F(8.86, 664.55) = 8.96, p < 0.001; \epsilon = 0.738$]. Greener checkerboard clear-cuts and irregular clear-cut patterns were viewed more favourably than redder checkerboard and irregular clear-cut patterns. Colour had little effect on the acceptability of roadways (Figure 4a).

The interaction between forest operation pattern and quadrant was significant [$F(4.38, 328.39) = 22.86, p < 0.001; \epsilon = 0.730$]. The roadway consistently showed the highest rating, and the



3

Main results, observers' preferences

checkerboard consistently showed the lowest rating, despite the location of the operation (Figure 4b). The scenes containing distant industrial operations were always given higher ratings than the scenes containing near industrial operations, although for roadways the difference between far and near was not significant.

The interaction between colour and position of the industrial operation (Figure 4c) and the three-way interaction among colour, pattern and position were not significant. Interactions between background and all remaining factors were not significant. Whether the observers viewed the industrial operations with or without a lake did not appear to influence the overall ratings, although observers did report finding a forest industry operation with a lake more disturbing than an operation without one.

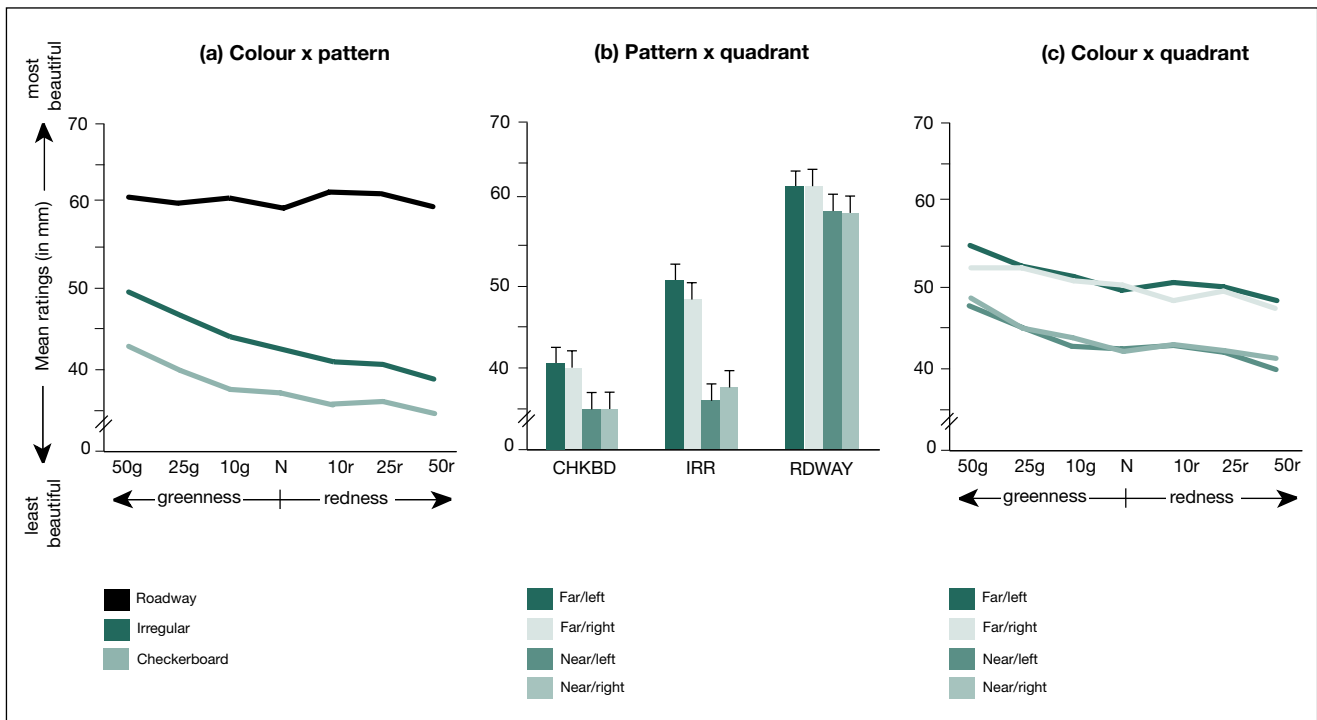
DISCUSSION

The study findings demonstrate that all of the dimensions that were manipulated

in the study (e.g. pattern, colour and location of forest industry operations) influence perceptions of scenic beauty. The measured values of the perceived beauty of the operations were supported by qualifying comments made after observers had viewed the scenes.

Forests should look “natural”

Observers consistently commented that clear-cut patterns had been a major determining factor in how they rated the forest scenes. Seventy-five percent of the respondents commented on the checkerboard clear-cut pattern and, of these, 85 percent commented negatively, stating that they looked unnatural and human-made. Sixty-three percent of the observers made comments about irregular clear-cut patterns. Of these, 54 percent indicated that they preferred the irregular patches to the checkerboard pattern because they looked more natural; for example, the patches might have been caused by forest fire or insect infestation. A possible explanation for the



4
Interactions of the mean ratings for the various dimensions – colour, pattern and quadrant

low ratings given to the checkerboard pattern is that although square landscape patterns are common in agricultural regions, they are extremely uncommon in forests.

The logging roadways appeared to have little negative impact on perceived scenic beauty. Of the 55 percent of the respondents who commented on roadways, 95 percent stated they viewed roads as “belonging to” the scene. Only 5 percent of respondents disapproved of the roadways.

The importance of colour to scenic beauty was demonstrated by the high ratings for greener industry operations and by the observers’ comments. Sixty-six percent of respondents commented on industrial patterns appearing reddish. Of these, 88 percent disapproved of the patterns. Typical comments were that the reddish patterns appeared to represent a dying forest, recently destroyed by human hands. However, of the 73

percent of respondents who commented on the greenness of an industrial pattern, 97 percent approved of the green patterns stating they appeared as natural forest regrowth. Only 3 percent of the volunteers specifically disapproved of the green operations, stating that forest clear-cut patterns had an unnatural and inappropriate look.

Operations were accepted better at a distance

The spatial distance of industrial operations had an impact on perceived forest beauty; observers seem to have objected to obstruction of background vegetation by forest industry patterns placed in the foreground. This was also evident in the observers’ comments. Of the 35 percent of comments on “far” operations, 100 percent rated them more acceptable than “near” ones. There was no significant difference between left and right.

These results were not interpreted to

suggest that harvesting should only be carried out far from human viewers, but they provide insight into the nature of human perception of beauty: they suggest that as a land form is viewed at greater distances, specific land patterns become less influential in the individual's rating of visual quality.

In post-rating comments, only 23 percent of observers made comments about lakes. Of these, 15 percent indicated that cuts near the lake were offensive. Interestingly, 7 percent of the respondents actually described irregular clear-cuts near lakes as aesthetically pleasing, because they appeared to represent recreational beach sites.

CONCLUSIONS

Measuring the effects of forestry land use against public expectations has added value for policy-making when social research is quantified. The study described in this article introduces a new approach for measuring aesthetic values and public acceptance of forestry operations. The conclusions about public preferences that can be drawn from the study are admittedly limited by the fact that the participants, although heterogeneous, were all university student volunteers, and thus arguably not a representative cross-section of society. To validate the findings, the method could be used with other groups of observers. It would also be interesting to examine responses to other types of scenes. For example, the roads could be examined further by varying their lengths and widths into the forest to match major harvesting operations. In addition, studies could be made using simulated industrial patterns modified to incorporate the specific recommendations of forest policy management.

The findings suggest that all forest industry operations manipulated in the study influence scenic beauty. However, the intent of the study was not

to advocate or condemn clear-cutting as a harvesting technique. Although comparable situations can be observed in real scenes that have undergone recent harvesting operations, it was not intended that the results, obtained by manipulating forestry operations under well-controlled experimental conditions, be generalized to real-life situations. Rather, it is hoped that the present study will begin to establish measurable indicators of aesthetic values that may be incorporated into future criteria and indicators processes, to help maintain the natural beauty and values that the public expects from forests. ♦

Schroeder, H. 1991. Preference and meaning of arboretum landscapes: combining qualitative and quantitative data. *Journal of Environmental Psychology*, 11: 231-248. ♦



Bibliography

- Carter, E. & Carter, R.** 1981. Color and conspicuousness. *Journal of the Optical Society of America*, 71: 723-729.
- Hodgson, R. & Thayer, R.** 1980. Implied human influence reduces landscape beauty. *Landscape Planning*, 7: 171-179.
- Hull, B.R., Buhyoff, G.J. & Daniel, T.C.** 1984. Measurement of scenic beauty: the law of comparative judgement and scenic beauty estimation procedures. *Forest Science*, 30: 1084-1096.
- International Commission on Illumination (CIE).** 1931. *International Congress on Illumination – Proceedings*. Cambridge, UK, Cambridge University Press.
- Owens, P.E.** 1988. Natural landscapes, gathering places, and prospect refuges: characteristics of outdoor places valued by teens. *Children's Environment Quarterly*, 5(2): 17-24.
- Patsfall, M., Feimer, N., Buhyoff, G. & Wellman, J.** 1984. The prediction of scenic beauty from landscape content and composition. *Journal of Environmental Psychology*, 4: 7-26.