Visual Land-use Compatibility and Scenic-resource Quality

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ABSTRACT.—The effect that land-use relationships have upon perceived quality of the visual landscape is discussed, and a case is made for expansion of fit-misfit theory into what has been called visual land-use compatibility. An assessment methodology that was designed to test people's perceptions of land-use relationships is presented and the results are discussed.

TRADITIONALLY, IN THE ANALYSIS of visual landscape quality, the parameters used most often are landscape diversity, landscape contrast, and landscape complexity *(Fabos 1973, Green 1972)*. In most of the assessment techniques, only the quantitative aspects of land-use adjacencies are considered. They consider only the length of the adjacency and degree of contrast between land uses. There is much evidence that people do indeed respond in a positive way to complexity and contrast *(Berlyne 1963, Day 1967, Munsinger and Kessen 1964, Lechart and Bakam 1965)*. Nonetheless, we are faced with the very real possibility that many of the land uses that contribute to contrast or complexity are themselves undesirable or are incompatible with other adjacent uses. This raises the need for a technique for qualitative assessment of land use relationships.

A review of historically related planning literature reveals that man has always been concerned with relationships between land uses in the development of communities. Early cities, for instance, were placed along or near bodies of water that provided the inhabitants with an adequate supply of water, transportation, waste disposal, and security from invading forces. This same need for security had a great influence on other development patterns. Forest land was not maintained immediately adjacent to communities because it provided concealment for attacking forces. Agricultural land on the outskirts of the cities not only provided necessary farm products, but also allowed ready observation of approaching visitors *(Mumford 1961)*. A less justified but nonetheless very real fear of the forest as a wilderness home of wild beasts and monsters further influenced the forest-town relationship *(Nash 1967)*. When the first Europeans arrived in America, the wild and natural environment they found reinforced these perceptions. Protection from the real and imagined enemies that lurked in the vast wilderness and development of farmlands led in part to the removal of much of the forest land throughout New England.

Late in the nineteenth century in the United States as well as Europe, perceptions of land-use relationships had begun to change. The romantic landscape movement in England and the subsequent park movement in the United States were the first evidences of these perceptual changes. In England, these movements were led by William Kent, Capability Brown, and Humphrey Repton. American leaders included Andrew Jackson Downing, Frederick Law Olmstead, and John Muir. By this time, people were beginning to see the value of natural elements in the landscape.

Early interest in land-use relationships was reflected in nuisance law. "While many land use incompatibilities are a product of physical damage flowing from close proximity, in many cases the conflict is predicted solely on matters of taste and preference rather than an observable physical effect" *(Mandelker 1970)*. By late in the nineteenth century, the separation of incompatible land uses had begun to take the form of present-day zoning. In the 1880s or 90s, Chinese laundry establishments in San Francisco were prohibited or restricted in certain parts of the city. When contested, the decisions were upheld in the courts as being valid use of the police power. Early in the twentieth century, zoning ordinances had become the common form of land-use regulation in the United States. The ordinance enacted in New York City in 1916 was the first of these *(Toll 1969)*. Since that time, zoning has become the most widely used method of land-use control and clearly represents a concern for the separation of what are perceived to be incompatible uses.

In developing methodologies for assessing metropolitan landscapes, land-use compatibility may be an important parameter. Although recent research has shown that land-use compatibility plays an insignificant role in influencing perception of visual quality at the natural end of the landscape continuum, *(Anderson et. al. 1976)*, it may play a major role at the urban end. This is explained by the fact that nearly all elements in a natural landscape are found to be compatible with one another, while the metropolitan landscape is made up of a variety of elements that are incompatible. Those rare elements found in the natural landscape that are incompatible with their surroundings can be treated as misfits. The occurance of incompatible uses in the metropolitan landscape is so frequent that they cannot really be termed misfit. Thus the application of land-use compatibility concepts to the metropolitan landscape can be thought of as an extension of misfit theory.

The research reported here was conducted to develop a methodology for assessing visual land-use compatibility in the metropolitan landscape. This research represents only a small part of a larger ongoing project at the University of Massachusetts, called the Metropolitan Landscape Planning Project (METLAND).

METHODS

This research had three primary objectives. The first was to identify a technique that could be used to determine compatibility values for possible land-use adjacencies in the metropolitan landscape. The second was to translate these values into a procedure for assigning actual scores to the landscape. The third was to apply the entire procedure to a study area in the Boston metropolitan area.

Although there is considerable literature about land-use compatibility, no clear technique for determining values exists. To resolve this problem, a testing procedure was designed. It was hypothesized that the relationship between two adjacent land uses may be a function of the effect that each land use has upon the other. That is, the relationship between land uses A and B would be a function of the effect that A has on B and the effect that B has on A. Furthermore, the effect of A on B might be significantly different from the effect of B on A. For example, in consideration of a forest/residential adjacency, the effect of the forest upon the residential areas might be positive while the effect of the residential area upon the forest might be negative. Thus the combination of these two effects could be considered a parameter of visual land-use compatibility.

The METLAND Study has used a land-use classification system generated from aerial photography by the Department of Forestry at the University of Massachusetts *(MacConnell 1972)*. Since its initial development, the system has been modified and expanded, and with the addition of several urban uses it now includes 126 distinct land types. This same classification system was used as a basis for the land-use compatibility component of the study. A few simple calculations show that this system generates an enormous number of land-use adjacencies. Using the formula

$$A = \frac{n^2 - n}{2}$$

where A is the total number of possible adjacencies, and n is the number of land uses, we find that there are 7,875 possible adjacencies. Obviously it is impossible to consider the visual compatibility of such a large number of adjacencies. Furthermore, the distinctions that can be made among many of these 126 land uses are relatively insignificant, especially with respect to visual characteristics. For instance, the difference between two forest types — H3A and H4A — is only in the heights of the trees, 30 feet and 40 feet respectively. Both are relatively mature forests, and the visual distinction is slight.

The first task was to find a technique for aggregating these 126 land uses into a smaller number of common types. It seemed that the maximum number of adjacencies that could be considered was approximately 100. This meant that the 126 types would need to be collapsed into 15 or fewer general classes (15 types would produce 110 adjacencies).

To accomplish this aggregation, a group of designers, planners, and resource managers were asked to sort 126 cards, each describing a land use, into 9 categories ranging from most man-made to most natural. Examination of the data received from this survey identified 10 distinct groups consisting of land uses with similar visual characteristics. For example, all of the land-use types that fell into the wetland category were obviously associated with water, consisted primarily of low vegetation, and lacked man-made structures; while those types that fell into the industry category were represented by large densely-built structures and a lack of vegetation or open land. An eleventh category, open water, was added because of its importance in influencing perceptions. These 11 general land-use groups, each representing a number of more specific land-use types having similar characteristics, were chosen for further study.

In any research of this nature, it is desirable to obtain as large a sample as possible. Generally the larger the sample, the more valid will be the results. However, other constraints such as limited personnel, finances, and time place restrictions upon the number of responses that can be obtained. For this study, it appeared that 50 responses was the maximum number that could be gathered in the time available and was an adequate number to achieve the desired results. To test a wide cross-section of the population, the 50 respondents were selected from 5 subgroups: designers (architects, landscape architects, and interior designers), planners (regional planners and community planners), realtors, conservationists, and nonprofessionals. It should be noted that nonprofessionals as used here is meant to include people who are not familiar with land-use related issues. Ten individuals from each of these 5 groups provided the sample of 50 respondents.

To elicit responses from participants, some sort of environmental stimulus is needed. This stimulus can be as simple as a written description, or as complex (to administer) as an actual on-site inspection. Again, time and money constraints greatly influenced our choice of a procedure. For this study black-and-white photographic prints of the eleven general land-use types were selected. Recognizing the difficulty in locating typical examples of each land use, we decided to produce 3 sets of photographs of the 11 general types.

An attempt was also made to control as many variables as possible in the photographs. The following criteria were used in selecting and photographing examples of land uses:

- All photographs were taken on sunny cloudless days in late spring between the hours of 10:00 a.m. and 2:00 p.m.
- Topographic relief was held constant in all photographs. Only sites with slightly rolling or flat topography were photographed.
- The amount of foreground was kept constant in all the photographs. This was accomplished by keeping the foreground line at the same position in the view finder of the camera for each photograph.
- The horizon line was kept constant in all the photographs.
- All photographs were taken from a normal viewer position.
- Each photograph was to represent only one land use.

To maintain consistency of procedure, all of the 50 surveys were administered by the author. Each participant in each subgroup was randomly assigned to one of the three sets of photographs so that 3 persons from each group responded to set A, 4 to set B, and 3 to set C. Each participant was shown all 11 photographs so that he or she would be familiar with the general land-use types. After this, one of the photographs, randomly selected, was placed on the participant's left. The remaining 10 photographs were then presented in a predetermined random order on the right. In all cases the participant was asked to respond to the following question:

> If the two land uses represented by the photographs you are observing were adjacent to one another, how would the land use on the right affect the visual quality of the land use on the left?

After all 10 photographs had appeared on the right, a different photograph was placed on the left, and the procedure was repeated until all 11 photographs had appeared on the left and had been compared with the other 10, making a total of 110 observations. The participants were asked to record their responses on the following scale:

$$-3 \quad -2 \quad -1 \quad 0 \quad +1 \quad +2 \quad +3$$

If the land use represented by the photograph on the right had no effect upon the visual quality of the land use represented by the photograph on the left, the participant was asked to record his response in the space marked 0. If the one on the right enhanced the one on the left, the response would be recorded in the appropriate space on the positive side of the scale. If the one on the right detracted from the one on the left, the response would be recorded on the negative side of the scale.

FINDINGS

The results of the survey are presented here in two ways, first in relation to the consistency of the responses between the five subgroups and secondly, in relation to the actual compatibility values themselves. It was assumed at the outset that the extent of agreement among participants would not be the same for all of the adjacencies. To test this assumption, an analysis of variance was conducted to examine the variance between the 5 groups for each of the 110 observations (fig. 1). It should be noted that each relationship in the matrix, representing a possible adjacency, is derived from the combination of two observations. If there were no

Figure 1.—Extent of agreement matrix.

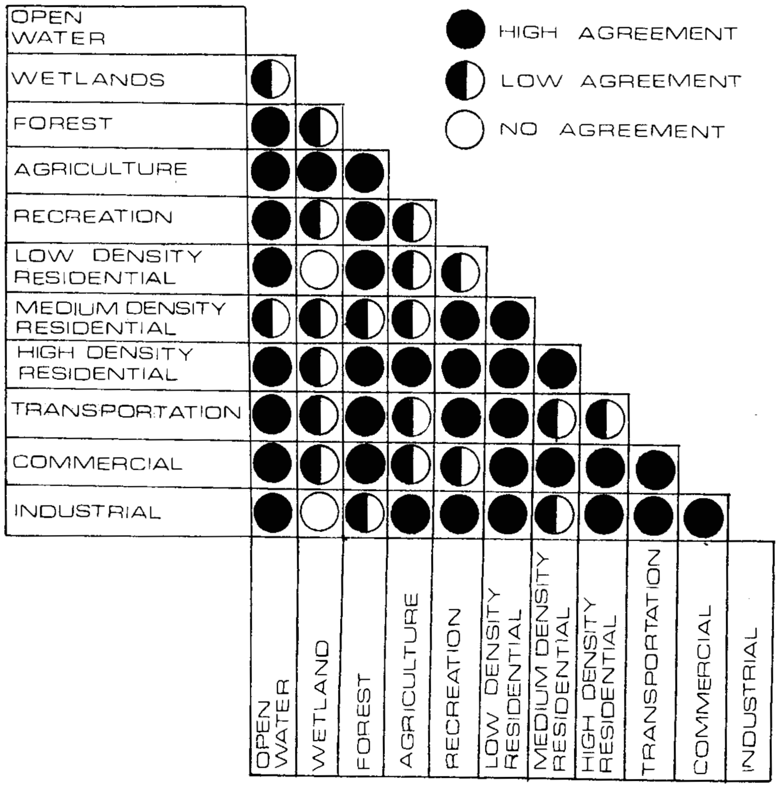
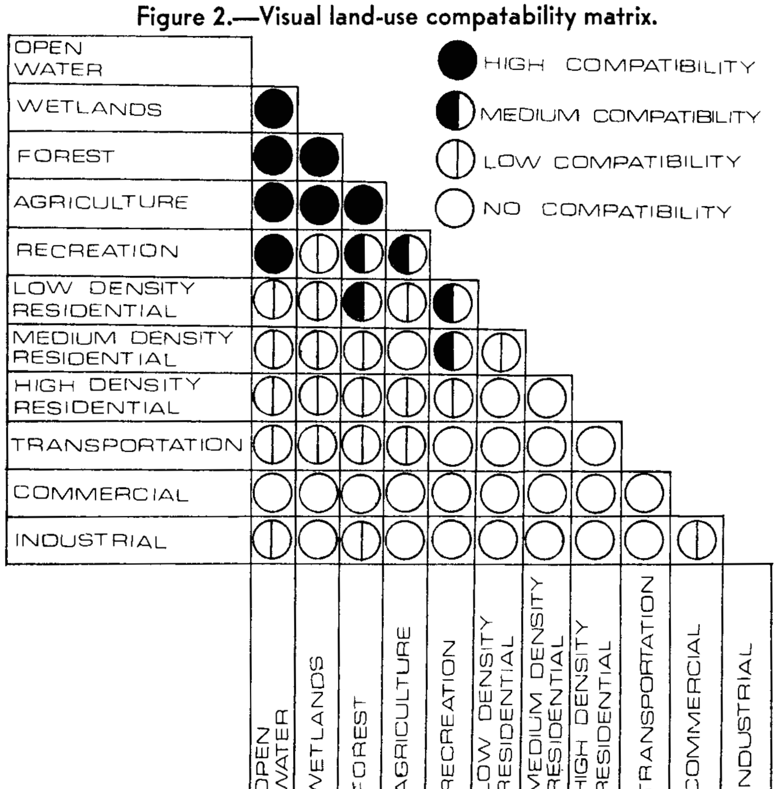


Figure 2.—Visual land-use compatability matrix.



disagreement between groups for either of the two observations, the agreement on that relationship was considered to be high; if there were disagreement between groups on one of the observations, the agreement on that relationship was considered to be low; and if there were disagreement between groups on both of the observations, there was considered to be no agreement on that relationship. There was considered to be disagreement on an observation when the scores from the 5 groups were found to be different at the 95-percent confidence level.

The actual compatibility values are recorded in figure 2. Again it should be noted that each of these values represents the scores obtained for two observations. The mean scores of all 50 participants for each of the 2 observations were added to derive the single value for each adjacency. The values were found to range from a low of −1.98 to a high of 4.78, which when normalized vary between 0 and 6.76. These values were then distributed into the four classes of visual land-use compatibility listed below:

High compatibility	4.51 - 6.76
Medium compatibility	3.01 - 4.50
Low compatibility	1.51 - 3.00
No compatibility	0 - 1.50

These visual land-use compatibility ratings (fig. 2) were applied to a preexisting assessment technique. A further discussion of that technique can be found in Fabos *(1973)* or Hendrix *(1973)*.

CONCLUSIONS

Several conclusions can be drawn from this study. It seems reasonable to expand the concept of *misfit* into a broader concept that expresses the relationships that exist between adjacent land uses. That is, people respond to all manner of relationships, not just to those that represent misfits.

This research was not designed to examine the multivariate aspects of land-use compatibility. The survey was made in such a way as to elicit responses about the visual aspect of compatibility only. In spite of this, several participants expressed concern for other aspects while being interviewed. Housewives, for instance, commented about the safety aspects of a housing and transportation adjacency. Similarly, many participants seemed to be concerned about other than visual aspects when confronted with an adjacency involving wetlands. While the developers expressed economic interests, the conservationists seemed to be concerned with pollution and loss of wildlife habitat. This may in part explain why there is so little agreement about wetlands adjacencies between groups (fig. 1). It could be concluded that more research, perhaps by environmental psychologists, is needed to resolve this problem.

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