

Analysis of Landscape Character for Visual Resource Management¹

Paul F. Anderson^{2/}

Abstract: Description, classification and delineation of visual landscape character are initial steps in developing visual resource management plans. Landscape characteristics identified as key factors in visual landscape analysis include land cover/land use and landform. Landscape types, which are combinations of landform and surface features, were delineated for management purposes by analyzing land resource data for a study area near Ames, Iowa. Then quality ratings and land use controls were developed for each landscape type in the study area. This approach is currently being used in several resource planning and management programs in Iowa.

INTRODUCTION

Landscape planning is one of several inputs in the comprehensive planning process, along with social planning and economic planning. In all three types of planning, the need exists for input from visual landscape analysis. Visual landscape analysis has three major stages (Unwin 1975):

1. Inventory, description, and classification of landscapes--the landscape measurement stage.
2. Investigation and measurement of value judgments or preferences for the visual landscape--the landscape preference stage.
3. Assessment of the quality of the objective visual landscape in terms of individual or societal preferences for individual

landscape types--the landscape evaluation stage.

Collectively, these three stages comprise visual landscape analysis (sometimes called landscape assessment or landscape evaluation) which, when combined with other types of landscape analysis, can provide useful information for use in landscape planning, design, engineering, and management.^{3/} One specific need in visual landscape analysis is for methods and techniques to describe, classify, and delineate landscape character efficiently and accurately in the first stage prior to applying value judgments or preferences.

Application to Iowa

The Landscape Architecture Department and the Land Use Analysis Laboratory at Iowa State University have been active since 1971 in an analysis of the state's visual landscape character and in developing tools and techniques for landscape planning in general. Before beginning a technical analysis of detailed land information sources, the Labora-

^{1/} Presented at the Conference on Applied Techniques for Analysis and Management of the Visual Resource, Incline Village, Nevada, April 23-25, 1979.

^{2/} Landscape Architect and Resource Analyst, Land Use Analysis Laboratory, Iowa State University; and Instructor, Department of Landscape Architecture, College of Design, Iowa State University, Ames.

^{3/} Concepts, techniques, principles and applications of landscape analysis are described in a forthcoming book, Regional Landscape Analysis, by Paul F. Anderson.

tory examined general data sources. These general data were analyzed in terms of how visual patterns were created on the landscape. The result was a delineation of ten landscape regions of Iowa and descriptions of typical topography, drainage, soil, vegetation, urban and land management patterns (Faxlanger, Sinatra and Uban 1973).

The Land Use Analysis Laboratory is an interdisciplinary research team with active input from socioeconomic, engineering, physical science, resource management, environmental design and planning disciplines. A major thrust of the Laboratory has been the development of computer-assisted landscape analysis techniques and software. The Multi-Scale Data Analysis and Mapping Program (MSDAMP) is a computer program for the static modeling and display of data on spatially-distributed land characteristics. The systems package is based on data overlay concepts, statistical sampling of data, multiple resolution analysis and geodetic coordinates (Beavers 1977).

During the past two years, analysis techniques have been developed expressly for visual resource management considerations in the landscape planning process using existing MSDAMP program capabilities and existing data at the Land Use Analysis Laboratory. Techniques for classifying and analyzing visual landscape resources were needed to add to those already developed at the Laboratory for soil, vegetation, wildlife, water and mineral resources. Techniques were needed that also were appropriate to landscapes of the central interior plains. The work has been supported by the Design Research Institute of the Iowa State University College of Design, in cooperation with the Land Use Analysis Laboratory, the Iowa Agriculture and Home Economics Experiment Station, Story County and the City of Ottumwa, Iowa.

The research work on visual landscape analysis at Iowa State University began with an investigation of landscape characteristics which are used to describe and classify landscape character. Using data on these landscape characteristics, landscape types were described, classified and delineated in a local study area (fig. 1). This approach is currently being used for several resource planning and management studies in Iowa.

LANDSCAPE CHARACTERISTICS

Landscape analysis models may be descriptive or predictive. Descriptive models are useful for landscape measurement, the first stage of visual landscape analysis. This paper reports the work to date in Iowa on

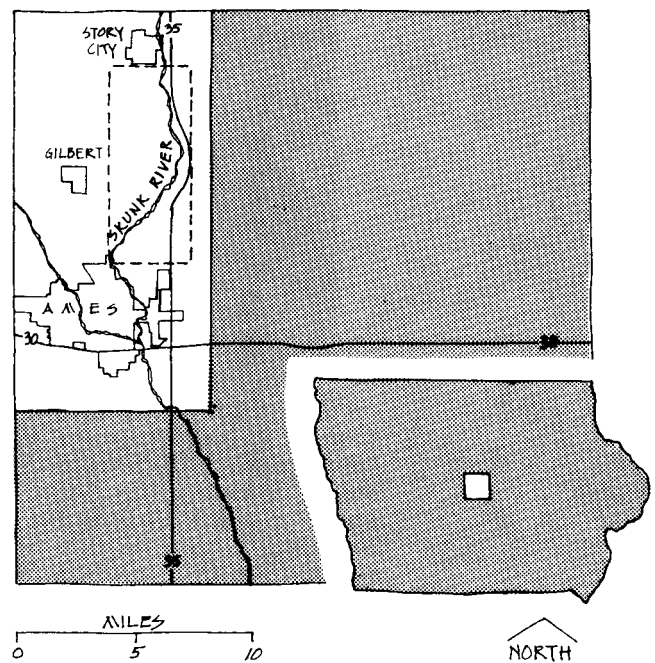


Figure 1--Location and features of the Skunk River valley study area in Story County, Iowa mapped in figure 2. Broken lines indicate the recreation greenbelt area mapped in figure 3.

descriptive models involving independent variables (landscape characteristics). Predictive models are useful for landscape preference, the second stage of visual landscape analysis. Work on predictive models for Iowa landscapes is reported in Nassauer (1978). Finally, these two types of models are currently being combined in specific applications for visual resource management: scenic quality ratings, plan and policy formulation and plan evaluation.

A review of investigators' literature suggests that two landscape characteristics--landform and land cover/land use--are indicators of visual landscape character.^{4/} These two landscape characteristics describe the shape of the land surface, natural and man-made materials on the land surface, and cultural activities on the land surface. Many land use and natural resource planning and management studies typically involve data on landforms and land cover/land use. In Iowa studies conducted by the Land Use Analysis

^{4/} A more complete description of results is contained in the forthcoming final research report to the Design Research Institute, College of Design, Iowa State University, Ames.

Laboratory, landform characteristics are derived by interpreting soil survey data. Land cover and land use characteristics are derived by interpreting aerial imagery, topographic maps, geology maps and maps of surface water.

LANDSCAPE TYPES

Description

Landscape types are areas of homogeneous visual landscape character, which may be described by the basic visual elements of various landform types and land cover types. Form, line, color and texture are the basic visual elements often listed as determining the visual response to landscape characteristics (Stone 1978). Thus, a descriptive model for the first stage of visual landscape analysis has this general form: landscape character is a function of the form, line, color and texture of landform and the form, line, color and texture of land cover/land use.

To avoid unnecessary introduction of value judgments in the first stage of visual landscape analysis, landscape types must be based on value-free measures of landscape character (Jacobs 1975). An approach used in this study is to assume that landscape types are described by unique combinations of landform types and land cover types.

Classification

The next step in completing a delineation of landscape types is classification of landforms into various classes. A classification of land cover is likewise needed. Landform classes and land cover classes must be selected based on visual characteristics so that they are reasonably representative of their actual state. First, how can landforms be classified based on form, line, color and texture? The shape of the land surface is one answer--ridges are convex, depressions and drainage ways are concave. Orientation of the ground plane is another possibility--horizontal, vertical, or sloping. Degree of topographic enclosure may also be useful as in relative position of the observer with the landscape--superior, normal, inferior. Information for all three of these is provided by interpreting soil data for landscape position. Landscape position indicates general landform shape, slope, topographic enclosure and relative landform position.

Second, how can land cover/land use be classified based on form, line, color and texture? Materials covering the land surface have different visual characteristics--man-made, plants, water, minerals. Differences

in the intensity of human use and management of these surface materials also have visual expressions. An example of this in Iowa is the visual differences between tree plantations with regular tree spacing and woodland areas with random tree spacing. A third basis for land cover/land use classification for visual analysis is the height of land surface materials which, along with landform, affects spatial enclosure and view distances. Surface material, height and intensity of human use and management together become a meaningful basis for land cover/land use classification.

Delineation

Each unique combination of landform and land cover/land use as previously classified is considered a landscape type. A specific model of landscape types was prepared for the study area using appropriate data on landform classes and land cover/land use classes (fig. 2). This delineation of landscape types was verified and documented through field evaluation and photography.

APPLICATIONS

The second stage of visual landscape analysis, the preference stage, includes the identification and measurement of value judgments or preferences for the visual landscape. Nassauer (1978) established a predictive model for visual value in Iowa by asking 150 respondents in a sample population to rate the visual quality of 82 selected photographs of Iowa's landscapes. Land use, water presence and topography were, in declining order, the most significant physical characteristics of the scenes in predicting visual value, according to the study. Together, these three characteristics explained 67 percent of the variance in the respondents' visual value scores.

This work and the descriptive model of landscape types in Iowa become the basis for the third stage of visual landscape analysis, landscape evaluation. In this stage, documented values are applied to landscape types to assist in making visual quality ratings in a study area, establishing land use policies, formulating land use and management plans and evaluating proposed plans or actions.

Scenic Quality Ratings

One of the first steps in developing or evaluating landscape policies and plans is the measurement of scenic quality in the policy or plan area. Scenic quality may be estimated in



Figure 2--Landscape types. Darker symbols represent areas of lower intensity human use and management. Each of the 31,682 symbols represents 2.78 acres.

a study area by applying visual landscape preferences to landscape types. The framework for estimating scenic quality ratings was established by combining landscape preferences in Iowa (Nassauer 1978) with an adaptation of scenic quality rating criteria for western landscapes (U.S. Bureau of Land Management 1978). Major differences in the landscapes of the western states and central interior plains required careful evaluation and adaptation of BLM rating criteria. These differences included degree of cultural modifications, land ownership, road density, visual sensitivity, topographic relief, distance zones and delineation of rating units. The resulting scenic quality

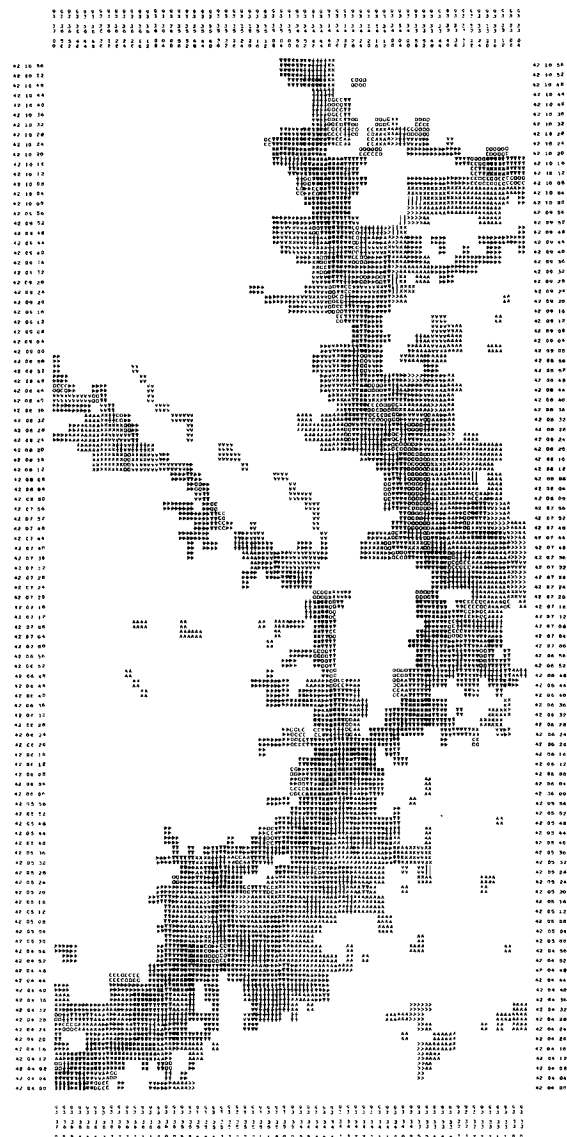


Figure 3--Scenic quality rating of the Skunk River recreation greenbelt. Darker symbols represent areas with higher ratings.

criteria for analyses of Iowa landscapes include--

- Landform - relief and features
- Vegetation - diversity
- Water - presence and visual dominance
- Color - land cover diversity
- Adjacent scenery - compatibility
- Scarcity - land cover uniqueness
- Cultural modifications - degree

These criteria were tested and evaluated, first on the study area as a whole, then on broad scenic quality rating units within the study area. The rating units were delineated

by aggregating landscape types in figure 2 into urban and non-urban types, then subdividing the non-urban types into upland and valley landscape positions. The mean scenic quality rating score for the entire study area was 10.2 on a scale of 1 to 33 (where 33 indicates the highest scenic quality). The mean, maximum and minimum scores for each of the rating units are--

	Mean	Maximum	Minimum
Study area	10.2	24.0	3.5
Urban	9.3	18.5	4.0
Rural upland	9.6	21.0	3.5
Rural valleys	12.0	24.0	6.0

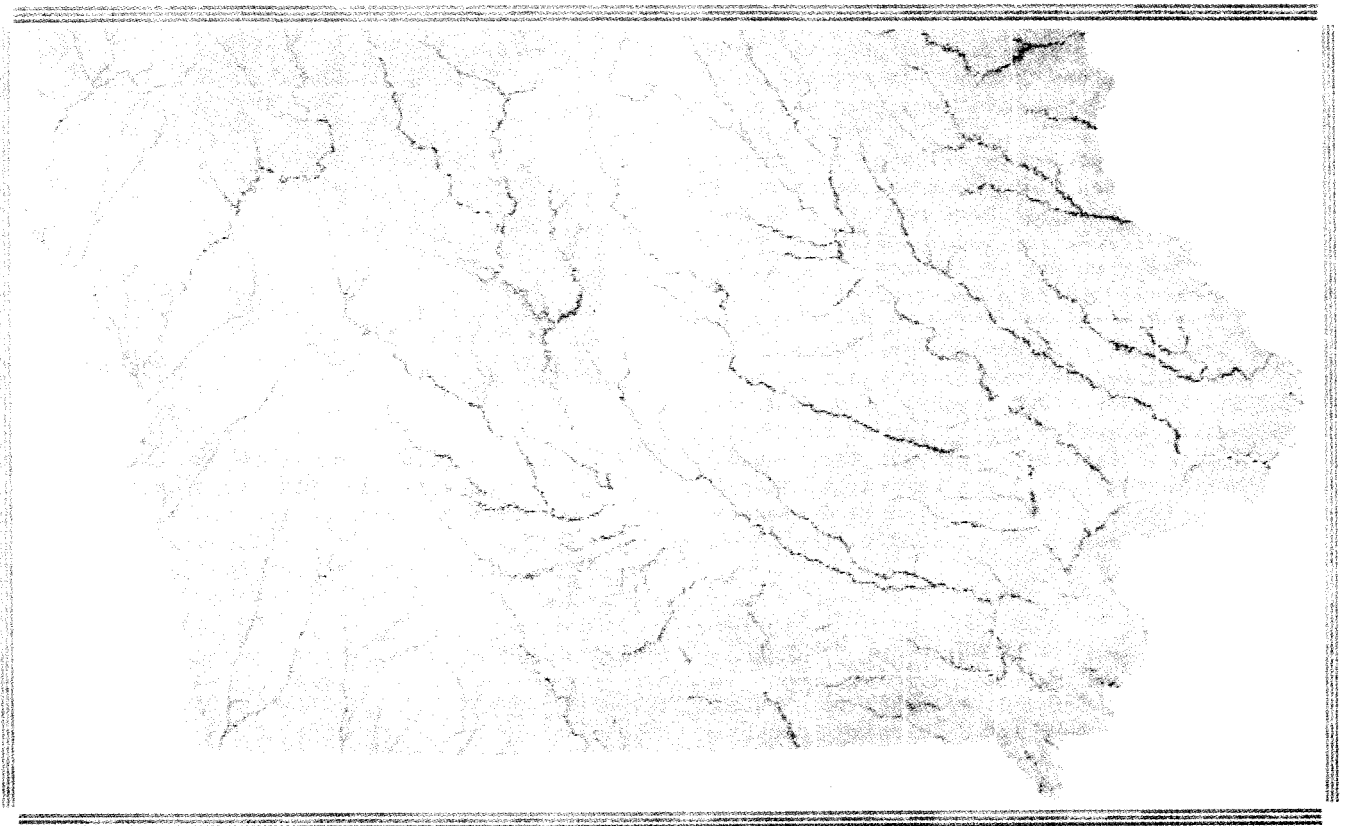
Little significant difference is found in the results for the upland rating unit and the urban rating unit. The scores for the valley rating unit, however, are significantly higher. The test results presented here are considered an initial approximation of scenic quality ratings. Work currently in progress involves further refinement of the rating criteria and their measures for project situations and the landscape of Iowa.

Policy and Plan Formulation

Of particular concern in Iowa are areas that have high potential for recreation activities. Because over 90 percent of the state is in agricultural uses, little land is available for camping, picnicking, hiking, swimming and boating. Several counties have recognized the need to protect areas for active and water-based recreation. One approach to protection is the recreation greenbelt concept which has been included in the zoning ordinance of Story County, Iowa. Analyses of scenic quality are being used to develop a master plan for a recreation greenbelt along the Skunk River in Story County. Preliminary measurement of scenic quality in the greenbelt indicates a mean scenic quality rating of 13.1 (fig. 3).

At the state level, recent legislation provided for the establishment of state-designated Protected Water Areas in Iowa. Visual landscape analysis techniques described in this paper are being used to help develop a statewide master plan for potential Protected Water Areas. Over 3,100 miles of streams, lakeshore and wetland perimeter have been mapped using Land Use Analysis Laboratory land resource data (figure 4). These areas

Figure 4--Potential Protected Water Areas in Iowa. Darker symbols represent areas of higher potential. Each of the 229,745 cells represents approximately 156.7 acres.



are being evaluated further using aerial photography. Selected areas of high potential will then be evaluated by the Iowa Conservation Commission through site visits and meetings with local officials, landowners and interest groups. In the Protected Water Areas program, visual character is the most important consideration in selecting areas of high potential for further study and inclusion in the program.

Landscape planners working on the master plans are finding these kinds of visual analyses helpful in two ways. First, the analyses assist in locating and evaluating areas of high recreation potential. Evaluation at the general level using mapped land resource data before site level evaluation reduces the time and cost necessary to locate specific areas or boundaries. Second, the analyses help document the planners' visual perceptions and help justify their planning decisions and recommendations. This has been important in both of these studies. State legislation requires that areas nominated as Protected Water Areas be explicitly evaluated and fully documented. In Story County, an upcoming court test of the greenbelt ordinance will rely on analyses of visual resources to help document the location of greenbelt zone boundaries.

Plan evaluation

Another concern of Iowans is environmental impacts, including visual impacts, of specific plans and projects that have been proposed by public agencies and private interests. In Story County, for example, a federally-planned reservoir was proposed for the Skunk River between Ames and Story City (figure 5). Purported benefits of the proposed reservoir included flood control, water supply, low-flow augmentation, increased wildlife habitat and new recreation opportunities. Public concern for environmental impacts, including visual impacts, led to a two-year study (Dougal *et al.* 1973) as the basis for an Environmental Impact Statement. Reservoir construction had been deferred because of public reaction to the EIS; however, several years of dry weather have caused renewed interest in the reservoir. Several visual landscape analysis techniques described in this paper are currently being used to evaluate the visual impacts of reservoir construction and management on the Skunk River valley.

CONCLUSIONS

The visual landscape analysis techniques applied by the Iowa State University Land Use Analysis Laboratory do not replace value judgments nor do they reduce the number of planning

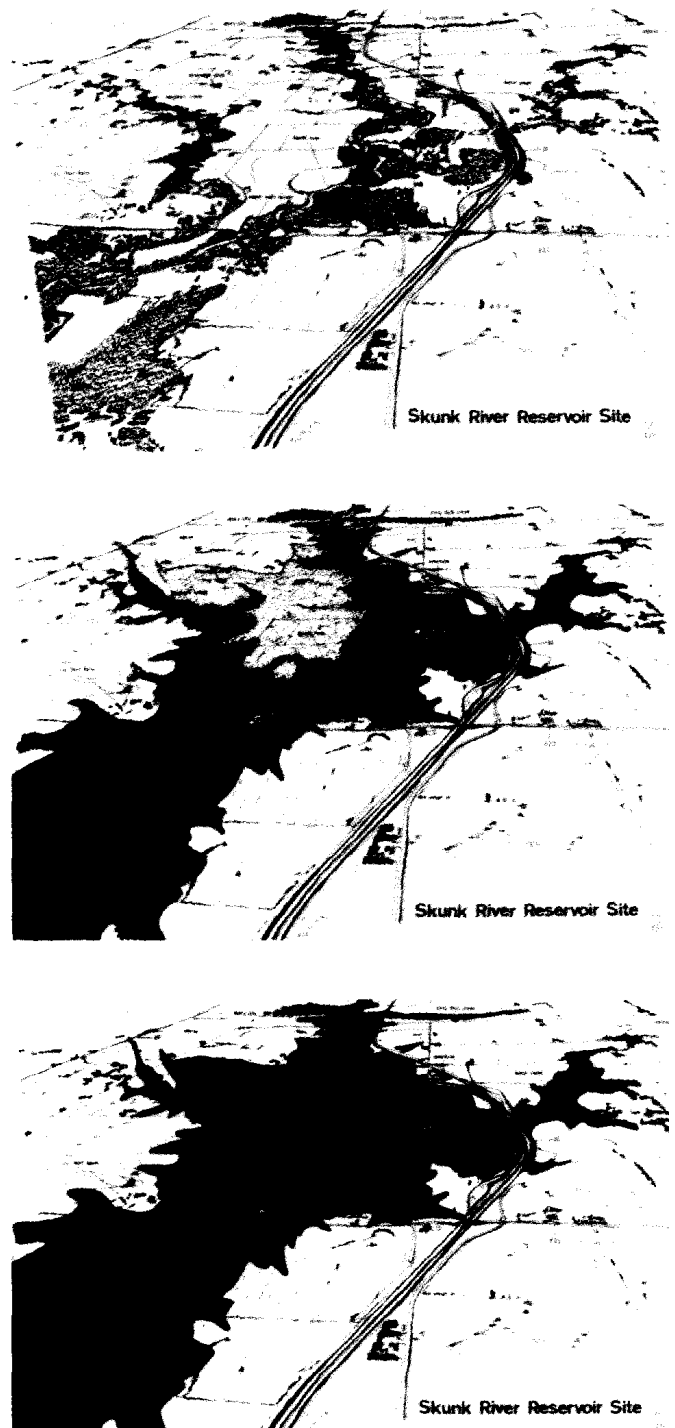


Figure 5--Sketches of the Skunk River valley as it appeared in 1972 (top), with the conservation pool of the proposed reservoir (middle) and with the flood pool of the proposed reservoir (bottom).

and management decisions. Rather, the analyses assist in the systematic consideration of visual resources, in objective measurement and delineation of landscape character, and in previsualization and documentation of resource planning and management decisions. These analyses make use of data typically available in land use and natural resource studies in Iowa and make use of existing MSDAMP computer program capabilities. Additional refinement of data, program capabilities and analysis techniques will be necessary before a comprehensive program for planning and managing visual resources can be adopted in Iowa.

LITERATURE CITED

- Beavers, Glenn H.
1977. A land information system support program--Multi-Scale Data Analysis and Mapping Program user's guide. 124 p. Land Use Analysis Lab., Iowa State University, Ames, Iowa.
- Dougal, Merwin D., et al.
1973. Summary report--Ames reservoir environmental study. 500 p. Iowa State Wat. Resour. Res. Inst., Iowa State University, Ames, Iowa.
- Faxlanger, David, James B. Sinatra, and C. John Uban.
1973. Land Patterns of Iowa. 64 p. Land Use Analysis Lab., Iowa State University, Ames, Iowa.
- Jacobs, Peter.
1975. The landscape image: current approaches to the visual analysis of the landscape. Town Planning Rev. 46(2):127-150.
- Nassauer, Joan I.
1978. Landscape characteristics as predictors of the visual quality of the Iowa landscape. 60 p. Dept. of Landscape Architect., Iowa State Univ., Ames, Iowa.
- Stone, Edward H.
1978. Visual resource management. Amer. Soc. of Landscape Arch., 32 p. Washington, D.C.
- U.S. Bureau of Land Management.
1978. A summary - visual resource management. U.S. Dept. of the Interior, 12 p.
- Unwin, K.I.
1975. The relationship of observer and landscape in landscape evaluation. Transactions of the Inst. of British Geog. 66:130-134.