RELATIONSHIPS BETWEEN LANDFORMS AND LAND USE IN THE HASTINGS QUADRANGLE, MICHIGAN

A STUDY IN NATURAL LANDSCAPE AESTHETICS

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RELATIONSHIPS BETWEEN LANDFORMS AND LAND USE IN THE HASTINGS QUADRANGLE, MICHIGAN

By

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Statement of Problem

The Hastings quadrangle, Michigan is an area of complex and varied glacial landforms. According to a recent interpretation of geomorphology within the Hastings quadrangle by Folsom (1971), six distinct glacial landscape types are distinguished on the basis of surface morphology in conjunction with consideration of sediments and stratigraphy. The purpose of this paper is to determine to what degree land use reflects different types of glacial topography within the Hastings quadrangle. Thus, the research hypothesis of this study is that different landscape types as mapped by Folsom will reveal different patterns of land use. In particular it is predicted that those less rugged topographic types such as ground moraine, outwash plain, and primary drainage channel will be most extensively cultivated. It is further hypothesized that abandoned farm land will be an important part of the land-use pattern in the more rugged areas, that is, in the interlobate moraine, kame topography, and stagnation moraine. The reasoning for this prediction is in part that the trend of increasing mechanization in farming has contributed toward making farming of hilly land less practical, resulting in the abandonment of some previously cultivated land. It is also expected that within areas of hilly terrain some land was cleared for cultivation and later abandoned as unsuitable because of the difficulty of controlling erosion or because of low soil fertility.

Man has long recognized certain relationships between topography and human activity. The existence and location of wind and water gaps are often important regarding transportation routes, and irregular coasts may severely impede transportation efficiency on land. The importance of such features as natural harbors and the fall line in the eastern United States in determining the location of cities is recognized, and continuing investigations have revealed numerous relationships between features and the location of cities. Obviously relationships exist between topography and human activities on a regional scale; is it not reasonable to suspect that topography will also have some influence on human activity at a local level? This paper is an attempt to test such a hypothesis in an area of southwestern Michigan. The investigation is justified because studies concerning relationships between landforms and land use are limited even though there is an increasing need for information about how man's activities and the physical environment are related. Besides being of intrinsic interest to geographers who have long concerned themselves with man-land relationships, information gained from such an investigation might have positive implications for rural land-use planning. The Hastings quadrangle, for which Folsom's landscape type map is available and which has a variety of landscape types, provides an excellent area for such an investigation.

Investigation Procedure

The procedure of investigation involved several steps described below:

1. Seven study areas of from about 5 square miles to 16 square miles in area were chosen. One study area for each of five of the six landscape types was identified. Because of topographic variations within the sixth type consisting of outwash plain two study areas were chosen, one for pitted and one unpitted outwash. The study areas comprise from about 20 per cent to 100 per cent of the extent of each particular landscape type recognized in the Hastings quadrangle. (See Figure 1.)

2. Four land-use categories were recognized as significant. These include (1) wooded land defined as land covered with mature trees close enough together so that the ground is rarely visible between them on air photos with a scale of about 1:8,100; (2) cultivated land which includes maintained orchards and cultivated pastures along with land in regular field crops and truck crops; (3) urban land, for lack of a better term, representing land occupied by facilities having to do with settlements. This category includes land occupied by cities and villages and other dense residential areas such as those around lakes. Land occupied by commercial activities, services and utilities, and industrial activities including extractive industries which are not actually located in an urban center is also included in this category. (4) Old field includes land retired from agricultural use, uncultivated pasture, and other brushy areas. Highways and roads as well as small streams and rural homesteads were not mapped but were incorporated into the adjacent land-use categories because of scale considerations.

3. To determine land use 1955 air photo coverage of the study areas with an approximate scale of 1:8,100 was used.

4. A base map of each study area was constructed from the Hastings quadrangle of the U.S.G.S. 15 minute series topographic sheets. The

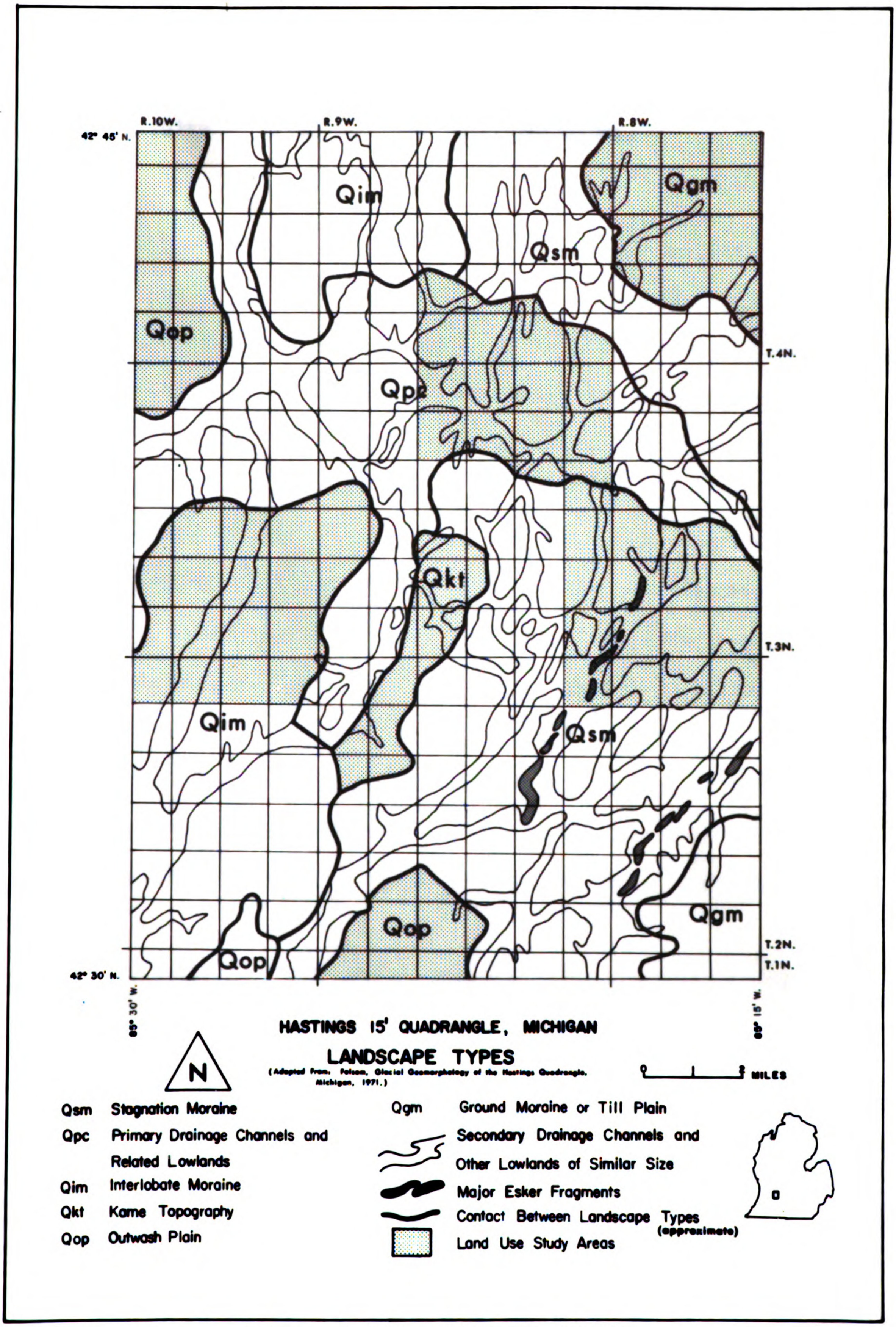


Figure 1 (after Folsom, 1971)

land-use data were transferred from the air photos to the base maps.

5. Several spot field checks were completed in each of the study areas to ensure reliability of land-use interpretations.

PREVIOUS WORKS

There is a large number of studies that either conceptually or spatially are related to this study. The following discussion of selected works concerned with landforms and land use treats a number of selected studies in chronological order with the objective of illustrating various relationships in a variety of geographical areas.

In 1912 Richard Elwood Dodge's "Some Geographical Relations Illustrated in the Practice of Agriculture" described the importance of slope in determining hand or machine tillage and relationships between topography, ground water, and air drainage as they affect agriculture. Dodge noted that gentler slopes are usually devoted to tilled crops, steeper slopes to fruits, and rougher regions to pasture, scrublands, and forest. He did not illustrate these relationships in the actual landscape, however, but treated the topic conceptually with the objective of instructing farmers to consider topography in their management practices.

R. H. Whitbeck (1913) did a comparative study of agriculture within a glaciated area as compared to farming in the driftless region of Wisconsin. He concluded that "notwithstanding the swamps introduced, a considerably larger proportion of the glaciated than of the driftless area is suited to the production of crops" (p. 85). Whitbeck reasoned that the difference is related to rougher topography and the lower fertility of soils formed on sandstone in the driftless region.

O. E. Baker (1921) considered the importance of physical factors in agricultural and forest production land use. He concluded that physical factors--topography, soils, moisture conditions, and temperature conditions--become more important as the activity (agriculture and forestry) becomes more highly organized and commercialized. He also noted that, generally speaking, the most easily cultivated and fertile land is used for crops, the more hilly and less fertile or wet land is used for pasture, and the poorest is left in forest. Apparently desirable land along rivers, he noted, may remain in forest because it is subject to flooding or is poorly drained. Another important conclusion is that increasing use of farm machinery has greatly increased the influence of topography in determining the utilization of the land.

In a study of relationships between land use and topography of various ages in England A. J. Stevens (1959) attempted to relate soils and land use to four different erosion surfaces in northeast Hampshire. He noted different types of agriculture and differences in field size on the various surfaces. The differences, he concluded, result from evolutionary differences among the four surfaces.

Merle C. Prunty (1961) considered topography as a determining factor in recently abandoned farm land in Madison County, Georgia but rejected it as a cause in favor of economic factors. He noted, however, that the roughest topography had already reverted to forest use and that the recently abandoned farm land was generally more desirable for agriculture in terms of both topography and soils.

In another study of rural land abandonment, this one in Prince Edward Island, C. W. Raymond and J. A. Rayburn (1963) concluded that local relief has considerable influence on land use, the best agricultural land being on slopes of 2.0 to 4.0 per cent. They associated the introduction of tractor power with the subsequent abandonment of fields with slopes not suited to mechanical cultivation.

In a study of agriculture in southwestern Nigeria R. P. Moss (1963) found close association of soils and slopes and a less direct but important relationship between soils and land use.

Carl O. Sauer (1963) noted the importance of steepness and irregularity of slope in reducing the utility of machinery and also the retention of fertilizers on agricultural land.

Philip A. Leighton (1966) in an article on the geography of air pollution considered relationships between topography which may affect air circulation so as to limit or promote local ventilation and location of cities. He observed that factors that limit local ventilation are also conducive to habitation so that man often builds cities in areas where the air supply is on occasion most limited.

John Fraser Hart (1968) in a study of loss and abandonment of cleared farm land in the eastern United States recognized urban expansion, strip mining, loss of locally dominant crops, and the Soil Bank program as local factors but concluded that physical hindrances to agriculture have been the most important factors influencing the abandonment of cleared farm land. Among the physical hindrances are land surfaces too steep or broken for effective use of modern farm machinery.

These studies consider relationships between topography and land use in various locales on either a regional or intraregional scale with similar conclusions that such relationships do exist. On the basis of fairly large-scale mapping this study is designed to examine the relationship between land-use patterns and different types of topography.

LANDSCAPE TYPES RECOGNIZED BY FOLSOM

Folsom identified six distinct landscape types in the Hastings quadrangle on the basis of topography, sediments, and stratigraphy. They are briefly described below.

Stagnation Moraine

This type of landscape is one of hills, swales, and depressions that lack a clear internal or external linearity. Local relief is generally about 50 feet per mile except where secondary drainage channels exist within the landscape. These channels, interpreted by Folsom as fluvial in origin and contrasting with stagnation moraine, are linear depressions that form a connective network within parts of the Hastings quadrangle. Within the area of stagnation moraine topography they lie from 60 to 100 feet below the general surface of the landscape. The sediments of the stagnation moraine area are mainly bedded sands and gravels with a covering of ablation till, "a loose-textured clayey sand material with some gravel and cobbles" (1971, p. 48). In places a 2 to 4 feet layer of lacustrine clay exists beneath the till. This landscape is interpreted to be largely the result of the wasting away of stagnant ice, a conclusion supported in part by the presence of eskers in the secondary drainage channels in the area. (See Figure 1.)

Primary Drainage Channel

The primary drainage channel is a broad lowland up to 4 miles wide which was at one time part of a large glacial meltwater drainage system. The sediments underlying this area are sandy, containing almost no cobbles and boulders and relatively little gravel. Broad, flat-topped valley-side terraces made of well-bedded sands and some gravels are found in the channel west of the city of Hastings. The greatest amount of local relief within the generally relatively flat primary drainage channel is located immediately adjacent to the Thornapple River.

Interlobate Moraine

The interlobate moraine area is one of hilly topography with many closed depressions. The hills are arranged in two parallel sets trending from north-northeast to south-southwest. Between the two sets of hills is a medial lowland not more than about 1 mile wide. The hills are usually steep-sided and have complex rather than smooth slopes. Local relief is as much as 150 feet within this unit and may be as great as 325 feet when compared with the adjacent area of lower topography. The underlying sediments are mainly partially sorted, poorly bedded sands and gravels that may vary considerably in texture and degree of sorting. Occasional masses of ablation till are found on the slopes of the medial lowland. This landscape type is interpreted to be complex interlobate forms of the Michigan and the Saginaw lobes. The western line of hills formed by the Michigan lobe contains more and larger closed depressions and is not as high or wide as the hills to the east associated with the Saginaw lobe.

Kame Topography

Kame topography consists of a complex of steep-sided hills within an area of numerous closed depressions. The hills have complex and irregular slopes and generally rounded summits. The depressions are not as numerous or large as those in the interlobate moraine area. Local relief is generally about 80 feet per mile but in places is as great as 140 feet per mile. The sediments of this area consist mainly of sands and gravels overlain in places by ablation till. The glaciofluvial sediments are less well bedded than those in the stagnation moraine landscape type but more stratified than those in the interlobate moraine area. The kame topography, which lies between the interlobate moraine and stagnation moraine areas, appears to be transitional between the two. Where the surficial layer of ablation till exists, it is thicker and more continuous than in the interlobate moraine area but thinner and less continuous than in the stagnation moraine area. Also, the topography is not so rugged as that of the interlobate moraine but more so than the stagnation moraine. Folsom interprets this assemblage of landforms as having been deposited by stagnant or nearly stagnant ice in an environment with much available sediment and an abundance of running water.

Outwash Plain

The outwash plain areas are plains laid down by shallow, rapidly aggrading proglacial streams. Local relief is generally less than 15 feet per mile and sometimes as little as 7 feet per mile except for some areas in the northern pitted outwash plain where local relief may exceed 45 feet per mile because of numerous kettles and stream dissection. In some places the southern unpitted outwash plain has experienced considerable stream dissection as well. The underlying sediments are mainly sand and gravel and are generally well stratified. In the pitted outwash plain thin coatings of ablation till exist in some places, usually in the vicinity of the larger pits.

Ground Moraine

Ground moraine is gently rolling topography of low relief. Slopes are long and relatively simple. Features adjacent to each other grade together smoothly. The surface morphology is similar to that of stagnation moraine but is more subdued. Relief is slightly more in the stagnation moraine because hills are steeper and more closely spaced, and closed depressions are deeper, more steep-sided, and more numerous. The sediment in the ground moraine area is usually till, "a heavy clay-matrix basal till with much sand and gravel as well as some boulders" (Folsom 1971, p. 122). Occasionally a thin layer of ablation till or sand and gravel may be found on the surface. These sediments are interpreted to have been laid down and their characteristic morphology imparted to them by active ice with a tendency toward relatively orderly marginal retreat.

STUDY AREAS

Seven study areas were identified within the six landform types. The study areas range in size from about 5 square miles to about 16 square miles, each being several square miles in extent to assure adequate size for local patterns of land use to be identified. In the case of the kame topography the study area is about 5 1/2 square miles in size and represents the total extent of that landscape type in the Hastings quadrangle. There are two areas of ground moraine in the quadrangle, one in the northeastern corner and one in the southeastern corner. (See Figure 1.) The one in the northeastern corner, being the larger of the two at about 12 square miles, was chosen as the study area. There are also two areas of outwash plain in the Hastings quadrangle, one in the northwest corner, which is pitted, and one on the western southern edge, which is not pitted and which is divided into two parts by a tract of stagnation moraine topography. The pitted outwash plain, which is 8 square miles in area, and the larger of the two parts of unpitted outwash plain, which is almost 5 square miles in area, were both chosen as study areas. The purpose of this was to see if the two dissimilar areas would exhibit different land-use patterns. In the following discussions these landform types will be referred to as simply outwash plain where not pitted and pitted outwash plain where ice block depressions exist.

The interlobate moraine topography occupies roughly the western one-quarter of the southern one-half of the quadrangle plus another smaller area to the north and east. The two areas are separated by 3 or 4 miles of primary drainage channel. Roughly the northern half of the southern and larger interlobate moraine was chosen as the study area. This portion seemed to be most typical of Folsom's description of interlobate moraine. Here the two lines of hills are especially distinct as is the medial lowland whereas farther south the western line of hills is not located within the area of the Hastings quadrangle. This study area is just over 16 square miles and comprises one-third of the total extent of interlobate moraine topography in the Hastings quadrangle.

The broad primary drainage channel extends east to west across the northern half of the quadrangle with smaller appendages extending to the northern boundary and southward between the interlobate moraine and kame topographies. The Thornapple River flows west and north in this main channel and leaves the quadrangle by way of the northward-projecting lowland mentioned above. The city of Hastings, also lying in the main channel, was purposely excluded in the selection of the study area, which comprises a 13 1/2 square-mile tract located just west of the city. The primary drainage channel study area comprises almost one-fourth of the total primary drainage channel topography in the Hastings quadrangle.

Stagnation moraine topography is the most extensive in the Hastings quadrangle. It occupies roughly the southeastern quarter of the quadrangle plus another area in the northeast corner north of the primary drainage channel and south and west of the ground moraine study area. Two considerations entered into the choice of the stagnation moraine study area. The stagnation moraine north of the primary drainage channel was not sampled because Folsom describes it as lacking in places the ablation till cover typical over the rest of the stagnation moraine topography. Where the ablation till is found in the northern area, it is much thinner. The other consideration was the desire to include some esker fragments in order to determine if they are reflected in the land-use pattern. This study area is about 15 1/2 square miles in area and comprises close to one-fifth of the total extent of stagnation moraine topography in the Hastings quadrangle.

RELATIONSHIPS BETWEEN LANDFORMS AND LAND USE

Introduction

Mapping the distributions of the various land-use categories in each study area reveals some very different patterns. The ground moraine study area is characterized by extensive cultivation as is the pitted outwash plain. In marked contrast is the land use of the interlobate moraine area which is almost entirely wooded and old field. (See Figures 2, 3, and 4.) More complex patterns of use appear from the land-use mapping of the outwash plain, primary drainage channel, stagnation moraine, and kame topography. (See Figures 5, 6, 7, and 8.) Thus, two types of relationships between topography and land use emerge from this study. The first, which will be called the homogeneous land-use group, includes the ground moraine, pitted outwash plain, and interlobate moraine. The remaining topographic types comprise the heterogeneous land-use group.

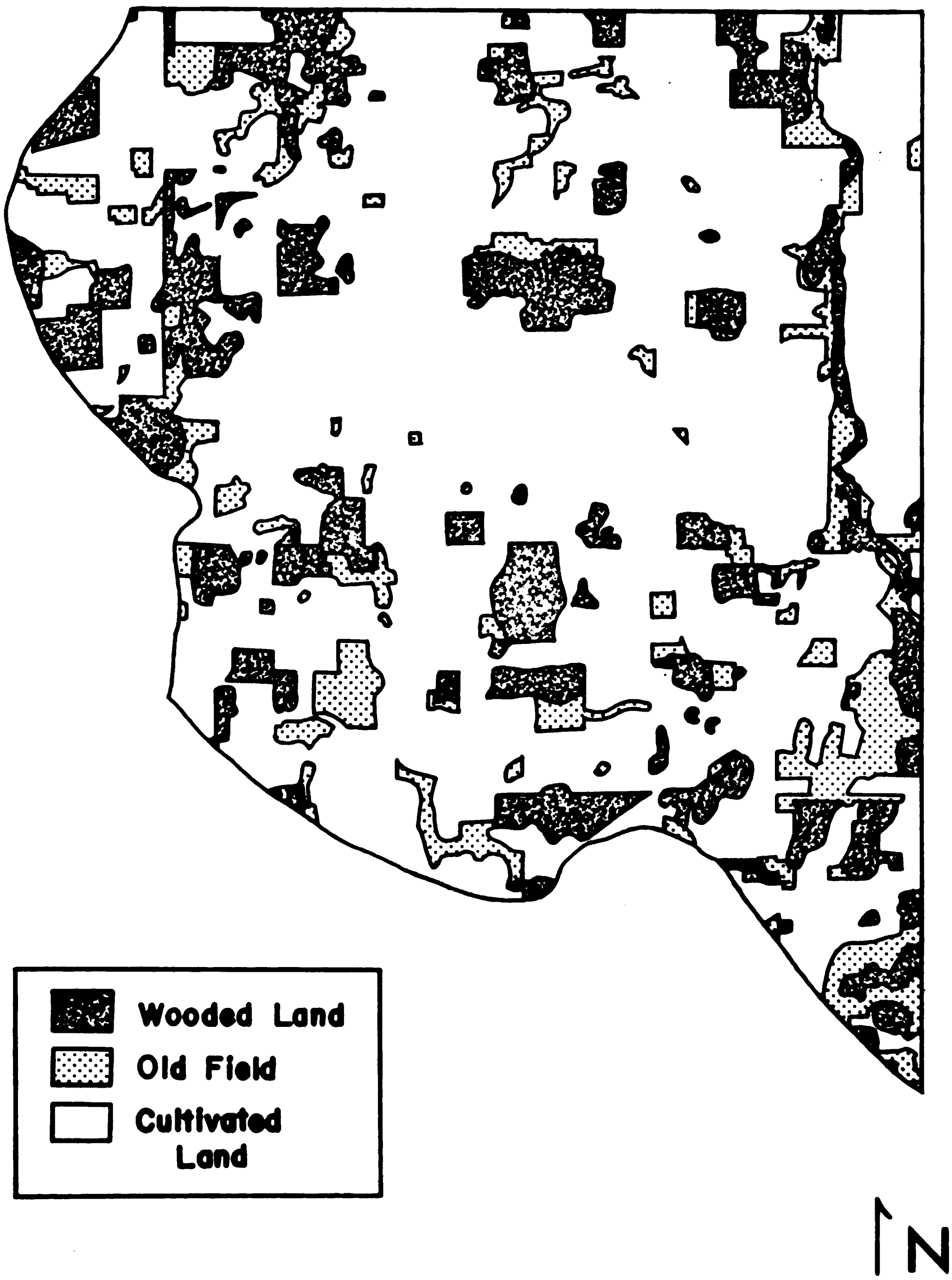
Homogeneous Land-Use Group

Even though underlain by different types of sediment, the ground moraine and pitted outwash plain study areas have many land-use characteristics in common as well as the general levelness of their topography. Wooded areas tend to be relatively small in extent and often toward the centers of the sections where they occupy land suitable for cultivation. Other wooded areas as well as old field generally occupy poorly drained spots or the steepest slopes. By far the major portions of both these study areas are cultivated in agreement with the hypothesis. The interlobate moraine, being an area of much more rugged topography than either the ground moraine or pitted outwash plain, was expected to have much less cultivated land and much more old field. That the pattern of land use in the interlobate moraine study area fits nicely with this hypothesis is apparent from Figure 4, which shows cultivated land to be sparce indeed, the land use of the interlobate moraine study area being almost entirely wooded and old field. When compared to the ground moraine or pitted outwash plain study areas, wooded land in the interlobate moraine is in much larger tracts and does not tend to be located near the centers of sections or away from the roads. A more detailed examination of each of these areas may be even more revealing regarding certain relationships between landforms and land use.

Ground moraine

In the ground moraine topography slope and drainage conditions appear to be closely related to the location of the tracts of wooded land and old field. Almost every old field area and much of the wooded land can be associated with either poor drainage or steep slope. The fact that some wooded land appears to be cultivable if cleared and the tendency for wooded land to be located toward the centers of sections indicate some cultural influence in addition to that of the condition of the terrain.

From Figure 2 it is apparent that a linear pattern of connected woodlots and old field areas extends north-south along the eastern edge of the study area and eventually trends to the east out of the study



GROUND MORAINE

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Figure 2

area. This pattern coincides with the course of the Coldwater River and is seen along other river courses in other study areas as well, especially where marshy conditions or steeper slopes resulting from postglacial erosion make cultivation as well as other types of land development impractical. In the southeastern part of the study area are two clusters of connected wooded and old field parcels. These are marshy areas which correspond somewhat, though not exactly, with two of Folsom's secondary drainage channels. The other two such channels in this study area are not clearly reflected in the land-use patterns. There is a striking absence of land uses other than agricultural in the ground moraine study area. There are no recreational areas, gravel pits, or other obvious land developments with the one exception of a recently built trailer park. This area, apparently well suited to agriculture, has over 70 per cent of the land in cultivation.

Pitted outwash plain

Pitted outwash plain, the other predominantly cultivated area with about 65 per cent of the land in cultivation, has the smallest proportion of wooded land of all of the study areas with the possible exception of the outwash plain. It has, however, a larger proportion of old field than wooded land in contrast to the ground moraine which it most nearly resembles in land-use pattern. In the pitted outwash plain, as in the tract of ground moraine, woods and old field exist mainly in association with steep slopes and poor drainage. Small isolated old field areas are generally pits which can be easily recognized on the topographic sheet. These topographic depressions may be quite steep-sided and may contain marshes. Irregularly shaped tracts of woods and old field are generally associated with marshy areas though some are related to steep slopes. The linear pattern of old field and woods along the Coldwater River in the ground moraine also exists along Duncan Creek in the northern portion of this study area.

An area of extensively cultivated land exists in the central-western portion of the study area and may be identified on the topographic sheet and soil map as well as the land-use map (See Figure 3). On the soil map from the 1928 soil survey of Barry County it is shown as "Scales Prairie," a body of loam soil surrounded by sandy loam. On the topographic sheet it appears as a singularly level area. It is prime farm land that apparently was not wooded when this part of Michigan was settled, and no woodlots have since been planted nor has any land reverted to old field.

The southern and southeastern portion of the study area is predominantly old field with some wooded land. This area, also apparent on the topographic quadrangle, is rougher than the rest of the pitted outwash plain. Pits are larger and more numerous than in the rest of the study area and slopes are generally steeper. Recently eroded gullies in the old field areas illustrate the impracticality of agriculture in the area. Another factor limiting agriculture at the southern portion of the study area is the sandy nature of the soil. Apparently the soil becomes sandier from north to south in the pitted outwash plain with a loam at the northern edge, a sandy loam over the central part interrupted by the "Scales Prairie," and a sand at the southern edge.

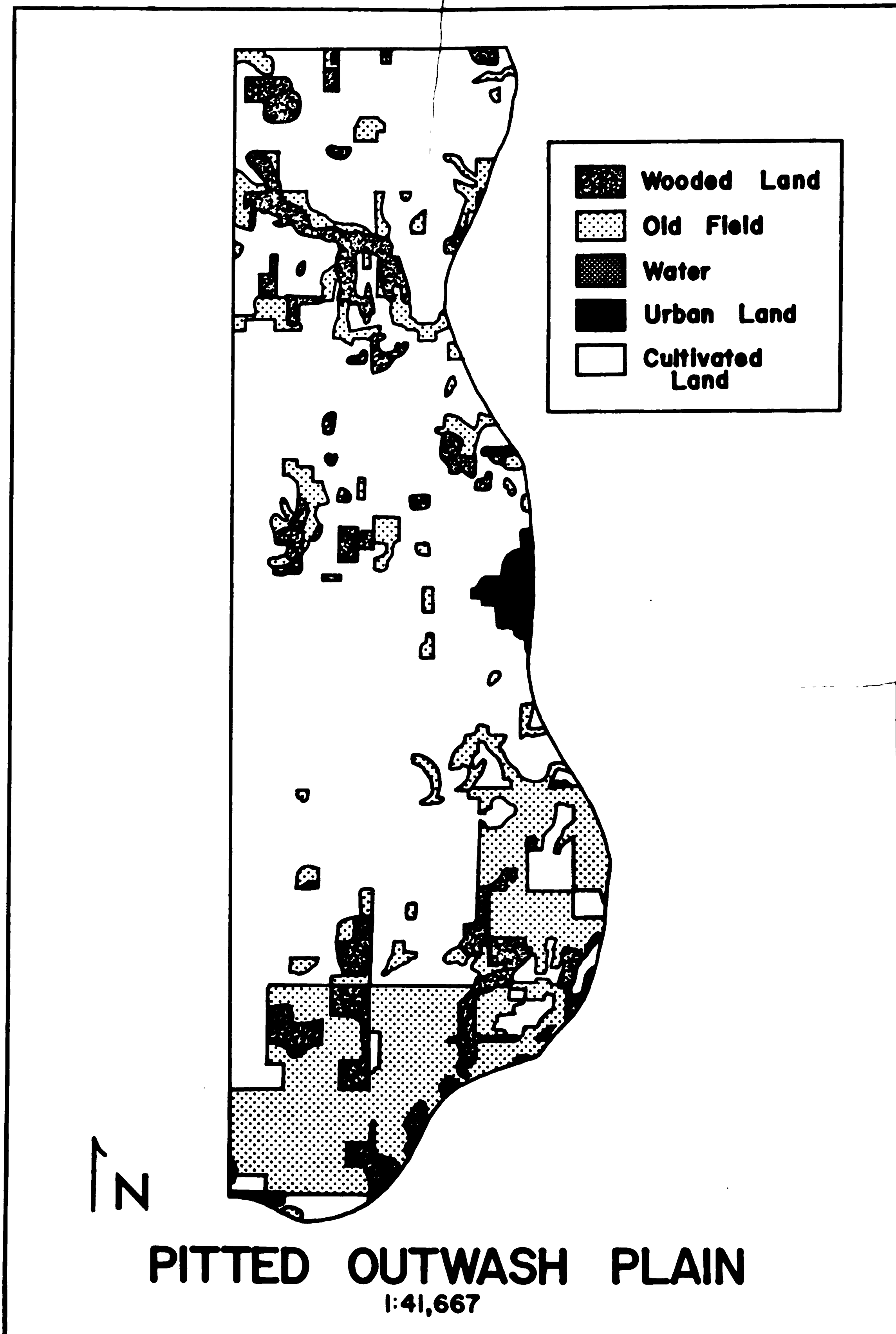
Wooded Land
Old Field
Water
Urban Land
Cultivated Land
N
PITTED OUTWASH PLAIN
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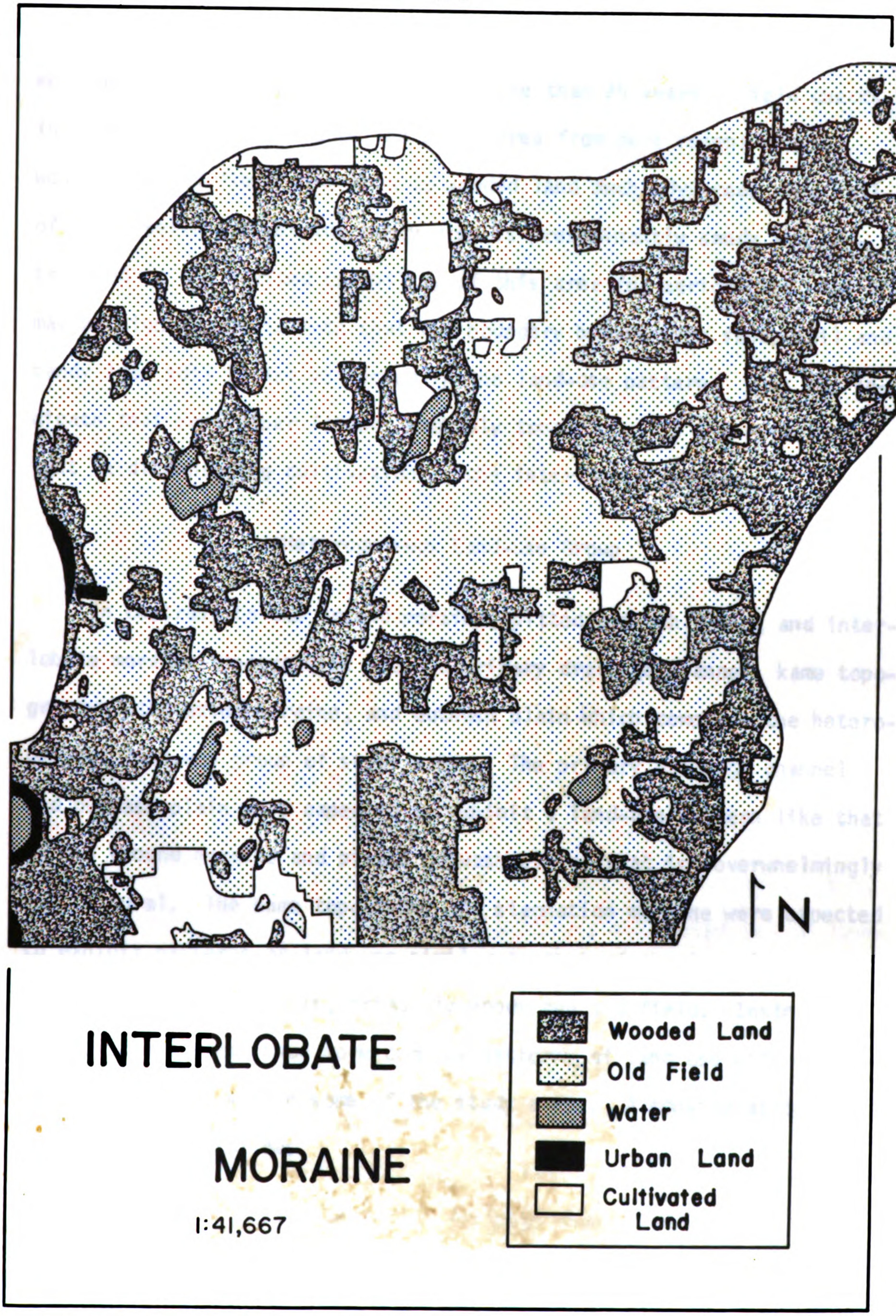
Figure 3

Interlobate moraine

The interlobate moraine study area is both the most rugged topographically and least cultivated of the landscape types investigated. It is predominantly old field (about 50 per cent) with many large tracts of wooded land and less than 10 per cent of cultivated land. (See Figure 4.) Wooded land occupies many of the steepest slopes, highest hills, and most pitted areas in the two hilly moraines. In the medial lowland wooded land and old field are most extensive and the land is generally marshy. Apparent exceptions to this relationship between land use and topography or drainage are several small, more geometrically shaped woodlots. These may be accounted for by cultural factors such as desire of individual land owners to retain some wooded land. The few cultivated areas which remained in 1955 exist mainly at the periphery of the landscape type area with the exception of that cultivated land within the southwest part of the study area and the cultivated land in the north-central part of the study area which occupy more level and well-drained land in the medial lowland. Gullying of the type that exists in the southern pitted outwash plain was not visible on the air photos in the area though it could have been obscured by small trees and shrubs in advanced old field areas. The 1928 Barry County Soil Survey (p. 4) reports that "a large proportion of the farms on the Coloma, Plainfield, and lighter Bellefontaine soils have been abandoned." The Coloma and Plainfield are sandy soils which are found over much of this study area. Bellefontaine sandy loam is found in the southern portion within an area about 1 mile in width and extending east-west across the southern edge of the study area. At the time of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INTERLOBATE
MORAINE
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Wooded Land
Old Field
Water
Urban Land
Cultivated
Land

Figure 4

the air photo coverage many of the old field areas in the interlobate moraine must have been abandoned for more than 25 years. Field checks indicated that remapping of the study area from more recent photos would show old field reversion to wooded land much advanced. The soil of the interlobate moraine study area is predominantly sandy and contributed to the limited capability of this area for agriculture, but it may be significant to note that the boundary between the sandy soil and sandy loam soil is not reflected in the land-use pattern. This may indicate that some other factor, probably topography, is the more important in discouraging cultivation in the interlobate moraine.

Heterogeneous Land-Use Group

In contrast to the ground moraine, pitted outwash plain, and interlobate moraine topographies are the primary drainage channel, kame topography, stagnation moraine, and outwash plain which comprise the heterogeneous land-use group of study areas. The primary drainage channel and outwash plain were expected to exhibit a land-use pattern like that of the ground moraine and pitted outwash plain, that is, overwhelmingly agricultural. The kame topography and stagnation moraine were expected to exhibit patterns of land use similar to that of the interlobate moraine study area, that is, primarily woods and old field. Instead all four of these areas show more complex patterns of land use with considerable variation within some of the study areas. A consideration of each study area follows.

Outwash plain

It may be expected that an area of outwash plain would be at least as cultivable and probably more so than the pitted outwash plain described previously. Instead Figure 5 shows relatively more areas of old field mixed with the cultivated tracts and a small amount of wooded land. While the pitted outwash plain was 65 per cent cultivated land, the outwash plain has only about 50 per cent cultivated land. This apparent anomaly is explained by the fact that the old field areas correspond very closely with marsh. They are, in fact, not true old field at all, certainly never having been cultivated, but simply brushy marsh. Those areas which are cultivated are quite level and appear to be as productive as ground moraine farm land or the better part of the pitted outwash plain.

Primary drainage channel

The land use of the primary drainage channel is similar to that of the outwash plain in many respects. As an area of low relief it might be expected to have a land-use pattern dominated by agriculture. But, as in the outwash plain, drainage is a complicating factor in the land-use pattern. Much of the old field and wooded land is the result of marshy conditions. As a result, the same pattern of irregularly shaped but somewhat linear, connected tracts of old field and wooded land separating cultivated areas that exists in the outwash plain may be observed in the primary drainage channel. These marshy areas correspond quite well with Folsom's secondary drainage channels in places such as the strip of old field and woods that extend north from the center of

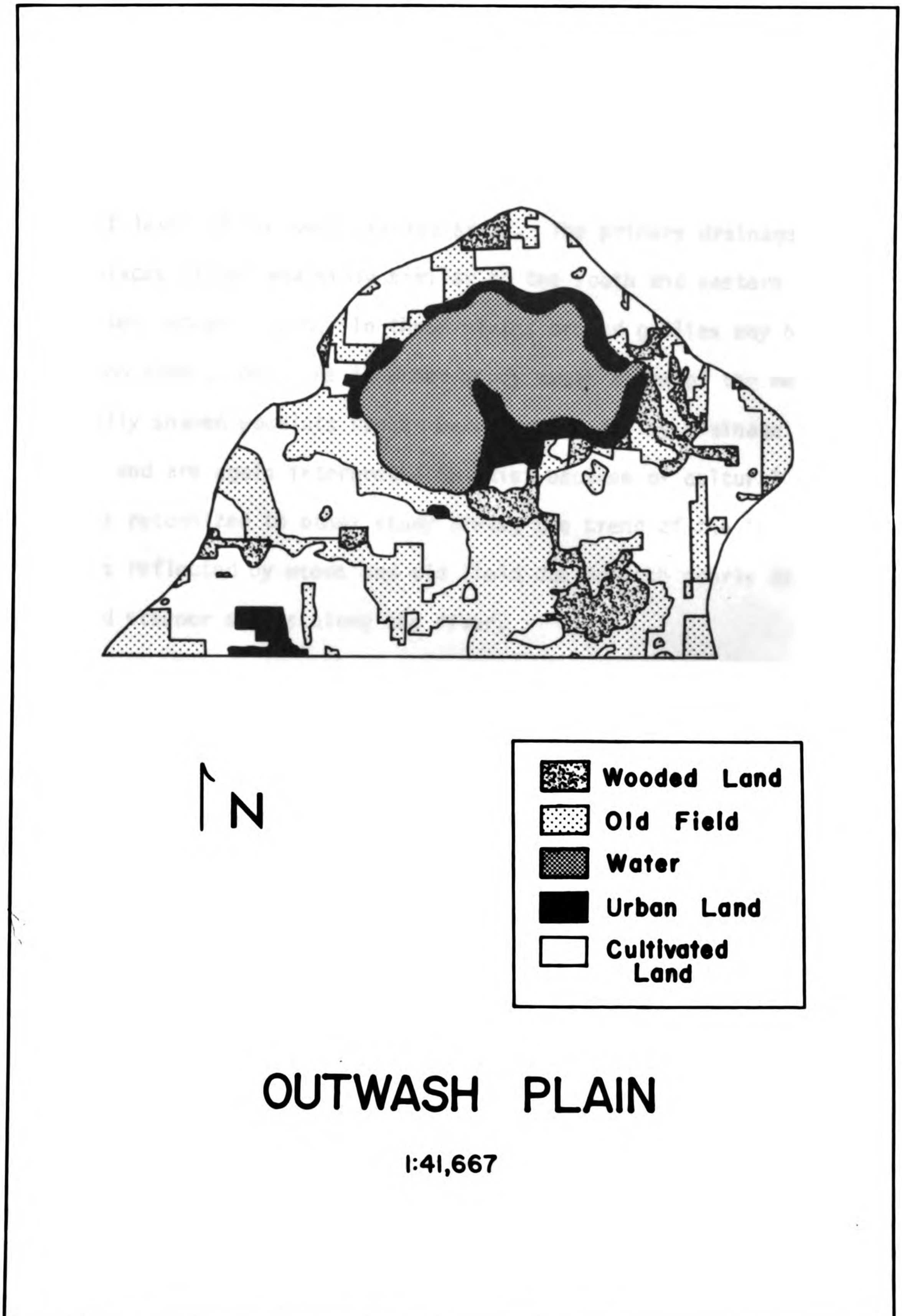
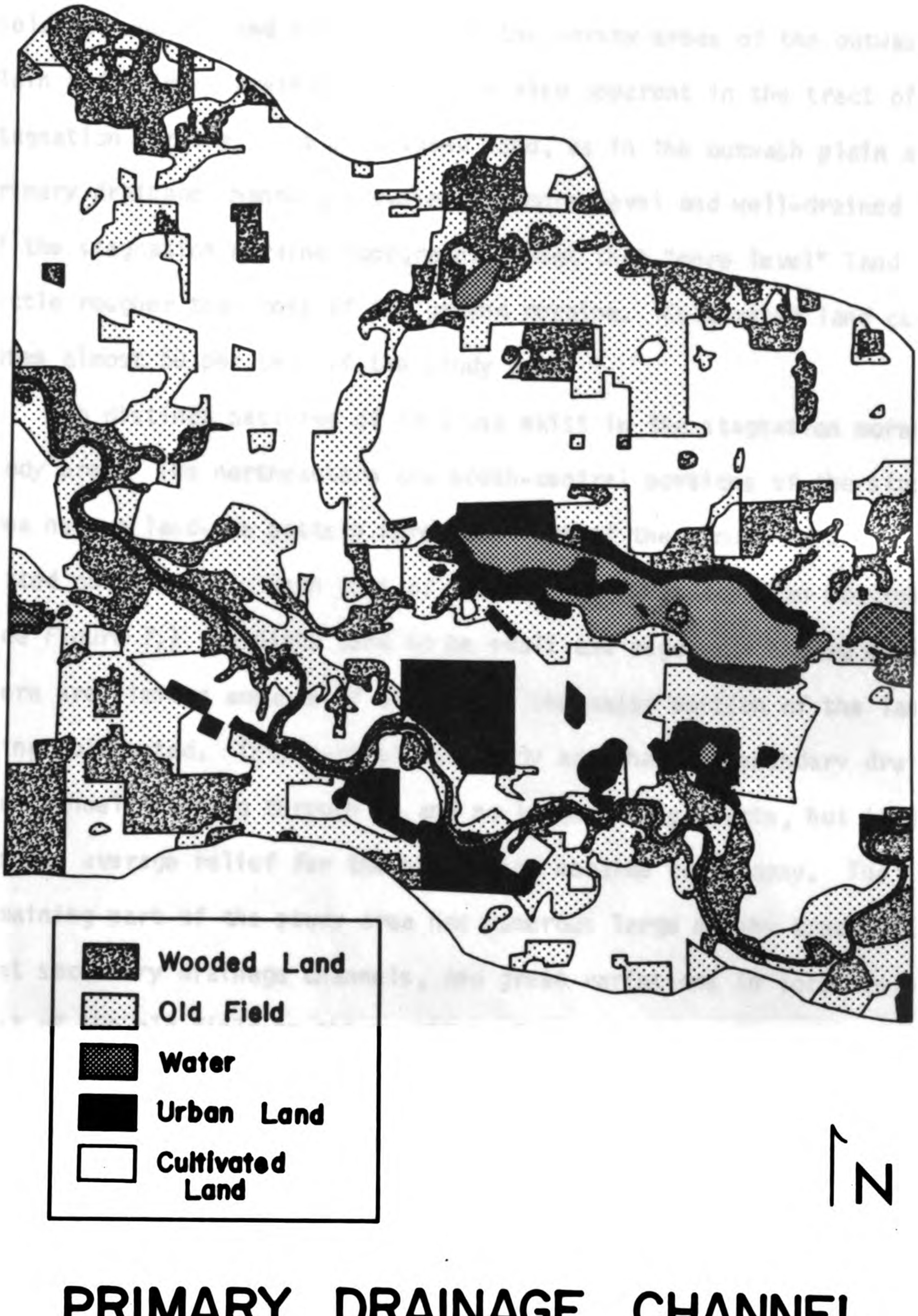

N
Wooded Land
Old Field
Water
Urban Land
Cultivated Land
OUTWASH PLAIN
1:41,667

Figure 5

the study area to the northern boundary in Figure 6. Topography also plays a part in the land-use pattern in the primary drainage channel. Examination of the topographic sheet reveals that the cultivated areas, which constitute less than 50 per cent of the study area, are clearly the most level of the well-drained areas. The primary drainage channel is in places pitted and hilly similar to the south and eastern edges of the pitted outwash plain. In these places eroded gullies may be observed on some slopes. As in other study areas a few of the more geometrically shaped woodlots cannot be accounted for by drainage or slope factors and are again interpreted to exist because of cultural factors. Also, as recognized in other study areas, the trend of the Thornapple River is reflected by woods and old field due to both poorly drained land and steeper slopes along the river.

Stagnation moraine

The stagnation moraine tract was expected to reveal a pattern of land use similar to that of the interlobate moraine study area, that is, mainly abandoned farm land and wooded land. Instead a mixed pattern of cultivated land, old field, and wooded land exists. Evidently the roughness of the topography and the nature of the soil are not everywhere sufficient to discourage cultivation. Steep slopes of ridges, hills, and pits do account for some of the land not cultivated, but poorly drained conditions account for even more. The stagnation moraine has numerous and large tracts of marsh which correlate to some extent, though not perfectly, with Folsom's secondary drainage channels. These marshes may be wooded or old field (brushy) or a combination of



PRIMARY DRAINAGE CHANNEL
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Figure 6

both. The pattern of connected, irregularly shaped patches of old field and wooded land that exists in the marshy areas of the outwash plain and primary drainage channel is also apparent in the tract of stagnation moraine. The cultivated land, as in the outwash plain and primary drainage channel, occupies the more level and well-drained land of the stagnation moraine topography though that "more level" land is a little rougher than most of the ground moraine. Cultivated land constitutes almost 50 per cent of the study area.

Two distinct patterns of land use exist in the stagnation moraine study area. The northeastern and south-central portions of the study area have a land-use pattern more like that of the ground moraine or pitted outwash plain than that of the rest of the stagnation moraine. (See Figure 7.) Woodlots tend to be small and regularly shaped and there are limited amounts of old field, the major portion of the land being cultivated. This part of the study area has no secondary drainage channels running through it and no large marshy tracts, but it does possess average relief for the stagnation moraine topography. The remaining part of the study area has numerous large marshy tracts, abundant secondary drainage channels, and great variations in local relief. Most of the old field in this portion of the study area, as in the outwash plain and much of the primary drainage channel, is not true old field but brushy marsh which apparently should be recognized as a separate land-use type.

Kame topography

The kame topography is an area of rough hummocky topography that was expected to exhibit a land-use pattern dominated by old field.

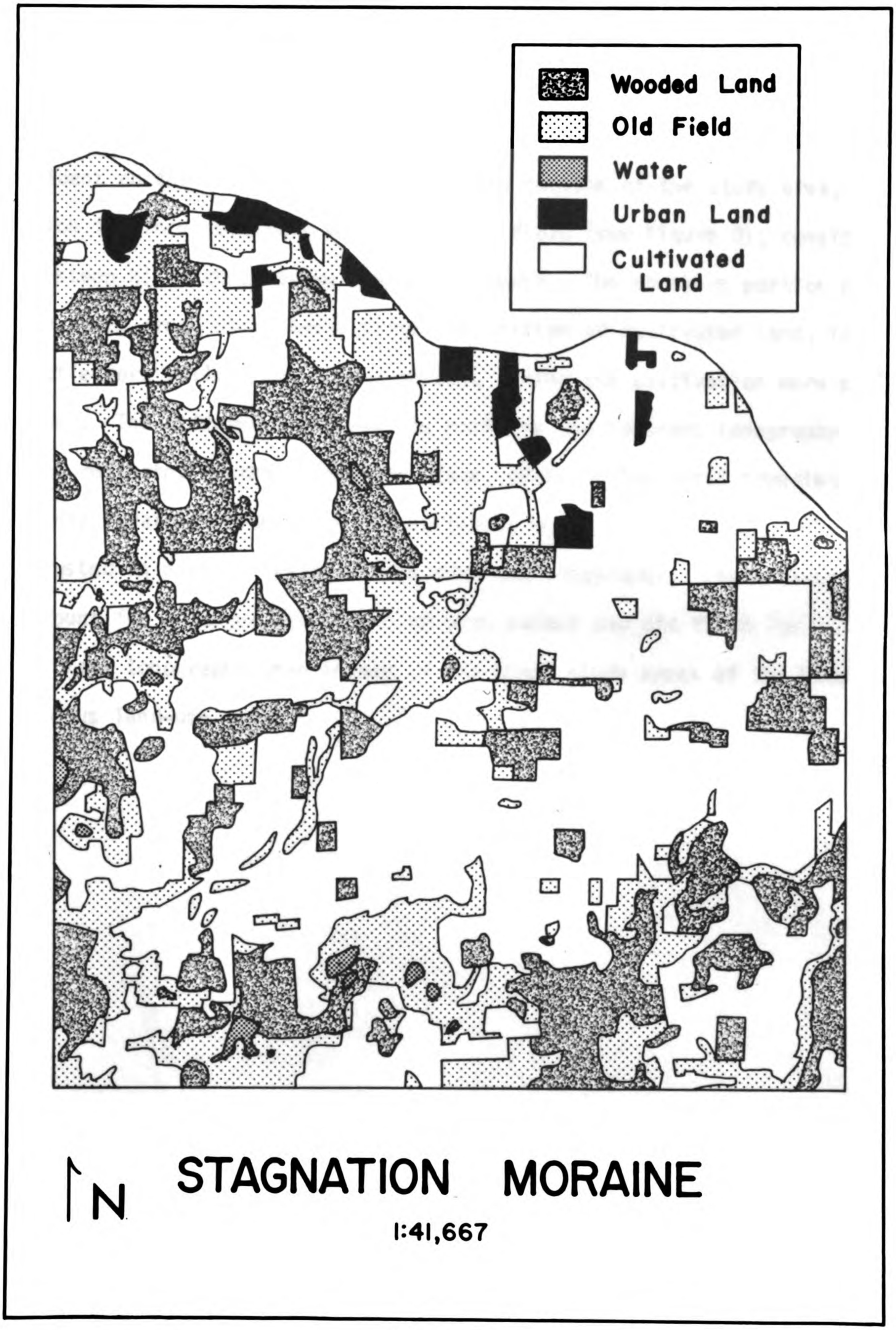
Wooded Land
Old Field
Water
Urban Land
Cultivated Land
N
STAGNATION MORAINE
1:41,667

Figure 7

Instead its pattern is mixed wooded, old field, and cultivated land with cultivated land less than 40 per cent of the study area. Some rough land indeed is cultivated with the resultant eroded slopes clearly evident on the air photos. The southern portion of the study area, which is almost entirely wooded and old field (see Figure 8), consists of steep hills that may be bounded by marsh. The northern portion of the study area, which has a larger proportion of cultivated land, is a little more rolling and less hummocky, making the cultivation more practical. The difference between the northern and southern topography is also reflected in the pattern of roads, those in the north trending mainly straight north-south and east-west while those in the south are adjusted in part to variations in the kame topography. Steep slopes account for a larger proportion of both wooded and old field land in the kame topography than in any of the other study areas of the heterogeneous land-use group.

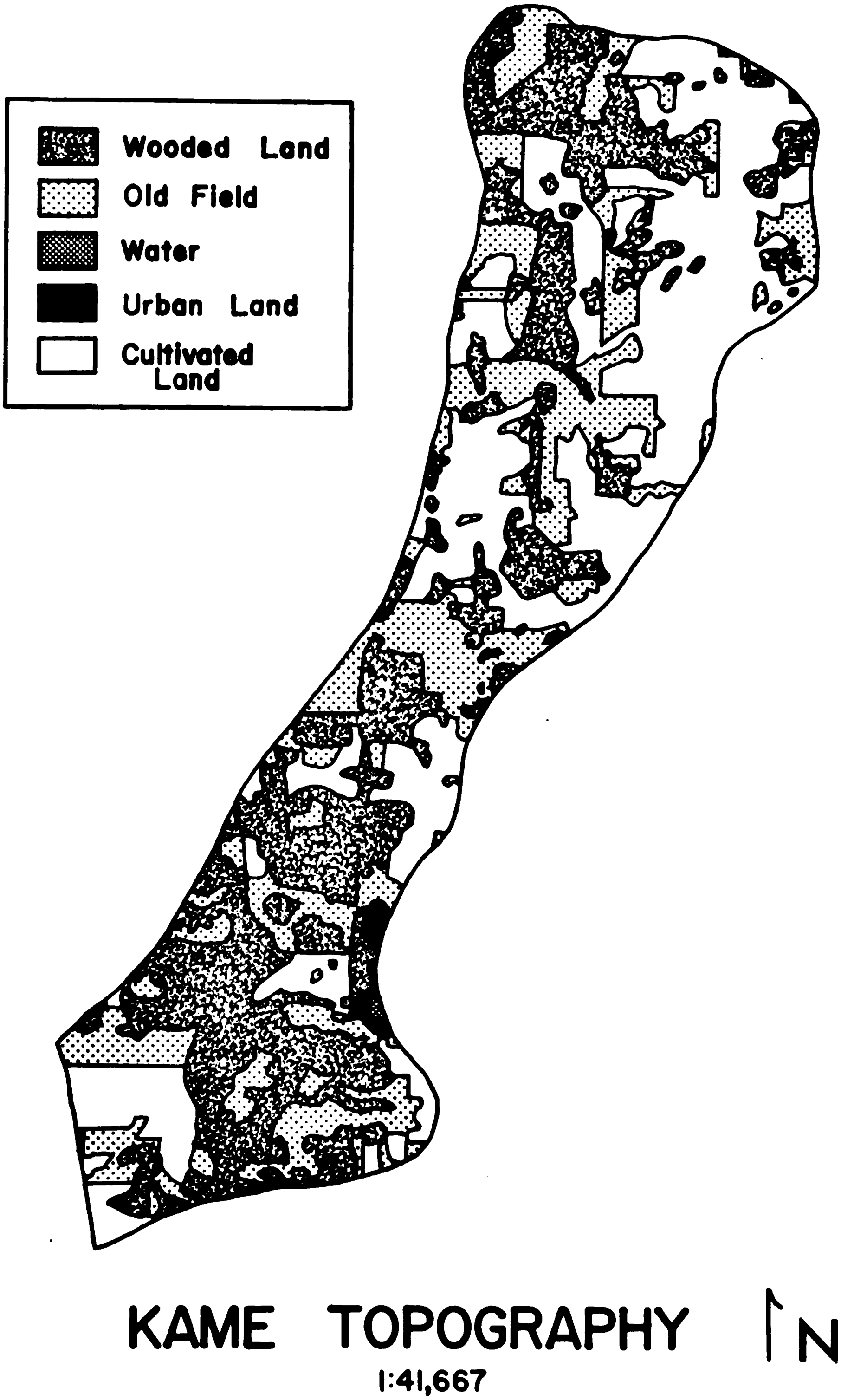
Wooded Land
Old Field
Water
Urban Land
Cultivated Land
KAME TOPOGRAPHY
1:41,667
N

Figure 8

SUMMARY AND CONCLUSIONS

The relationship between landscape types in the Hastings 15 minute quadrangle, Michigan, and the distribution of wooded, old field, urban, and cultivated land was investigated. Urban land included residential areas as well as land used for industry, commerce, and certain kinds of recreation which locate in population centers. Old field included other brushy areas as well as true old field. 1955 air photo coverage of the chosen study areas for each landscape type was used as the source of land-use data. The landscape types recognized by Folsom (1971) include ground moraine, outwash plain, interlobate moraine, primary drainage channel, stagnation moraine, and kame topography. Ground moraine and outwash plain are fairly level landscapes of different origin. Interlobate moraine is the most rugged hilly topography of the six. The primary drainage channel is a broad valley; stagnation moraine a topography of hill, swale, and depression; and the kame topography one of steep hills and closed depressions. Two outwash plain study areas were chosen, one pitted and one not pitted.

Maps of land use in the ground moraine and pitted outwash plain showed them to be clearly dominated by cultivated land. The interlobate moraine map shows old field predominating with wooded land running a close second. The outwash plain, stagnation moraine, primary drainage channel, and kame topography showed a mixed pattern of cultivated land, old field, and wooded land. In all four of the study areas mentioned previously the cultivated land tended to occupy the most level and also well-drained areas. The rather large amount of old field in the outwash plain was accounted for by the extensive tracts of poorly drained land. In the stagnation moraine as in the outwash plain extensive marsh land was found to be the primary factor discouraging cultivation though in places steep slopes also appeared a factor. The same conditions as those in the stagnation moraine accounted for the mixed land-use pattern in the primary drainage channel. In the primary drainage channel and stagnation moraine, as in the outwash plain, much of the land designated old field is actually brushy marsh. In the kame topography steep slopes play a more important part in discouraging cultivation so that much of the land use is true old field and similar to land use in the inter-lobate moraine.

Urban land tended to be associated with the primary drainage channel but also extended onto contiguous landscape areas. Residential areas around lakes were not observed to show any landscape type bias.

Land-use patterns were shown to be definitely different in different landscape types though the distinction made using four land-use categories were not as fine as those made by Folsom (1971) in distinguishing landscape types. While Folsom arrived at six distinct landscape types, there were only three distinct land-use patterns: (1) primarily cultivated; (2) primarily old field with much wooded land; (3) a mixed pattern of wooded land, old field, and cultivated land. Of those with the mixed land-use pattern, the kame topography stands out as a mixture of wooded land, old field, and cultivated land while the primary drainage channel, stagnation moraine, and outwash plain have a mixed pattern of wooded land, brushy marsh, and cultivated land.

Thus, it has been demonstrated that certain glacial landscape types are reflected in different land-use patterns in the Hastings quadrangle, Michigan, and that land use can be shown to be related to landforms at an intraregional level.

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A STUDY IN NATURAL LANDSCAPE AESTHETICS

By

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A RESEARCH PAPER

Submitted to

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in partial fulfillment of the requirements

for the degree of

MASTER OF ARTS

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INTRODUCTION

Planners in outdoor recreation operate on certain assumptions concerning what kinds of "scenery" people enjoy. Few definite statements about the role of various physical features in relation to appeal of landscapes can be made, however, due to the small amount of research that has been done concerning natural landscape aesthetics. The purpose of this paper is to serve as a pilot study for a method of investigating relationships between selected features and appeal of natural landscapes. To be considered are relief; types, variety, and amount of vegetation; vista; color; and types and variety of water features in relation to expressed preference for landscapes. Should information be obtained concerning the relative importance of various landscape features as well as that concerning the research design there may be implications for recreational land-use planning.

From a review of selected studies concerning landscape aesthetics several features of the natural landscape have been identified as probably related to landscape appeal. Other features have been suggested by experts in resource development and recreation planning. Information from both types of sources was considered in constructing the following hypotheses.

Research hypothesis number 1: Preference for a landscape can be associated with the following factors: relief; variety of relief categories; presence, type, and variety of water features; variety of general features present (landforms, water, vegetation); vista (distance of view); amount, type, and variety of vegetation; variety of color.

Research hypothesis number 2: The following will be characteristic of landscapes rated as appealing by persons interviewed: great relief, a variety of relief categories, presence of at least one water feature, apparently fast moving water ("white water"), a variety of water features, greater variety of general features, great vista, a high percentage of vegetative cover on land, trees the dominant vegetation type, a variety of vegetation types, variety within vegetation types, and a variety of color in the landscape.

A study of landscape aesthetics is justified by the increasing need to know how persons relate to the natural environment. With limited areas of natural landscapes and increasing numbers of recreationists using wilderness and semiwilderness areas while other interests continue developing land for other uses there is a need for more information on which to base decisions concerning land to be retained in a natural state. Part of that information should concern aesthetics which is important in terms of the value of land for recreation.

PREVIOUS WORKS

In the last decade, as a consequence of increasing interest in relationships between man and the physical environment, numerous publications concerning landscape aesthetics have appeared. The following selected works were chosen to illustrate a variety of methods of treating the subject as well as conclusions concerning relationships between landscape features and aesthetic appeal.

Elwood L. Shafer (Shafer et al., 1969) devised a model in which landscapes in black and white photographs were divided into zones of vegetation, nonvegetation, water, and sky. A 1/4-inch overlay grid was used to divide photographs into the above zones which were described in terms of perimeter, interior, area, and horizontal end squares. Tonal variables, determined by a photometer, were also added. A matrix was constructed to describe landscapes in the photographs and a numerical model formed for predicting preferences for landscapes by the described characteristics. The model was tested by comparing ranks assigned to photographed landscape scenes by campers in the Adirondacks to predictions based on the model. Though the results were encouraging in terms of consistency there is a possibility that preference for photographic composition as well as preference for landscapes was being measured. Shafer repeated the study near Salt Lake City, Utah (Shafer et al., 1970) with similarly consistent results except in cases in which photographs showed water features. From observation of the discrepancies between the ratings and those predicted Shafer concluded that respondents preferred various types of water features in the following order: waterfalls, stream, and lake combined; multiple waterfalls; single waterfall and stream (rocky shoreline); stream (rocky shoreline); lake; stream (swampy shoreline).

Marie Morisawa (1970) conducted a study in which riverscapes shown in color slides were described in terms of vista, color, amount of vegetation, relief, serenity, naturalness, accessibility, water appearance, and pollution and litter. These characteristics were related to ratings of attractiveness by students and "experts" on a scale of 1 to 6. Preliminary results indicated low ratings of riverscapes with low relief, little color, and evidence of man's activity while those with great relief were rated high.

Luna Leopold (1969) devised a system of quantifying the aesthetic qualities of stream valleys in terms of a uniqueness ratio based on physical factors, biologic and water quality factors, and human use and interest factors. Physical factors rated on a 1 to 5 scale included: river width, depth, and velocity; flow variability; river pattern; valley height-width ratio; stream bed material; bed slope; drainage area; stream order; erosion of banks; sediment deposition in bed; and width of valley flat. Leopold demonstrated application of the method by comparing a portion of Hell's Canyon on the Snake River at the Idaho-Oregon border to several other riverscapes concluding that Hell's Canyon is second only to the Grand Canyon in uniqueness among those riverscapes compared.

Kenneth R. Swinford (1970) and Floyd L. Newby (1971) conducted a study concerning roadside aesthetics using color slides of roadside scenes to sample preferences. The scenes were described in terms of order and complexity. Preliminary results indicated both order and complexity to be associated with appeal of those managed roadsides used for testing.

In a still different approach to assessing appeal of landscapes David L. Linton (1968) devised a method of mapping landscapes by categories of lesser and greater appeal. He drew three separate maps of Scotland by categories of morphological interest (relief), significant water elements, and land use. Land use was divided into wild landscapes, farmland and woods, forest and moorland, moorland, treeless farms, continuous forest, and urbanized and industrialized land. From these maps Linton constructed a composit scenic resource map. He then compared his map to the results of a survey of scenic beauty done by W. H. Murray for the National Trust for Scotland finding close agreement between the results of the two studies.

Various agencies concerned with resource development or recreation planning have devised methods of assessing aesthetic appeal based on expert opinion rather than empirical testing. One of these is described in a Vermont Agricultural Experiment Station publication, "Scenery Classification" (Sargent, 1971). Factors considered in the devised scenery rating system include: distance of view, variety in the scene, depth of view, width of view, intermittency (pertinent to scenery along a highway), eyesores, and features of historical interest.

The above described works illustrate several methods--all of which may be usefull and reliable--of investigating or assessing aesthetic appeal of both natural landscapes and those changed by man. In this study relationships between appeal of natural landscapes and selected landscape features will be investigated by a method similar to that used by Morisawa (1970) in evaluating riverscapes but with some additional features considered, some deleted, and greater variety of landscape types.

INVESTIGATION PROCEDURE

The procedure of investigation involved several steps which are described below.

1. Two sets of twenty-five 35mm color slides of landscape scenes were selected and the landscapes described by the following set of numerical scales:

relief

(1) mountainous--more than 1000 feet between adjacent high and low areas
(2) great--500 to 1000 feet between adjacent high and low areas
(3) moderate--100 to 500 feet between adjacent high and low areas
(4) gentle--30 to 100 feet between adjacent high and low areas
(5) flat--less than 30 feet between adjacent high and low areas

When two or more relief categories appear in one slide the greater will take precedent in categorization unless the lesser clearly dominates the landscape scene, as when an area of greater relief is far in the background of the scene.

variety of relief categories

(1) all five relief categories visible
(2) four of the five relief categories visible
(3) three categories visible
(4) two relief categories
(5) one relief category

presence of a water feature

(1) at least one water feature present
(2) no water features

type of water feature

(1) falls
(2) stream with rapids

(3) stream without rapids
(4) lake
(5) other still water
(6) none

If two or more water features are present the first on the scale will be recorded.

variety of water features present

(1) all five types present
(2) four of the five present
(3) three types present
(4) two types present
(5) one type present
(6) none

variety of general features (landforms, water features, vegetation)

(1) all three visible
(2) two of the three visible
(3) one general feature visible

vista

(1) view extends over 10 miles in the distance
(2) view extends from 5 to 10 miles
(3) view extends from 2 to 5 miles
(4) view extends from 1 to 2 miles
(5) view extends to less that 1 mile

per cent of vegetation cover on land

(1) 75% or more covered
(2) 50% to 75% covered
(3) 25% to 50% covered
(4) 10% to 25% covered
(5) less than 10% covered

dominant vegetation type (that vegetation type which covers the larger portion of the land)

(1) trees
(2) shrubs
(3) grasses--including reeds, sedges
(4) flowers
(5) mosses or lichens
(6) none

second dominant vegetation type

(1) trees
(2) shrubs
(3) grasses
(4) flowers
(5) mosses or lichens
(6) no second dominant type

1 through 5 of this scale are used when two vegetation types cover nearly equal portions of the land.

variety of vegetation types

(1) all five types present
(2) four types present
(3) three types present
(4) two types present
(5) one type present
(6) none

variety within vegetation types

(1) gross differences within a type which would be obvious to laymen, such as coniferous and deciduous trees, or very different height, shape, and color of bushes, grasses, mosses or lichens, or flowers.
(2) no gross differences within types present

Where 1 applies to any vegetative type within a landscape scene it will take precedent in rating.

color variety

(1) four colors or more
(2) three colors
(3) two colors
(4) one color varying in chroma or value
(5) one chroma or value of a color

Colors are red, green, yellow, blue, brown; others were fit into the nearest category. Black and white are not colors.

The landscapes in the two sets of slides were paired to make the sets very similar; in fact, seven of the scenes were exactly the same in both sets. Slides showing cultural features such as roads, bridges, and fences were excluded in the choice of the landscape scenes. Slides which were obviously taken in some season other than summer were also excluded in order to eliminate favorite seasons as a confusing factor in the preference for landscapes. The author recognizes that some information may have been lost by this seasonal standardization as some landscapes may be most appealing in seasons other than summer.

2. Aesthetic appeal was operationally defined as rating of a landscape by respondents as beautiful or pleasing to look at. An introductory geography class of 63 students was divided into two groups, the first being shown set number 1 of the landscape slides, and the second viewing set number 2. The respondents were asked to rate the landscapes according to the following scale:[1]

(1) extremely beautiful
(2) more than average in beauty
(3) average, pleasing and pleasant to look at
(4) drab and unattractive
(5) very unattractive, an eyesore

Each slide was viewed for nine seconds with respondents cautioned to rate the landscape and not photographic composition or quality, though slides were chosen with technical quality as well as landscape features in mind.

3. The mean rating for each landscape was computed as were mean ratings for each respondent. Spearman's Rank Correlation Coefficients were computed for the mean landscape ratings and the landscape descriptions. A correlation and regression program was run on the Michigan State University 6500 computer with the mean slide ratings as the

[1]Essentially the same scale used by Morisawa but with one less category. Marie Morisawa, "Evaluating Riverscapes," Environmental Geomorphology, ed. by Donald R. Coates (State University of New York, 1971).

dependent variable and the landscape descriptions as the independent variables, and, in another run, with the mean individual ratings as the dependent variable and individual information as the independent variables. The individual information included: sex of the respondent; whether the respondent lives in the country, in a city of less than 20,000, in a city of 20,000 to 100,000, or in a city of over 100,000; whether the respondent was raised in the country, in a city of less than 20,000, in a city of 20,000 to 100,000, or in a city of over 100,000; if the respondent had visited a national park or forest in the last year; or in the last two years; and whether the respondent had visited a state park or forest in the last year; or in the last two years.

DATA

Several analyses of the data collected were performed. Results of the various analyses are presented below.

Spearman's Rank Correlation Coefficient Analysis

The values for Spearman's Rank Correlation Coefficients computed for mean landscape ratings and landscape characteristics are presented in Table 1. From a table of critical values for Spearman's Rank Correlation Coefficients critical values for n=25 and an alpha of .05 were found to be .336 and -.336, and for the same n and an alpha of .01, .475 and -.475. A null hypothesis of no association can be rejected at the alpha of .01 level for mean landscape ratings and the following: type of water feature--sets numbers 1 and 2, and variety of general features--set number 2. The same hypothesis of no association can be rejected at the alpha of .05 level for mean landscape ratings and the following: variety of general features--set number 1, presence of a water feature--set number 2, variety of water features--set number 2, dominant vegetation type--set number 1, and variety within vegetation types--set number 2.

Four of the scales for features describe in part the same thing, those for presence of a water feature, type of water feature, variety of water features, and variety of general features all encorporating a designation of presence or absence of a water feature in the landscape

TABLE 1

SPEARMAN'S RANK CORRELATION COEFFICIENTS

	Mean Ratings			Mean Ratings	
	Slide Set Number 1	Slide Set Number 2		Slide Set Number 1	Slide Set Number 2
Relief	.304	.118	Per Cent Veg. Cover	.270	.222
Var. Relief Categories	.186	.103	Dom. Veg. Type	.446	.319
Presence of Water Fea.	.294	.369	Second Dom. Veg. Type	.060	.142
Type of Water Fea.	.496	.770	Var. Veg. Types	-.073	.149
Var. of Water Fea.	.293	.434	Var. within Veg. Types	.074	.443
Var. Gen. Features	.362	.578	Color Variety	-.151	-.004
Vista	.182	.094			

scene. These scales account for six of the coefficients which fall within the ranges of greater than .336 or less than -.336. The coefficients for type of water feature were the highest in the respective slide sets and comprise the only cases in which coefficients for both sets numbers 1 and 2 fall not only within the critical range for an alpha of .05 but also within the critical range for an alpha of .01. These data seem to indicate that presence of a water feature is indeed an important factor relating to preference for a landscape and that, furthermore, the type of water feature present is important with apparently rapidly moving water preferred.

The remaining two landscape features for which coefficients fall within the critical range for the selected alpha of .05 are variety within vegetation types--set number 2, and dominant vegetation type--set number 1. The coefficient for variety within vegetation types--set number 1 is much lower than that for set number 2, providing inconclusive evidence as to the relationship between variety within vegetation types and preference for a landscape. The coefficient for dominant vegetation type--set number 2 is .319, the highest value not included in the critical range with an alpha of .05. These data suggest a relationship between vegetation type and preference for a landscape but a weaker one than that between type of water feature and preference for a landscape. This apparent weaker relationship may be explained in a couple ways: (1) type of vegetation may indeed be less closely related to preference for a landscape than type of water feature, (2) the description scale may be constructed in the wrong order. To explore this possibility coefficients for three other arrangements of the scale for dominant vegetation type were computed. The results are presented in Table 2 along with the coefficients for the original arrangement of the scale.

TABLE 2

COEFFICIENTS FOR VARIATIONS OF DOMINANT VEGETATION TYPE SCALE

	Arrangement (1) trees shrubs grasses flowers mosses none	Arrangement (2) trees grasses flowers shrubs mosses none	Arrangement (3) shrubs mosses grasses flowers trees none	Arrangement (4) flowers trees grasses shrubs mosses none
Slide Set No. 1	.446	.375	-.297	.397
Slide Set No. 2	.319	.365	-.384	.418

The coefficients for arrangements numbers 2 and 4 do not deviate greatly from the values of the coefficients for the original scale, number 1, however, in both cases the coefficients for both slide sets numbers 1 and 2 fall within the critical range for an alpha of .05 while the coefficient for set number 2 for the original scale arrange- does not. Arrangement number 4, with the highest coefficients for arrangements 2 and 4, may be more like the actual order of preference. Arrangement number 3 yielded negative coefficients with that for set 2 falling within the critical range for an alpha of .05. This scale is apparently least like the actual order of preference.

The correlation coefficient for relief and mean landscape ratings--set number 1 approaches the critical value for an alpha of .05 with a value of .304, but that for set number 2 is only .118, once again

providing inconclusive evidence as to the relationship of this variable to preference for a landscape scene (Table 1).

Coefficients for per cent vegetation cover and mean landscape ratings at .270--set number 1, and .222--set number 2 suggest the possibility of some relationship between per cent vegetation cover and preference for a landscape but do not approach the critical value for an alpha of .05.

The remaining components, variety of relief categories, vista, second dominant vegetation type, variety of vegetation types, and variety of color do not appear to be related to appeal of landscapes according to Spearman's Rank Correlation Coefficient data.

Correlation and Regression Analysis

Correlation and regression analyses were performed on mean landscape ratings and landscape characteristics and on mean individual ratings and individual characteristics of the respondents. The results of these analyses must be interpreted with caution since the data do not satisfy the assumptions of the analysis routine but they do provide some information which is not obtained from the Spearman's Rank Correlation Coefficient analysis.

Analysis of mean landscape ratings and landscape characteristics

The results of the correlation and regression analysis of mean landscape ratings and landscape characteristics tend to coincide with the findings of the Spearman's Rank Correlation Coefficient analysis. Simple correlation coefficients between mean landscape ratings and landscape descriptions are presented in Table 3.

TABLE 3

CORRELATION COEFFICIENTS OF MEAN LANDSCAPE RATINGS AND LANDSCAPE CHARACTERISTICS

Landscape Characteristics	Coefficients of Correlation
Relief	.25388
Variety of relief	.12201
Presence of a water feature	.35256
Type of water feature	.57630
Variety of water features	.33285
Variety of general features	.46886
Vista	.11485
Per cent vegetation cover	.26567
Dominant vegetation type	.34876
Second dominant vegetation type	.08231
Variety of vegetation types	.06907
Variety within vegetation types	.16395
Color variety	-.05694

The three highest and fifth highest coefficients are those of the four landscape characteristics which encorporate presence or absence of a water feature--presence of a water feature, type of water feature, variety of water features, and variety of general features. Type of water feature shows the strongest correlation with a coefficient of .57630. The fourth highest coefficient is that of dominant vegetation type which is also one the higher rank correlation coefficients in the Spearman's analysis. The coefficient for per cent vegetation cover is sixth highest; relief is seventh. The possibility of some relationship between these features and mean landscape ratings was indicated by the Spearman's Rank Correlation Coefficient analysis. The coefficient for variety within vegetation types is only .16395 but this feature has the

second lowest R^2 delete value, .56137, indicating, as did the Spearman results, that there may be some relationship with landscape appeal. The multiple correlation coefficient, R^2, is .6894 with a significance level less than .0005. As expected, the coefficients of correlation between the four scales encorporating presence of a water feature indicate strong intercorrelation. Some weaker intercorrelations are also indicated between the following variables: vista and variety of relief categories, dominant vegetation type and per cent vegetation cover, variety within vegetation types and dominant vegetation type, and variety of vegetation types and second dominant vegetation type.

An examination of residuals revealed some factors which may be related to preference for landscapes but were not accounted for by the set of characteristics used to describe landscapes. Among those indicated as possibly important in scenes rated higher than predicted are: size of lakes, steepness of slopes, presence and character of rock outcrops (roundness or angularity), and extent of individual vegetation types. Scenes which were rated lower than predicted indicate that presence and amount of certain types of vegetation in water and lack of clearings in tree-covered landscapes may be related to landscape appeal. These factors could easily be included in the set of scales for describing landscapes.

Analysis of mean individual ratings and individual information

Information concerning the respondents was gathered to investigate whether such factors might have an influence on the landscape ratings. The simple correlations between mean individual landscape ratings and individual characteristics are listed in Table 4.

TABLE 4

CORRELATION COEFFICIENTS OF MEAN INDIVIDUAL LANDSCAPE RATINGS AND INDIVIDUAL CHARACTERISTICS

Individual Characteristics	Coefficients of Correlation
Sex of respondent	-.00841
Size of community lived in	.33091
Size of community raised in	.16845
Visit to a national park or forest in the last year	.30938
Visit to a national park or forest in the last two years	.01085
Visit to a state park or forest in the last year	.15022
Visit to a state park or forest in the last two years	.10322

The two factors with the highest correlations with mean individual landscape ratings, size of community lived in and visit to a national park or forest in the last year, also have the lowest R^2 delete values, .16315 and .16941. The multiple correlation coefficient, R^2, is .2653, however, indicating that all of these factors together account for little of the variation in mean individual landscape ratings. These data suggest that factors other than those tested are more closely related to individual differences in ratings of the landscapes.

These results must be viewed with caution because of missing data. Eleven out of the total 63 respondents either did not fill out or filled out incorrectly the portion of the questionnaire requesting the above information.

Other Analyses

A comparison of ranks of mean ratings of the landscapes shown in the paired slides is presented in Table 5.

TABLE 5

RANKS OF LANDSCAPES BY RATINGS

Set #1		Set #2		Difference
Slide Number	Rank	Slide Number	Rank	in Rank
1	11.5	26	9	2.5
2	5	27	2	3
3	17	28	14.5	2.5
4	7	29	7	0
5	19	30	22	3
6	25	31	23	2
7	1	32	4	3
8	14.5	33	12.5	2
9	11.5	34	11	0.5
10	23	35	24	1
11	20	36	16	4
12	10	37	17	7
13*	13	38*	14.5	1.5
14*	6	39*	5	1
15*	16	40*	18	2
16*	8	41*	7	1
17*	2	42*	1	1
18	22	43	21	1
19	14.5	44	7	7.5
20	4	45	12.5	8.5
21*	3	46*	3	0
22	24	47	25	1
23	21	48	10	11
24	9	49	19	10
25*	18	50*	20	2

*The exact same slide in both sets.

With a few exceptions the matched slides are ranked very closely indicating consistency in rating similar landscapes between the two groups of respondents. Examination of differences between the paired slides with greater differences in rank indicate the following as possibly related to aesthetic appeal: presence of a water feature, vegetation diversity, presence and character of rock outcrops, relief, vista, and dominant vegetation type. Presence of a water feature in one slide of a pair and not in the other accounted for the greatest differences in ranks. These conclusions support both the Spearman's Rank Correlation Coefficient results and the correlation and regression analysis results.

SUMMARY AND CONCLUSIONS

Two sets of 25 color landscape slides were selected and described in terms of the following characteristics: relief, variety of relief categories, presence of a water feature, type of water feature, variety of water features, variety of general features, vista, per cent vegetation cover on land, dominant vegetation type, second dominant vegetation type, variety of vegetation types, variety within vegetation types, and color variety. An introductory geography class of 63 students was divided with one group viewing set number 1 of the slides and the other viewing set number 2. The respondents were asked to rate the landscapes on a 1-to-5 scale with 1 the most pleasing. Spearman's Rank Correlation Coefficients were computed for mean landscape ratings and landscape characteristics and compared to a table of critical values for alphas of .05 and .01. A correlation and regression analysis was also performed for mean landscape ratings and landscape characteristics. Both analyses indicated that presence of a water feature, type of water feature, variety of water features, and variety of general features are related to mean landscape ratings. All of these components encorporate an indication of the presence of a water feature, however, while three of them give additional information. Type of water feature was shown to be most strongly correlated with mean landscape ratings. Dominant vegetation type was also shown to be related to preference for landscapes. Characteristics for which there is some, but less strong, evidence for relationship to appeal include: relief, per cent vegetation cover, and variety within vegetation types. An examination of residuals indicated other features that may be related to preference for landscapes including: presence and character of rock outcrops, extent of particular vegetation types, size of lakes, steepness of slopes, and presence of vegetation in water.

A correlation and regression analysis of mean individual landscape ratings and the following individual characteristics: sex of the respondent, size of community lived in, size of community raised in, whether or not the respondent had visited a national park or forest in the last year, or two years, and whether or not the respondent had visted a state park or forest in the last year, or two years was also performed. The strongest correlations with mean individual ratings were with size of community lived in, those from smaller communities giving higher ratings, and a visit to a national park or forest in the last year. All of the tested factors together accounted for little of the variation in mean individual landscape ratings, however. Apparently, there are other, more important factors related to differences in individual ratings.

Several recommendations can be made for a study of less limited resources than this one.

1. Landscapes to be used should be chosen to provide for the necessary diversity, then photographed with controls for technical quality as well as for photographic composition. One way composition might be controlled for is by using slides of the same landscapes but with different composition in the two or more slide sets tested.

2. A systematic sampling method might be used.

3. The questionnaire should be redesigned and expanded (see questionnaire in appendix) to solicit additional information concerning the respondents. For example, age and geographical area raised in or lived in might be variables.

4. Several landscape characteristics mentioned previously that were identified as possibly related to aesthetic appeal of landscapes should be added to the landscape descriptions.

5. Changes in some of the descriptive scales used might be made. For example, a system of describing landforms might be devised which encorporates such factors as angularity of landforms, amount of rock exposure, and complexity and steepness of slopes as well as relief. Breadth of view as well as distance might be encorporated into the vista scale. The dominant vegetation type scale might be revised to encorporate the second dominant vegetation type. The variety of color scale might be based on ranges of Munsell color notations, an internationally accepted set of color designations. With control of the consistency of color reproductions of the landscape scenes this system would be feasible.

6. With the above five steps carried out the data collected should warrant a more extensive statistical analysis which might include a factor analysis or cluster analysis.

It has been demonstrated that some features of natural landscapes can be related to appeal of those landscapes by a method of sampling expressed preferences using color slides and describing the landscapes by numerical scales for various features. Presence and type of water features and dominant vegetation type were demonstrated to be related to appeal of landscapes with evidence for relationships between aesthetic appeal and per cent vegetation cover, variety within vegetation types, and relief. Some additional features which may be related to appeal of landscapes were identified with implications for improvement of the research design.

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APPENDIX

APPENDIX

Landscape Aesthetics Questionnaire

LANDSCAPE AESTHETICS STUDY

In order to aid interpretation of the results of this study the following information is requested.

Sex: M___ F___

Do you live: In the country ___; In a city of less than 20,000 ___;

In a city of 20,000 to 100,000 ___; In a city of over 100,000 ___?

Were you raised: In the country ___; In a city of less than 20,000 ___;

In a city of 20,000 to 100,000 ___; In a city of over 100,000 ___?

Have you visited a National Park or Forest in the last year?

Yes ___ No ___

Two Years? Yes ___ No ___

Have you visited a State Park or Forest in the last year?

Yes ___ No ___

Two Years? Yes ___ No ___

You will be shown 25 color slides of different landscapes. Please rate the landscapes in the slides according to the following scale:

(1) Extremely beautiful
(2) More than average in beauty
(3) Average, pleasing and pleasant to look at
(4) Drab and unattractive
(5) Very unattractive, an eyesore

1. ____ 2. ____ 3. ____ 4. ____ 5. ____ 6. ____

7. ____ 8. ____ 9. ____ 10. ____ 11. ____ 12. ____

13. ____ 14. ____ 15. ____ 16. ____ 17. ____ 18. ____

19. ____ 20. ____ 21. ____ 22. ____ 23. ____ 24. ____

25. ____

Comments: