The Evolution of the Gull Lake Community, 1900-1975

Mary E. Penzkofer

Follow this and additional works at: https://scholarworks.wmich.edu/masters_theses

Part of the Geography Commons

Recommended Citation
https://scholarworks.wmich.edu/masters_theses/3902
THE EVOLUTION
OF THE GULL LAKE COMMUNITY,
1900 - 1975

by

Mary E. Penzkofer

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment
of the
Degree of Master of Arts

Western Michigan University
Kalamazoo, Michigan
April 1975
ACKNOWLEDGEMENTS

In writing this thesis, I have benefited from the assistance, encouragement and advice offered me by Professor Charles F. Heller. In addition, the cooperation extended me by Professors George H. Lauff and David F. Tague, of the Michigan State University Biological Station, has been most helpful. I wish to take this opportunity to offer my sincere thanks and appreciation to these individuals.

Mary Elizabeth Penzkofer
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td></td>
</tr>
<tr>
<td>INTRODUCTION AND CONCEPTUAL FRAMEWORK</td>
<td>1</td>
</tr>
<tr>
<td>The Purpose</td>
<td>1</td>
</tr>
<tr>
<td>The Problem: An Analysis of the Gull Lake Community</td>
<td>8</td>
</tr>
<tr>
<td>A Model Lakeshore Dormitory Community</td>
<td>9</td>
</tr>
<tr>
<td>Testing of the Model</td>
<td>12</td>
</tr>
<tr>
<td>II</td>
<td></td>
</tr>
<tr>
<td>THE PHYSIOGRAPHY AND SETTLEMENT OF THE GULL LAKE AREA</td>
<td>14</td>
</tr>
<tr>
<td>The Origin of the Lake</td>
<td>14</td>
</tr>
<tr>
<td>The Geomorphology of the Area</td>
<td>15</td>
</tr>
<tr>
<td>Soil and Vegetation</td>
<td>16</td>
</tr>
<tr>
<td>The Historical Background of the Gull Lake Area</td>
<td>17</td>
</tr>
<tr>
<td>Early Settlement</td>
<td>17</td>
</tr>
<tr>
<td>The Resort Era Arrives</td>
<td>23</td>
</tr>
<tr>
<td>The Interurban Era</td>
<td>23</td>
</tr>
<tr>
<td>The Decline of the Resort Era</td>
<td>28</td>
</tr>
<tr>
<td>III</td>
<td></td>
</tr>
<tr>
<td>RECENT CHANGES IN LAND USE IN THE GULL LAKE AREA</td>
<td>30</td>
</tr>
<tr>
<td>Methodological Considerations</td>
<td>31</td>
</tr>
<tr>
<td>Results: Land Use Change, 1938 - 1964</td>
<td>32</td>
</tr>
<tr>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>AN ANALYSIS OF THE GULL LAKE COMMUNITY</td>
<td>41</td>
</tr>
<tr>
<td>Methodology: Formulation of the Classification Scheme and the Classification of the Dwellings</td>
<td>42</td>
</tr>
<tr>
<td>CHAPTER</td>
<td>PAGE</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td>Results of the Survey</td>
<td>48</td>
</tr>
<tr>
<td>Growth Rates and Locational Patterns</td>
<td>48</td>
</tr>
<tr>
<td>An Analysis of the Gull Lake Neighborhoods</td>
<td>55</td>
</tr>
<tr>
<td>The Age Distribution of the Dwellings</td>
<td>56</td>
</tr>
<tr>
<td>An Analysis of Settlement Density by Neighborhoods</td>
<td>62</td>
</tr>
<tr>
<td>The Size Distribution of the Dwellings</td>
<td>65</td>
</tr>
<tr>
<td>The Distribution of the Dwellings According to State of Repair</td>
<td>69</td>
</tr>
<tr>
<td>CURRENT PROBLEMS AND PROPOSED SOLUTIONS: THE GULL LAKE COMMUNITY LOOKS AHEAD</td>
<td>83</td>
</tr>
<tr>
<td>Current Environmental Problems in the Community</td>
<td>83</td>
</tr>
<tr>
<td>The Future: A Search for Solutions</td>
<td>86</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>95</td>
</tr>
<tr>
<td>APPENDIX</td>
<td>99</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Land Use in the Gull Lake Drainage Basin, 1938-64</td>
<td>33</td>
</tr>
<tr>
<td>2. Classification Scheme for the Survey of the Dwellings</td>
<td>43</td>
</tr>
<tr>
<td>3. Gull Lake Neighborhood Data - From 1973 Survey</td>
<td>49</td>
</tr>
<tr>
<td>4. Simple Correlation Coefficients Showing the Relationship Between Dwelling Characteristics</td>
<td>65</td>
</tr>
</tbody>
</table>
# LIST OF MAPS

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gull Lake, Kalamazoo and Barry counties, Michigan</td>
</tr>
<tr>
<td>2.</td>
<td>Gull Lake, Circa 1900.</td>
</tr>
<tr>
<td>3.</td>
<td>Land Use in the Gull Lake Drainage Basin, 1938</td>
</tr>
<tr>
<td>4.</td>
<td>Land Use in the Gull Lake Drainage Basin, 1964</td>
</tr>
<tr>
<td>6.</td>
<td>Neighborhoods and Areal Means for each Period, 1973</td>
</tr>
<tr>
<td>7.</td>
<td>Mean Dwelling Age, by Quintile Group, 1973</td>
</tr>
<tr>
<td>8.</td>
<td>Dwelling Density, 1973</td>
</tr>
<tr>
<td>10.</td>
<td>Mean State of Repair of Dwellings, by Sextile Group, 1973</td>
</tr>
<tr>
<td>11.</td>
<td>Residuals from Regression of State of Repair on Age, Size, and Density, by Quintile Group, 1973</td>
</tr>
<tr>
<td>12.</td>
<td>Residuals from Regression of Density on Age and Size, by Quintile Group, 1973</td>
</tr>
<tr>
<td>13.</td>
<td>Residuals from Regression of Size on Age and Density, by Quintile Group, 1973</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION AND CONCEPTUAL FRAMEWORK

The Purpose

Kalamazoo County, like much of southern Michigan in which it is located, is the locale for a unique type of rural settlement - the lakeshore dormitory community. These communities, located at inland lakes which were popular summer resorts in the early years of this century, have experienced stages of development unlike those of any other type of rural community. These stages and the historical events connected with them, have undoubtedly left visible impressions on the character of the present communities.

This paper will trace the development of one of these communities, Gull Lake, in an attempt to ascertain the effects of various developmental factors on the present character of the community. Emphasis will be placed on the most visible aspect of the community - its dwellings. An effort will be made to determine the relationship between certain dwelling characteristics and events which took place during different periods in the community's development. In addition, the problems which have resulted from these events will be discussed and a number of possible solutions will be considered. In doing so,
this paper will provide insight into the character and function of both the Gull Lake community itself and the large number of lakeshore dormitory communities located throughout southern Michigan.

At the outset of the Twentieth Century, only those lakes near regional railroads or at the sites of logging operations were accessible to vacationing city dwellers. Lumber operators, envisioning an additional source of profit, left strips of uncut virgin forest along the lake shores to be sold for resort development. The resultant resort business "was directed and promoted mainly by the transportation companies, the resort hotel owners, and real-estate operators, who generally were land agents for a lumber company" (Prophet, 1947). Since only the most suitable sites were selected and the costly and rugged journey kept the number of resorters to a minimum, the acreage devoted to resorts at this time was quite limited (Prophet, 1947).

During the next five to ten years, however, the development of interurban connections between cities and lakes throughout southern Michigan led to a reversal of this pattern. The number of acres devoted to resorts skyrocketed as rural lakes became easily accessible. Thousands of city-dwellers joined the ranks of resorters, patronizing hotels and renting weekend cottages. The result was a boom in the growth of lakeside communities
and a marked change in lakeshore land use, which would have far-reaching effects on the character of these communities for years to come.

Between 1910 and 1920, the automobile became popular and, aided by the establishment of better roads, the tourist came into being. Since public transportation was no longer the sole means of conveyance for the vacationer, the railroad-connected resort hotel declined in popularity. The lakeshore became accessible to a greater number of people and, by the end of this period, city-dwellers began maintaining cottages on nearby lakes (Prophet, 1947). This trend became so popular that, as early as 1930, McMurry noted: "It is now almost impossible to find attractive water frontage on lake or stream in the Lower Peninsula which has not already been preempted" (1930).

In addition, Prophet observed that "problems of pollution, sanitation, over-crowding, and over-fishing became commonplace" (1947). D. M. Anderson also noted that problems had developed.

This trend has been manifest in urban sprawl, in dormitory and satellite communities, and by increasing pressures on outdoor recreational resources particularly (in) those areas close to large urban centers. The impact of urban population pressures upon outdoor recreational space has also exerted many influences on the economic life of smaller municipalities within the recreational areas (Anderson, 1964).

From the 1930's to the present time, as roads have been improved and the automobile has become more effi-
cient, the lakeshore dwelling has metamorphosed from a weekend resort to a year-around residence. Cottages have been winterized and new homes constructed as countless city-dwellers became commuters, employed in the city but residing in the country.

Metropolitan encroachment upon the rural environs has become commonplace as private and commercial automobile registration increased seven-fold in forty years. Highways and byways around the great population nodes have taken on new meaning, and metropolitan 'fallout,' as Lewis Mumford has termed it, now splatters the countryside (Mather, 1963).

This fallout has taken on a variety of forms, as is evidenced by Wilbur Zelinsky's somewhat abbreviated listing.

Currently, at least seven rural-nonfarm categories might be defined: (1) essentially urban persons who live in villages or unincorporated segments of the urban fringes of cities of fewer than 50,000 people; (2) retired persons and persons working in cities who live in dispersed rural dwellings; (3) residents of agglomerated settlements (hamlets and villages) in rural territory beyond urbanized areas; (4) dispersed rural folk engaged in nonagricultural but distinctly rural activities (for example, forestry, mining, fishing, trapping, and various services for rural residents); (5) dispersed rural folk employed in transportation, recreational services, highway services, and other occupations catering to transients and seasonal visitors; (6) institutional populations and military personnel stationed at rural camps; (7) students living on rural campuses or in rural residences while attending college (1962).

To this list should be added, the lakeshore-oriented agglomeration of cottages and permanent homes whose residents rely on neighboring cities for employment.
Many types of rural-nonfarm settlements, including several in southwestern Michigan, have been the subject of detailed geographical inquiry in recent years. John Fraser Hart, in his studies of Vermontville and Augusta (1964), investigated the structure and economic function of the village form of settlement. He focused on age and employment structure and the pattern of population change. His investigations showed that more than fifty per cent of the villagers had been life-long residents of the village or surrounding area, and that relatively few of them were urban "refugees." In addition, he discovered that the population "rose to a peak around 1900 to 1920, dropped in 1930, and subsequently remained stable or increased slowly and rather erratically" (1964). Recent lack of village growth, Hart states, is the result of increased employment mobility of the village resident, which was brought about by the advent of the automobile, and which has induced "economic leukemia" in the village by encouraging the residents to look to the city for their basic needs (1964).

Another rural-nonfarm settlement form, the dispersed rural dwelling, was studied by Mather in an area northeast of Kalamazoo (1963). He discovered a multitude of residential types with little in common other than their role as homes for urban-employed rural-dwellers. This type of settlement fosters a large degree of diversity in
both structural style and size due to widespread lack of rural zoning regulations in the past. Presumably, the relatively low cost of rural land also leads to a heterogeneity of housing values and varied levels of upkeep, both of which influence the character of the settlement.

The lakeshore village was studied by D. M. Anderson, who investigated the economic function of Delton, Michigan, a village in close proximity to two medium-sized urban areas. He found that more than ninety per cent of both seasonal and permanent lake residents originated from either Battle Creek, Kalamazoo, or the surrounding rural areas. In addition, more than fifty per cent of the residents "indicated that they did their basic shopping in Battle Creek, Kalamazoo, or Hastings, all over fifteen miles from the village of Delton" (1964). The area underwent many of the developmental phases mentioned previously, gaining popularity as a railroad-based resort in the early Twentieth Century, and developing into a densely-populated bedroom community of sorts in recent years. The physical environment has also followed a somewhat predictable path, with eutrophication taking its toll in Crooked Lake and "For-Sale" signs sprouting up along weed-grown shores.

Another lakeshore settlement, Haslett, Michigan, was studied by Raphael (1958). Located on the shores of Pine Lake (now Lake Lansing), it originated in the latter half
of the Nineteenth Century as a summer Spiritualist encampment. It was later developed into a summer resort, complete with hotels, excursion boats, and an amusement park. Connected by interurban lines with Lansing, it was a popular vacation spot during the late-Nineteenth and early Twentieth centuries. The 1920's marked the beginning of its decline as a resort community, and its gradual metamorphosis into the year-around dormitory community that it is today.

The extensive development and "urbanization" of lakeshore areas has had differential effects on the environments of many of Michigan's lakes. On the "human" side of the question, the effects have been partially beneficial. The growth of the population has resulted in increased economic activity, an enlarged tax base, and relatively little growth in the demand for services.

Resort subdivisions, especially after cottages are constructed, contribute heavily to the local governmental units in taxes. . . . Most of the owners of this property created no additional expense to the township by their presence during a limited part of the year. The main services received in return for their taxes were ones that the township provided anyway for its own residents. . . . The summer visitors make no use of the schools or other local services. One wonders how much of the present services could be provided and financed if it were not for the property devoted to recreational use (Prophet, 1947).

Uncontrolled growth, however, can have serious effects on the quality of the lake itself. The increase
in plant nutrients provided by septic tanks and fertilizers can result in intensified algae and weed growth (Henderson, 1969). If left unchecked, as is most often the case, eutrophication proceeds rapidly and the lake meets an untimely death. If the lake is shallow, as many inland lakes are, the effects are more rapidly visible. But, even in deep lakes, such as Kalamazoo County's Gull Lake, pollution of the water by lawn fertilizers, sewage, and detergents poses a serious threat that could eventually destroy the very cause for settlement - the amenities of lakeshore living.

The quality of life in the settlement itself is also of concern. Residential densities far exceeding those of many small towns already exist at several lakes. Cottages and houses sometimes are left unrepaired and virtually untended, even though most of them are permanent homes. Narrow paths serve as unsafe streets, crowded with children and pets, as well as cars. These settlements are in serious need of regulation and renewal if they are to be prevented from degenerating into rural slums.

The Problem: An Analysis of the Gull Lake Community

Since lakeshore living has become increasingly popular and will probably continue to do so, the risk that the population of existing settlements will increase dramatically in future years is being incurred. It is
necessary, then, to study existing settlements, to discern trends, and to learn from previous mistakes, in an effort to prevent deterioration of both the physical and human environments of the lakeshore retreat.

Many lakeshore dormitory communities throughout southern Michigan have experienced markedly similar stages of growth, and it is likely that the Gull Lake community has developed in a parallel manner. Located in north-eastern Kalamazoo County, halfway between the cities of Kalamazoo and Battle Creek (Figure 1), it demonstrates several of the characteristics of rural-nonfarm settlement that have been discussed herein. In addition, it appears to have developed into a thriving lakeshore dormitory community - one which is representative of lakeshore communities throughout southern Michigan.

Since I am proposing that the settlement at Gull Lake typifies many lakeshore communities, this hypothesis will be tested by an analytic study of the community's development. The following model of a typical lakeshore dormitory community is presented as a hypothetical norm with which the Gull Lake community can be compared.

**A model lakeshore dormitory community**

The initial settlement of the typical lakeshore dormitory community occurred in the mid-Nineteenth Century, at the site(s) along the lakeshore which was nearest
FIGURE 1

GULL LAKE
Kalamazoo and Barry Counties
Michigan

- Hastings

BARRY COUNTY

KALAMAZOO COUNTY

1:500,000

Miles
to the area's main transportation route. As the settlement grew and developed into a resort, it diffused along the shoreline away from the original population node(s). Later, when accessibility decreased in importance, the more remote shoreline areas were settled and, finally, those portions of the community which lacked lakeshore frontage were settled.

As a result of the length of the period of settlement and expansion (mid-Nineteenth to mid-Twentieth Centuries), the ages of the dwellings vary greatly. The oldest dwellings are located near the early population node(s), and the newest are located in the inland areas which were settled most recently. While many of the neighborhoods are composed of dwellings which are similar in age, a number of others exhibit considerable heterogeneity with respect to dwelling age.

The density, size, and state of repair of the dwellings in the typical lakeshore community vary with the age of the dwellings. Densities are greatest in the older neighborhoods near the original population node(s), and are lowest in the newer inland neighborhoods.

Conversely, the size of the dwellings is smallest in the older neighborhoods and larger in those areas which were settled most recently. Finally, the state of repair of the dwellings in the typical lakeshore dormitory community is worst in the original neighborhoods and best in
the residential areas which were developed in recent years. All these dwelling characteristics may be expected to exhibit some variation due to the length of the periods of development, and to differing factors and events which were influential in the community's history.

The present lakeshore community serves as a residential area, whose inhabitants commute to neighboring cities for employment and for shopping and cultural activities. As a result of the events which took place during the community's development, a number of environmental problems have arisen. These are visible in the dwellings themselves, as well as in the physical environment of the lakeshore.

Testing of the model

In the application of the model to Gull Lake, two key questions arise. First, does the Gull Lake community essentially conform to the model and, if so, to what degree? Second, how have the different stages in its development into a lakeshore dormitory community influenced the present environment of the community?

In an effort to answer these questions, the remainder of this paper will focus on the historical development of the area, changes in land use over a period of time, and the present structure and function of the community. Population growth and changes in settlement
density, as well as the age, size, and state of repair of the dwellings will be studied. Subsequently, an effort will be made to discern trends that may be applicable to other settlements, both actual and proposed. By pointing out the results of past development, the need for caution and controls in the planning of future lakeshore developments will be made clear.
CHAPTER II

THE PHYSIOGRAPHY AND SETTLEMENT
OF THE GULL LAKE AREA

The Origin of the Lake

Gull Lake owes its existence to the Pleistocene glacial epoch, which buried the northern half of the continent under at least six hundred meters of ice (Flint, 1971). Ice sheets advanced over southern Michigan during four major glacial periods, possibly beginning as early as 700,000 years ago (Embleton & King, 1971), and blanketing the land surface with 500 to 750 feet of glacial sands, gravels, boulders, and clays.

Approximately 13,000 years ago, the last of these stages, the Wisconsin, began its final northward retreat (Flint, 1971). As it did so, the meltwater deposited another layer of sediment on top of the already thick layers of till. This new material was composed primarily of sand and gravel, and was deposited in layers, as is characteristic of outwash deposits. At this time, north-eastern Kalamazoo County was in an interlobate location between the Michigan ice lobe on the west, whose source was the present Lake Michigan basin, and the Saginaw lobe, which had advanced from the northeast (Scott, 1921). Thus, the Gull Lake area was in a position to receive
meltwater from two sources.

Gull Lake is believed to be a kettle lake, formed by the melting of an ice block which had been separated from the glacier's terminus and then buried by the tremendous volume of outwash material. As the ice sheet retreated and the climate gradually warmed, the ice block melted and the surface collapsed, forming a pit, or kettle (Scott, 1921). In the case of Gull Lake, the kettle gradually filled with water and formed a lake almost five miles long and more than a mile wide at several points. It is a deep lake, with depths of at least forty feet in most places, and two "deeps" reaching 108 and 110 feet. However, the southern end is shallower and an island there rises above the surface. The lake is unusually large for a kettle, and has a surface area of 2,030 acres (Lake Inventory Summary No. 2, 1952).

The Geomorphology of the Area

The present topography of the surrounding area is gently rolling, with altitudes ranging from 800 to 980 feet above sea level. There are a multitude of depressions, many of them the sites of small lakes, swamps, and bogs. The drainage system is "interrupted," as is typical of other "recently" glaciated areas where an integrated drainage network has not had sufficient time to develop. Consequently, the land is poorly drained, with few surface
streams of any significance.

Gull Lake is fed by several short streams on the north, west, and east, as well as by underground drainage from several small lakes. The known drainage basin is quite small, having an area of approximately 6,656 acres, although it is probable that an additional 4,000 acres drain into the lake via subsurface routes (Lauff & Tague, 1972). The lake, in turn, is drained by one of the few sizable surface streams in the vicinity -- Gull Creek, which flows southward from the outlet at Yorkville to join the Kalamazoo River system.

Soil and Vegetation

The soils that developed on the glacial till and outwash materials are locally quite varied, and range in fertility from very poor to good. They are primarily loams and sandy loams, with muck interspersed in the lowlands. Loam (a mixture of sand, silt and clay) is an ideal soil for agricultural purposes because it provides good drainage and loose structure. Muck, a highly organic soil with a high moisture-holding capacity, is unsuitable for most types of agriculture, although it has proven desirable for some specialty crops. The majority of the soil surrounding Gull Lake is either loam or sandy loam, thus providing good drainage in the higher portions of the drainage basin. Most of it is at least adequate for agricultural
purposes, and served as an inducement to early settlement.

The pre-settlement vegetation in northeastern Kalamazoo County consisted primarily of "rolling land thinly timbered with oak" (oak openings) and prairies (Peters, 1969). The oak openings were composed of scattered white, red, black and yellow oaks, and hickories. The soil was relatively fertile, particularly in the prairies, and in combination with the rich hardwood forests, served as an invitation for settlement to the westward-moving pioneers.

The Historical Background of the Gull Lake Area

Early settlement

Kalamazoo County, like the rest of Michigan, had been inhabited by various Indian tribes long before the area was "discovered" by the Europeans. Even as recently as the early 1800's, there were villages of Ottawa and Potawatomi Indians situated at Prairie Ronde (in the southwest portion), Gull Prairie (in the northeast), and at the Kalamazoo River site where Kalamazoo is situated today (Bernard, 1967; Peters, 1969).

Soon after the War of 1812 and certainly by the early 1820's (accounts vary), white fur traders had established a trading post "on the north side of the Kalamazoo River, within the present day city of Kalamazoo" (Peters, 1969). This was a convenient location for sev-
eral reasons. First, it was centrally located between the aforementioned Indian villages. Secondly, the Indian trails converged there to cross the river, and finally, the river itself provided a direct route to Lake Michigan, down which the furs could be transported for eventual sale at Mackinac Island (Peters, 1969).

By the end of the 1820's, word of the county's rich forests and fertile soil had spread far to the east, and settlers bent on farming and lumbering began to stake their claims. The village of Bronson (now Kalamazoo) was established in 1829, and served as a departure point for settlers heading to other parts of the county. In 1830, a settlement was founded at Gull Prairie (now Richland), a few miles west of Gull Lake (Figure 2) by Col. Isaac Barnes (Illustrated Atlas of Kalamazoo County, Michigan, 1890).

By 1833, settlement had pushed even further into the hinterland and Tillotson Barnes had built a cabin near the south end of Gull Lake, in what was to become Yorkville (Durant, 1880). That same year, the industrious Tillotson Barnes dammed Gull Creek, the lake's outlet, and constructed a sawmill. It was the first in the township, and was kept in constant operation by the growing population's demand for lumber products (Durant, 1880).

In the following year, 1834, Barnes constructed a grist mill, which made the day-long journey to the Com-
stock mill unnecessary. By this time, a substantial portion of the land in the area was being farmed, and the mill was such a welcome addition to the community that the local people operated it by hand prior to the installation of all of the equipment (Durant, 1880).

During the 1830's, settlers also began fanning out to the north of Richland to stake their claims in what was to become Barry County. Hickory Corners was settled in 1834 and Delton in 1836 (Bernard, 1967), and in the latter year, a group of Detroit bankers began promoting land sales in the vicinity of the present city of Hastings (Quaife, 1940). As a consequence, the area around Gull Lake was soon settled (History of Allegan & Barry Counties, 1880). A land survey had been conducted in the late 1820's and township units were gradually organized. Richland Township was organized in 1832 and Ross Township in 1839 (Durant, 1880). To the north, Barry Township was subdivided in 1841, forming the present townships of Barry and Prairieville (Bernard, 1967).

The populations of the townships grew rapidly and the settlers began to demand that provisions be made for education of the area's children. Schools were soon established in each of the settlements and, by 1835, a school had been constructed in Yorkville, bringing the first semblance of "culture" to the Gull Lake area (Durant, 1880).
In the early days, there were several roads constructed through this portion of the county. The first of these followed an Indian trail between Battle Creek and Yorkville. In 1835, however, two new roads were surveyed. The first ran northwest from Gull Creek through Richland Township, and the second ran from Augusta north to a point a short distance east of Yorkville, near Gull Lake Bay in Ross Township (Durant, 1880). A stage route was soon established connecting Battle Creek, Augusta, Richland, and Kalamazoo, passing through Yorkville en route. In 1844, Yorkville became the site of a United States Post Office (Wells, 1920).

During the period between 1844 and 1873, claims were entered on almost all of the remaining land in both counties and, by 1873, virtually all of the land bordering on Gull Lake was privately owned (Beers, 1873). By 1869, the population of Richland had grown to 196, Augusta's population was 538, while the city of Kalamazoo had 9,607 residents (Thomas, 1869). The 1880 census reflected continued growth. Richland Township had 1,189 residents, of which 223 lived in the village of Richland, and Ross Township had 1,617 residents (including Augusta).

By 1880, Yorkville had also become a sizable village, with approximately eighteen houses, the lumber and grist mills, a feed and plaster mill, a grocery store, blacksmith shop, tavern, cooper shop, school, church, and the
post office which now received mail semi-weekly (Durant, 1880). In addition, a depot was proposed at Yorkville Station to accommodate the passengers and freight carried on the recently-constructed Mansfield, Coldwater, and Lake Michigan Railroad. The steam railway passed through both Yorkville and Richland in its east-west journey through this portion of Kalamazoo County (Durant, 1880). Even though the area was growing rapidly, settlement was still confined to the vicinity of Yorkville and there were few homes built along the shores of the lake. Area residents were still dependent on lumbering and agriculture for their livelihood, and wanted to stay, it may be assumed, within a reasonable distance of the mills.

The north end of the lake also became more populated during this period. In 1850, a sawmill was built on Swartout Creek near what is now Prairievile Township Park, thus forming the second settlement on the lake. The sawmill was later replaced by a grist mill, and a store and blacksmith shop were soon added. In 1867, a post office was established under the name of Gull Lake (Figure 2), with the initial mail delivery coming from Richland. In 1904, the post office was discontinued and the mail was then transported by train from Cressey (Griffith, 1962).
The resort era arrives

By 1882, several cottages had been built along the lake shore, the steam railroad was in operation, and a steam powered excursion boat - the first of its kind - was plying the waters of the lake between Hawks Landing on the south shore and Gelger Landing on the north (Figure 2). The population of the area continued a gradual upward climb until, in the 1890's, the lake's popularity as a summer resort brought about a series of changes in the size and character of the settlement.

In 1894, Midland Park was established by the Methodist Church, which had purchased the land for use as a conference center and summer camp. At this same time, cottages were being constructed on the island, which became known as Island Park. The Island Park Association also owned land there and maintained cabins and a dining hall for the use of its members. The central portion of the island later became a girls' camp (Griffith, 1962).

The interurban era

The turn of the century brought with it a rapid metamorphosis as land was platted, cottages were built, and electric interurban lines were constructed connecting the lake resorts with Kalamazoo, Battle Creek, and the larger urban centers. Like many other inland lakes near urban-
ized areas, Gull Lake benefited from the sudden popularity of the newly-introduced electric interurbans. The convenience offered by their routes, the frequency of scheduled arrivals and departures, and the low ticket price encouraged more frequent travel between the residents of neighboring cities and nearby lake resorts. The heightened accessibility resulted in the rapid economic growth and physical expansion of this formerly "remote" area. In addition, it brought with it a change in the structure and function of the resorts at Gull Lake.

The electric interurban was a product of the rapid growth of towns and cities throughout the country in the late Nineteenth Century (Dunbar, 1969). The first result of this growth was the necessity for improved transportation between cities and their suburbs. Once this need was successfully met, the next step was to devise a convenient form of transportation between nearby cities -- something that would improve on the service already offered by the railroads. The electric interurban filled this need remarkably well. It was considerably more convenient than the railroads because it made stops at locations ranging from farmhouse doors to central business districts, rather than at poorly-located depots (Beal, 1907). In addition, it offered lower rates (a fare of thirty-five cents was common), thus encouraging more frequent travel (Hager, 1969).
In southern Michigan, interurbans were very popular and several lines were constructed. The electric interurban was introduced to Kalamazoo County in 1900 with the completion of the Michigan Traction Company line from Battle Creek to Kalamazoo (Hager, 1969). That same year, a spur line was constructed from a point near Augusta north to Allendale Park at Gull Lake. In 1901, the MTC line was extended to Yorkville and a branch line to Willow Beach was added (Hager, 1969; Lenderink, 1959).

Gull Lake was thus connected to both Kalamazoo and Battle Creek by interurban lines and, from those cities, it was connected with Detroit and Chicago by several railroad lines. Interurban service was frequent, with cars arriving and departing hourly and, with well-timed train connections, the trip could be made from Chicago or Detroit in four hours (Wells, 1920). This fledgling transportation network set the stage for the Gull Lake area's rapid growth throughout the early years of the Twentieth Century.

By 1901, both Yorkville and Gull Lake had become sizable settlements. The Michigan Business Directory and Gazetteer for that year listed the following services and business establishments for Yorkville: Allendale Hotel; LaBelle Hotel; Idlewild Resort; Allerton Co., Shipbuilders; a Justice of the Peace; a dentist; two carpenters; a market gardener; a telephone operator; a fruit grower and
grocer; and a combination grocer, railroad, express, and telegraph agent (Griffith, 1962). The Yorkville Milling Company and the Allerton Company represented the only form of manufacturing in the village, and it is clear from this list that the village was by now strongly oriented toward providing services for the resorters. In just twenty years, it had changed from an agricultural and lumbering community to one with resorts and vacationers as its base, and its residents had changed from primary and secondary to tertiary economic activities.

The same issue of the Gazetteer showed a somewhat smaller - but evidently thriving - settlement at Gull Lake, on the north shore. It included a hotel, a general store, a postmaster, and a mason. Five years later, another hotel and restaurant were built and operated as a resort for several years, and 1911 brought the addition of a grocery store to the community (Griffith, 1962).

The lakeshore was rapidly undergoing development and, by 1904, no fewer than twenty subdivisions and resorts had been platted. Hotels, private cottages, a dance pavilion, and an Elks Club were already in existence, and the lake was being touted as a resort of almost paradisaical splendor. The claims of "high altitude -- the all-day cool breezes -- perfect drainage -- pure water -- absence of mosquitos -- the absence of low lands and marshes..." (Wells, 1920), even though they could hardly have been
further from the truth, attracted people in droves. Resort patronage and land sales were solicited from neighboring cities as well as from larger urban areas, and routes of travel were laid out from cities in Michigan, Indiana, and Illinois (Wells, 1920).

Throughout the next several years, the resorts did a prosperous business and land sales skyrocketed, with eight new subdivisions being developed. All the conveniences of life in the city were provided the ressorter. Upon arrival by either train or interurban, the vacationer was met by public launches and steamers, which could transport him to any beach on the lake (Wells, 1920). Once there, daily deliveries by the government mail boat kept him in touch with the outside world. Grocery, milk, and laundry wagons and a grocery boat made daily stops at his cottage door.

The resorts provided a variety of amusements for their patrons. There were several public bathing beaches and, at Allendale Park, where most of the lake activities were centered, refreshment booths, merry-go-rounds, toboggan slides, a ball diamond, and a tennis court kept life at the lakeshore from becoming tiresome (Wells, 1920). A country club on the west side of the lake also added to the pleasures of the resort.

For those whose idea of relaxation was more closely associated with the lake itself, fishing for bass, pickerel, and perch provided good recreation. Boating,
whether on one of the public launches or in a canoe, was one of the most popular activities and "Lovers' Lane" (the lake's outlet) was a favorite spot (Wells, 1920).

By 1920, thousands of resorters were spending a weekend, a week, or even the entire summer at Gull Lake, with Midland Park alone attracting upwards of two thousand people throughout the season. In fact, Midland Park had by then become the only incorporated municipality on the shoreline. It had a millage board, a lighting system, volunteer fire protection, and daily mail delivery, as well as a hotel, restaurant, general store, and an ice cream parlor. The Methodist Protestant Camp Meeting Association owned a large portion of the land, including several of the cottages, and various conference buildings (Wells, 1920).

The decline of the resort era

Not many years later, changing times coupled with the increased freedom of automobile travel brought about a decline in the popularity of resort hotels such as those at Gull Lake. City dwellers began to seek a different type of vacation, one composed largely of sightseeing, and the tourist replaced the resorter. The lakeshore, then, was turned over to those urbanites who chose to establish year-around residences at the lake, and who would use the automobile to commute to the city.
Thus, Gull Lake underwent another sweeping change, the extent of which will be seen in the following chapters. The hotels, trains, launches, and almost every other semblance of the resorts disappeared, and countless businesses closed their doors. These were replaced by hundreds of cottages and permanent homes whose inhabitants could look to Richland, Kalamazoo, Battle Creek, and other nearby towns to supply their needs.

The historical development of the Gull Lake community prior to the 1920's closely paralleled the sequence of events outlined in Chapter I. Located in close proximity to both Kalamazoo and Battle Creek, it metamorphosed from a small railroad - and hotel-based Nineteenth Century resort into a thriving summer community during the Interurban Era. By the early 1920's, the popularity of the automobile began to take its toll and the decline of the Resort Era soon followed. The following chapters will illustrate the extent of the changes which took place, and will test the hypotheses generated by the model.
Between the time of its initial settlement and the present day, the Gull Lake area has undergone a tremendous change in the manner in which its land is utilized. In the 1830's and 1840's, most of the land that was used at all was devoted to lumbering and farming. By the turn of the century, however, a growing portion of the land was being used for resort-related activities. By the end of World War II, the residential area was rapidly encroaching on agricultural and forest lands.

The expansion of the residential area has become the single most important factor in the changing land use of the Gull Lake drainage basin in recent years. It has affected the nature of land use in the basin and, ultimately, the quality of the lake itself. This chapter will trace the changes that have taken place, particularly the expansion of the built-up area, during the period from 1938 to 1964. It will serve as a background to the remainder of the study and will help the reader to view the present lakeshore community in historical perspective.

This chapter is based almost entirely on data from aerial photography. The years 1938 and 1964 were selected because they were the earliest and latest years for which
photo coverage was available. Also, it was felt that this twenty-six year period would show a significant change in land use patterns, and would allow accurate interpretation of this change.

Methodological Considerations

In selecting a system of land use classification that would be appropriate to the scope of this chapter, several systems were given consideration. In the end, James R. Anderson's scheme, which was designed for use with satellite photographs, was considered to be most useful (Anderson, 1966). Since only a very general categorization was desired, Anderson's "Scheme I" satisfied this need adequately. His scheme was only approximated, however, because minor revisions were necessary to improve its usefulness.

Land use in the Gull Lake drainage basin is divided into six categories, as follows:

1. **Built-Up Land**: All land used as residential, commercial, recreational, or for other activities associated with densely populated areas.

2. **Agricultural Land**: All land used for agriculture, including orchards, croplands, and pastures.

3. **Forest Land**: All forested areas containing no more than three dwellings per square mile.

4. **Lakes**: All areas covered by standing water, in which open water predominates over vegetation.

5. **Wet Lands**: All areas covered by standing water,
in which vegetation predominates over open water.

6. **Idle Land**: All dry land, other than forest, that is still in its natural state, or has been permitted to return to its natural state (e.g., open fields, abandoned and decaying orchards).

Following the establishment of these categories, the drainage basin was outlined on each photograph and the entire basin was keyed-out according to this system. A dot planimeter guaranteeing at least ninety-seven per cent accuracy was used to compute the acreage in each category, with the raw data converted into acres with the aid of a conversion table (Avery, 1968).

Following completion of the land use differentiation and the computation of acreages, the public road network was analyzed. An effort was made to determine if there was any correlation between the expansion of the built-up area and the number of miles of roads that have been constructed between 1938 and 1964. This was facilitated by determining the length of the roads on the photos and then converting these distances into miles according to the following formula:

\[
\text{Ground Distance} = \frac{\text{Photo Distance}}{\text{Representative Distance}} \times \text{Fraction}
\]

**Results: Land Use Change, 1938 - 1964**

As a brief study of Table I shows, the first two land use categories underwent a marked change in size
### TABLE 1

**LAND USE IN THE GULL LAKE DRAINAGE BASIN - 1938 and 1964**

<table>
<thead>
<tr>
<th>Land-Use Classification</th>
<th>Acreage 1938</th>
<th>Acreage 1964</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built-up Land</td>
<td>482.36</td>
<td>1,238.40</td>
</tr>
<tr>
<td>Farm Land</td>
<td>3,961.06</td>
<td>3,382.40</td>
</tr>
<tr>
<td>Forest Land</td>
<td>408.68</td>
<td>345.20</td>
</tr>
<tr>
<td>Lakes</td>
<td>394.13</td>
<td>352.40</td>
</tr>
<tr>
<td>Wet Lands</td>
<td>260.40</td>
<td>296.80</td>
</tr>
<tr>
<td>Idle Land</td>
<td>324.40</td>
<td>406.80</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>5,880.63</strong></td>
<td><strong>6,021.60</strong></td>
</tr>
</tbody>
</table>

Source: Compiled by author from aerial photographs.

while the remaining four changed only moderately. The difference in the total acreage for the two years is due to the distortion of area on the photos, and the resultant difference in acreage computed with the planimeter.

The greatest increase in land area was in the first category, "Built-up Land." A comparison of Figures 3 and 4 will show that most of this expansion was in the immediate vicinity of Gull Lake. Four new residential subdivisions have been constructed and the shoreline has been almost completely developed.

The expansion of the built-up area has been partially
FIGURE 4

LAND USE in the Gull Lake Drainage Basin 1964

Legend:
- Built-up Land
- Farm Land
- Forest
- Lakes
- Wet Lands
- Idle Land

1:62,500

0 1/2 1
Miles
responsible for a decrease in the acreage devoted to farm land, as the data for the second category demonstrate. This decrease is also partially the result of the recent practice of allowing farmland to go idle; note the increase in idle land on Table 1, as well as on the land use maps.

The detailed reasons for the increase in idle land can only be speculated upon. It is possible that re-zoning of some of the agricultural land to residential use increased the tax value of the land, making farming of the more marginal land unprofitable. Or perhaps some of the farmers saw the profit to be had in selling their land (perhaps to speculators) at the high prices that residential land commands, and abandoned farming to "get rich quick." In any case, the amount of farmland in the basin underwent a significant decrease while idle land increased during the study period.

There was also a decrease in forest land and lakes between 1938 and 1964. The decrease in forested acreage was almost entirely the result of expansion of the build-up area, as a comparison of Figures 3 and 4 demonstrates. The decrease in the area of the lakes, however, is most likely the result of filling in of the water by vegetation, and the simultaneous increase in wetland acreage tends to substantiate this theory. This would indicate that some of the lakes are undergoing eutrophication and
are being occupied by vegetation along their shores. As the model in Chapter I suggests, this problem is common in inland lakes throughout Michigan.

Although the built-up area has expanded considerably, the number of public roads has not increased accordingly. In 1938, there were 45.56 miles of roads, while in the following twenty-six year period only 1.53 miles of roads were added. Even though these new roads were built in areas that since have become densely populated, it is evident that residential expansion took place without the aid of an enlarged transportation network. While the original road network has been improved from time to time since 1938, these improvements have been confined to resurfacing measures. Very little widening of the roads has been done and, without exception, all of the major roads in the area are only two lanes in width. In addition, many of the streets in the residential areas are merely one-lane wide, necessitating extreme caution, particularly on weekends and during the summer season. Thus, a burgeoning population, entirely dependent upon the automobile, is conducting its day-to-day activities on roads that have long since become obsolete.

Current land use in the built-up area of the Gull Lake community and the public and private road network which serves it are shown in detail in Figure 5. The following list of the commercial, public, and institu-
FIGURE 5

COMMERCIAL, PUBLIC, and INSTITUTIONAL FACILITIES
Including
THE ROAD NETWORK

See Preceding Page for List of Facilities

1:40,740 Miles

1973
tional facilities that serve the residents of the area is keyed to this map:

1. Prairieville Township Park
2. Schonie's Grocery Store and Gas Station
3. Gull Lake Country Club
4. Church
5. Yorkville Cemetery
6. Gas Station
7. Hazel Wildermuth School
8. Gull Harbor Inn
9. Harbor Cove Marina
10. Todd Boat Sales Warehouse
11. Todd Boat Sales
12. June Bell's Restaurant (closed)
13. Sommers Marine Company
14. Bay View Market
15. Gull Lake Marine Center
16. Tavern
17. Anchor Inn - House of Fine Food
18. Anchor Inn - Health Center and Styling Salon
19. Grocery Store and Gas Station
20. Gull Lake Bible Church
21. Kellogg Bird Sanctuary
22. Christian Youth Training Camp
23. Gull Lake Bible Conference Center
24. Michigan State University Biological Station (Kellogg Laboratories)
25. Ross Township Park

Both this list and Figure 5 indicate that there are relatively few services provided for the local residents. Other than the three small grocery stores and gas stations, there are no establishments that can supply their daily needs. The restaurants, parks, and retailers of marine equipment meet occasional needs, but for most everyday items the residents of the community must travel to one of the neighboring cities or towns. Thus, they are firmly established as residents of a bedroom community and must rely on outlying cities to supply the goods and serv-
ices that they require.

It is evident that the most dynamic change has been in the expansion of the acreage categorized as "Built-Up Land." This is the land use type that is playing the most important role in determining the future of the lake, and which has the most direct effect on the quality of the lake's environment. The following chapter will focus on the residential portion of the built-up area, and will trace its development from the turn of the century to the present day.
AN ANALYSIS OF THE GULL LAKE COMMUNITY

The Gull Lake community has undergone processes of growth and decay that are typical of many lakeshore settlements. As was suggested in Chapter I, many communities of this type, which originated as turn-of-the century resorts, later metamorphosed into year-around residential areas. Expectedly, the resort era left a distinct impression on the character of these communities, mostly in the form of small lots and high population densities in many of the early neighborhoods. The arrival of the automobile hastened the development of most remaining lakeshore property as summer homes for city-dwellers. Ultimately, the automobile was to make possible the appearance of a new phenomenon on the rural landscape - the lakeshore bedroom community.

As a result of this sequence of events, problems such as increased population density and decreased aesthetic quality, as well as potential safety and health hazards, are facing this and many other inland lakes. An insight into the causes and extent of these problems can be gained by studying the housing characteristics of the lakeshore neighborhoods. The age, size, state of repair, and distribution of the dwellings are indicative of the quality
of life in the settlement, and provide a clue to future prospects for either improvement or degeneration of that quality. This chapter will trace the growth of the Gull Lake community through a study of housing characteristics, and will attempt to correlate present conditions with historical factors which may be responsible for the current condition of the settlement.

Methodology:
Formulation of The Classification Scheme and The Classification of the Dwellings

The data for this analysis were gained through a visual categorization of the dwellings according to age, size, and state of repair, and it was therefore necessary to design an appropriate classification scheme. Since a certain degree of subjectivity exists in any such visually-based system, the categories for each of these three characteristics were restricted to a general level of differentiation. In this way, the classification process was simplified without detracting from the validity of the results.

Since the size of a dwelling can be evaluated easily by observation, the construction of size categories was relatively simple. As can be seen in Table 2, the size classification was subdivided into two broad categories, "Number of Floors" and "Number of Rooms." The number of floors in a dwelling, whether of the conventional one-to
### TABLE 2

**CLASSIFICATION SCHEME FOR THE SURVEY OF THE DWELLINGS**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Rating</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Period of Construction</td>
</tr>
<tr>
<td><strong>AGE</strong></td>
<td></td>
<td>1895 - 1919</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1920 - 1944</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1945 - 1954</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1955 - 1964</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1965 - Present</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>SIZE</strong></td>
<td></td>
<td>Number of Floors</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1½</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2½</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Split-level</td>
</tr>
<tr>
<td><strong>STATE OF REPAIR</strong></td>
<td></td>
<td>Dwelling</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Under Construction</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Extremely well-maintained; Very attractive.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Neat, well-maintained, attractive.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Presentable; no major repairs or painting needed.</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Paint &amp; repairs needed.</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Very run-down; Badly in need of paint &amp; major repairs.</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Dilapidated &amp; Uninhabited.</td>
</tr>
</tbody>
</table>

Source: Compiled by author.
three-story variety or the modern split-level, can be readily determined by casual observation. A determination of the number of rooms is somewhat subtler, however, and requires careful consideration of the dwelling's dimensions and design. To facilitate this portion of the classification process, several architectural sources were consulted (Rickert, 1967; Comstock, 1915; Power, 1927). Floor plans and interior designs for a variety of house styles and age periods were studied, with the intention to minimize error in determining the number of rooms in each dwelling.

The determination of the age of each house was much more difficult, since such a variety of styles exists. In addition, many of the older dwellings have been remodeled one or more times, with additions to - and subtractions from - the original structures commonplace. Consequently, five broad categories were constructed in order to reduce the margin of error (Table 2).

The "1895 to 1919" category includes most of the dwellings built during the resort era as well as those built before the turn of the century. The "1920 to 1944" category covers the twenty-five year period when the area was being transformed from a resort into a dormitory community. The post-war construction boom is included in the "1945 to 1954" category, and the remaining two groups, "1955 to 1964" and "1965 to 1973," mark a period of slow,
steady growth of the lakeshore settlement. These five time periods were chosen because they mark definite stages in the community's development, as well as for the relative ease with which they could be distinguished from one another. The two early periods cover longer time spans than the latter three because changes in architectural styles were not as rapid prior to World War II, and construction dates could not be so easily differentiated.

The aforementioned architectural sources were of great assistance in classifying the dwellings by age. The greatest aid was provided by John E. Rickert's 1967 study of house facades, in which he demonstrated the use of key elements in a dwelling's facade to determine the age of the dwelling (Rickert, 1967). His grouping of house characteristics by eras was extremely helpful and, in fact, provided the primary key by which the age of each dwelling in the Gull Lake community was determined.

Finally, each dwelling was categorized according to its state of repair. As in the size classification, this group too was subdivided into two major headings. Since a house may be subject to a much different level of maintenance than the surrounding yard, the two were separated in the classification scheme. As shown in Table 2, the state of repair of the dwelling could fall into any of seven categories ranging from new and unfinished - "Under
"Construction" - to old, dilapidated, and uninhabited - "Abandoned." The yards were classified similarly, with six states of repair being possible. These ranged from new and unplanted - "Undeveloped" - to those showing long-term neglect. Further explanations of the categories for both house and yard are contained in Table 2.

Following the construction of the classification scheme, a house-to-house survey was conducted in order to categorize each dwelling and locate it on the base map. After a preliminary automobile traverse, at which time the houses were plotted on the map, a number was assigned to each and the actual survey was made. On the basis of the classification scheme, each house received three ratings. In the case of the "Size" and "State of Repair" categories, this rating was a dual one, with separate ratings for each of the sub-categories. As is shown in Table 2, the possible ratings ranged from one to five in the "Age" category, from one to six and one to three for each of the subdivisions of the "Size" category, and from zero to six for "State of Repair" of the house, and zero to five for the yard.

These data were subsequently prepared for computerized manipulation, at which time two changes were made. First, it was decided to eliminate the "Number of Floors" factor in the "Size" category, because the number of floors in a dwelling is not a true indicator of dwelling
size and its inclusion would confuse the issue. Secondly, a decision was made to combine the "State of Repair" sub-categories so that each unit (dwelling and yard) would receive a single rating. This was necessary because, in too many cases, the house and yard fell in quite different categories and confusion would result from separating them. In addition, field observation led to the conclusion that each lot (both house and yard) is a single entity and must be treated accordingly. To accomplish this, the house and yard ratings for each unit were simply totaled, providing a single rating with a maximum of eleven points possible.

A total of 1,060 dwellings were counted and categorized in the vicinity of the lake. This number includes only those dwellings that are clearly part of the nonfarm bedroom community, thus excluding a very small number of farm homes. In addition, the homes on the island were eliminated due to their inaccessibility.

In order to facilitate significant spatial comparisons of the dwellings, the data were subsequently divided into groups according to neighborhoods. Most of the thirty-nine neighborhoods are based on the original resort boundaries as shown in Chadwick's Plat Book (1943). The rest were delimited on the basis of the proximity of the dwellings to each other and to the lake. Thus, where homes were not in clearly defined neighborhoods, they
were grouped together on the basis of their nearness to one another. In this way, the data for individual dwellings could be combined with that for other dwellings in the same area, and more meaningful averages could be obtained. Figure 6 shows the location of each neighborhood, and Table 3 gives the name of each as it is keyed to the map.

Results of the Survey

Growth rates and locational patterns

The dwellings were first mapped according to the time period in which they were constructed, and the center of settlement at the end of each period was determined by the Areal Mean method (Appendix, Part 1). The five areal means are shown on the map in Figure 6.

During the first period, 433 cottages were constructed, for an average growth of slightly more than seventeen homes per year. This period corresponds closely with the period of early development described in the model (Chapter I), and the high growth rate is indicative of the popularity of resorts at this time.

These cottages were located primarily in the neighborhoods immediately adjacent to the shores of the southern half of the lake, with a marked concentration along the extreme southeastern shore, where settlement origi-
<table>
<thead>
<tr>
<th>Neighborhood</th>
<th>Mean Year of Construction</th>
<th>Mean Size</th>
<th>Mean State of Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yorkville</td>
<td>1935</td>
<td>1.78</td>
<td>5.48</td>
</tr>
<tr>
<td>Indian Point</td>
<td>1951</td>
<td>1.65</td>
<td>4.25</td>
</tr>
<tr>
<td>-</td>
<td>1967</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>-</td>
<td>1943</td>
<td>1.80</td>
<td>5.20</td>
</tr>
<tr>
<td>Idlewild</td>
<td>1928</td>
<td>1.87</td>
<td>5.82</td>
</tr>
<tr>
<td>Gull Vista</td>
<td>1960</td>
<td>1.97</td>
<td>2.63</td>
</tr>
<tr>
<td>-</td>
<td>1920</td>
<td>1.83</td>
<td>4.16</td>
</tr>
<tr>
<td>Pleasant View Park</td>
<td>1939</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Highland Park</td>
<td>1930</td>
<td>1.80</td>
<td>5.17</td>
</tr>
<tr>
<td>Kenwood</td>
<td>1946</td>
<td>1.91</td>
<td>2.90</td>
</tr>
<tr>
<td>-</td>
<td>1958</td>
<td>1.70</td>
<td>2.50</td>
</tr>
<tr>
<td>Wildwood Park</td>
<td>1936</td>
<td>1.75</td>
<td>3.41</td>
</tr>
<tr>
<td>-</td>
<td>1955</td>
<td>1.83</td>
<td>2.83</td>
</tr>
<tr>
<td></td>
<td>1967</td>
<td>1.92</td>
<td>2.35</td>
</tr>
<tr>
<td>Ridgewood</td>
<td>1952</td>
<td>2.00</td>
<td>2.27</td>
</tr>
<tr>
<td>-</td>
<td>1951</td>
<td>1.41</td>
<td>4.53</td>
</tr>
<tr>
<td>North End</td>
<td>1943</td>
<td>2.03</td>
<td>3.14</td>
</tr>
<tr>
<td>Northwood</td>
<td>1950</td>
<td>2.75</td>
<td>2.00</td>
</tr>
<tr>
<td>Woodlawn</td>
<td>1923</td>
<td>1.83</td>
<td>4.00</td>
</tr>
<tr>
<td>-</td>
<td>1938</td>
<td>1.73</td>
<td>3.63</td>
</tr>
<tr>
<td>Hickory Point</td>
<td>1945</td>
<td>2.13</td>
<td>2.66</td>
</tr>
<tr>
<td>Long Beach</td>
<td>1953</td>
<td>2.13</td>
<td>2.59</td>
</tr>
<tr>
<td>Fair Oaks</td>
<td>1935</td>
<td>1.88</td>
<td>4.00</td>
</tr>
<tr>
<td>Oakwood Park</td>
<td>1948</td>
<td>1.83</td>
<td>2.88</td>
</tr>
<tr>
<td>Sylvan Beach</td>
<td>1934</td>
<td>1.62</td>
<td>4.61</td>
</tr>
<tr>
<td>Midland Park</td>
<td>1914</td>
<td>1.51</td>
<td>5.85</td>
</tr>
<tr>
<td>Crescent Beach</td>
<td>1939</td>
<td>1.68</td>
<td>4.50</td>
</tr>
<tr>
<td>-</td>
<td>1951</td>
<td>1.80</td>
<td>2.80</td>
</tr>
<tr>
<td>Willow Beach</td>
<td>1939</td>
<td>1.83</td>
<td>4.05</td>
</tr>
<tr>
<td>Sunset View</td>
<td>1919</td>
<td>1.77</td>
<td>5.00</td>
</tr>
<tr>
<td>Gull Lake Park</td>
<td>1942</td>
<td>1.60</td>
<td>4.35</td>
</tr>
<tr>
<td>-</td>
<td>1950</td>
<td>1.73</td>
<td>4.26</td>
</tr>
<tr>
<td>Allendale Park</td>
<td>1933</td>
<td>1.69</td>
<td>5.50</td>
</tr>
<tr>
<td>Bay View</td>
<td>1924</td>
<td>1.50</td>
<td>7.07</td>
</tr>
<tr>
<td>Orchard Place</td>
<td>1938</td>
<td>1.53</td>
<td>5.66</td>
</tr>
<tr>
<td>Franklin Beach</td>
<td>1927</td>
<td>1.70</td>
<td>5.33</td>
</tr>
<tr>
<td>Grand View</td>
<td>1943</td>
<td>1.69</td>
<td>4.07</td>
</tr>
<tr>
<td>La Belle Terrace</td>
<td>1924</td>
<td>1.48</td>
<td>6.10</td>
</tr>
<tr>
<td>Neighborhood</td>
<td>Number of Dwellings</td>
<td>Number of Acres</td>
<td>Density (Dwellings per Acre)</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------</td>
<td>-----------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>1. Yorkville</td>
<td>45</td>
<td>44.46</td>
<td>1.012</td>
</tr>
<tr>
<td>2. Indian Point</td>
<td>20</td>
<td>17.16</td>
<td>1.165</td>
</tr>
<tr>
<td>3. -</td>
<td>9</td>
<td>16.64</td>
<td>.540</td>
</tr>
<tr>
<td>4. -</td>
<td>5</td>
<td>15.60</td>
<td>.320</td>
</tr>
<tr>
<td>5. Idlewilde</td>
<td>69</td>
<td>46.80</td>
<td>1.474</td>
</tr>
<tr>
<td>6. Gull Vista</td>
<td>33</td>
<td>62.40</td>
<td>.528</td>
</tr>
<tr>
<td>7. -</td>
<td>6</td>
<td>15.34</td>
<td>.391</td>
</tr>
<tr>
<td>8. Pleasant View Park</td>
<td>4</td>
<td>21.58</td>
<td>.185</td>
</tr>
<tr>
<td>9. Highland Park</td>
<td>35</td>
<td>16.90</td>
<td>2.071</td>
</tr>
<tr>
<td>10. Kenwood</td>
<td>11</td>
<td>15.86</td>
<td>.693</td>
</tr>
<tr>
<td>11. -</td>
<td>20</td>
<td>24.96</td>
<td>.801</td>
</tr>
<tr>
<td>12. Gull Hills</td>
<td>15</td>
<td>33.80</td>
<td>.443</td>
</tr>
<tr>
<td>13. Wildwood Park</td>
<td>24</td>
<td>20.80</td>
<td>1.153</td>
</tr>
<tr>
<td>14. -</td>
<td>6</td>
<td>18.20</td>
<td>.329</td>
</tr>
<tr>
<td>15. -</td>
<td>28</td>
<td>49.66</td>
<td>.563</td>
</tr>
<tr>
<td>16. Ridgewood</td>
<td>29</td>
<td>33.28</td>
<td>.871</td>
</tr>
<tr>
<td>17. -</td>
<td>39</td>
<td>59.54</td>
<td>.655</td>
</tr>
<tr>
<td>18. North End</td>
<td>55</td>
<td>58.76</td>
<td>.936</td>
</tr>
<tr>
<td>19. Northwood</td>
<td>4</td>
<td>5.20</td>
<td>.769</td>
</tr>
<tr>
<td>20. Woodlawn</td>
<td>18</td>
<td>15.34</td>
<td>1.173</td>
</tr>
<tr>
<td>21. -</td>
<td>11</td>
<td>46.54</td>
<td>.236</td>
</tr>
<tr>
<td>22. Hickory Point</td>
<td>15</td>
<td>18.20</td>
<td>.824</td>
</tr>
<tr>
<td>23. Long Beach</td>
<td>32</td>
<td>41.60</td>
<td>.769</td>
</tr>
<tr>
<td>24. Fair Oaks</td>
<td>17</td>
<td>14.30</td>
<td>1.188</td>
</tr>
<tr>
<td>25. Oakwood Park</td>
<td>18</td>
<td>21.58</td>
<td>.834</td>
</tr>
<tr>
<td>26. Sylvan Beach</td>
<td>13</td>
<td>10.66</td>
<td>1.219</td>
</tr>
<tr>
<td>27. Midland Park</td>
<td>170</td>
<td>42.38</td>
<td>4.011</td>
</tr>
<tr>
<td>28. Crescent Beach</td>
<td>60</td>
<td>20.02</td>
<td>2.997</td>
</tr>
<tr>
<td>29. -</td>
<td>10</td>
<td>6.50</td>
<td>1.538</td>
</tr>
<tr>
<td>30. Willow Beach</td>
<td>36</td>
<td>14.04</td>
<td>2.564</td>
</tr>
<tr>
<td>31. Sunset View</td>
<td>13</td>
<td>11.18</td>
<td>1.162</td>
</tr>
<tr>
<td>32. Gull Lake Park</td>
<td>20</td>
<td>15.86</td>
<td>1.261</td>
</tr>
<tr>
<td>33. -</td>
<td>15</td>
<td>40.82</td>
<td>.367</td>
</tr>
<tr>
<td>34. Allendale Park</td>
<td>16</td>
<td>6.24</td>
<td>2.564</td>
</tr>
<tr>
<td>35. Bay View</td>
<td>28</td>
<td>9.62</td>
<td>2.910</td>
</tr>
<tr>
<td>36. Orchard Place</td>
<td>15</td>
<td>18.72</td>
<td>.801</td>
</tr>
<tr>
<td>37. Franklin Beach</td>
<td>33</td>
<td>14.82</td>
<td>2.226</td>
</tr>
<tr>
<td>38. Grand View</td>
<td>26</td>
<td>8.32</td>
<td>3.112</td>
</tr>
<tr>
<td>39. La Belle Terrace</td>
<td>40</td>
<td>14.04</td>
<td>2.849</td>
</tr>
</tbody>
</table>

Source: Compiled by author.
FIGURE 6

NEIGHBORHOODS
And
AREAL MEANS
FOR EACH PERIOD

1973

CENTER of SETTLEMENT
By Year
1 - 1919
2 - 1944
3 - 1954
4 - 1964
5 - 1973

See Table 3 for Neighborhood Names

1 : 40,740

0 1/2 1
Miles
inated. At the north end of the lake, there were two areas of concentration - one on the northwest shore and the other on the northeast, with the rest of the shoreline remaining sparsely inhabited. The center of settlement at the end of this period was approximately one-quarter mile offshore west of Midland Park (Figure 6), clearly in the southern one-third of the lake.

The rate of settlement growth decreased sharply to approximately eight homes per year for the next twenty-five years. This period corresponds with the second era described in Chapter I. The decreased growth rate is due partially to the advent of the automobile, which encouraged the growth of tourism and a decline in the popularity of resorts. In addition, the Depression of the 1930's and the onset of World War II during the early 1940's caused a temporary decline in the construction industry. In spite of these factors, by 1944 another 218 dwellings had been constructed, bringing the total number of lakeshore residences to 661.

These "new" homes were more widely scattered along the lakeshore than the first group of cottages had been, although the majority were still along the southern shores. Many of the older neighborhoods, particularly those at the south end of the lake, continued to experience growth. In addition, several new neighborhoods were developed, expanding occupancy further along the eastern
shoreline toward the north end of the lake. The center of settlement by the end of this period was slightly north and west of that for the preceding one (Figure 6), indicating an overall northwestward trend in the settlement pattern.

During the period immediately following World War II and extending into the early 1950's, a nationwide housing "boom" began. While only 143 homes were built at Gull Lake during this time, it must be remembered that this is a rate of approximately fourteen homes per year - almost as high as the rate of growth prior to 1920. Thus, the downward trend during the twenty-five year period before 1944 was checked.

These new homes were almost equally divided between the north and south ends of the lake, with very few constructed in between. As in the two previous periods, several neighborhoods along the southeastern shoreline experienced a marked increase in the number of homes constructed. On the north, most new homes were constructed in the neighborhoods on the northwest side of the lake, with settlement spreading beyond the perimeter of Gull Lake to the shores of Little Long Lake. By the end of this period, the center of settlement had again shifted north and west, showing a continuation of the previous trend (Figure 6).

Between 1955 and 1964, another 153 homes were built,
bringing the total to 957. The growth rate increased slightly to fifteen homes per year, and settlement made a decided shift toward the west. Only a few of the original neighborhoods gained new dwellings, with most of the homes being constructed on the west side of the lake. Of the older neighborhoods which experienced new growth, those on the southeastern shore were again the most popular, while two on the northwest also made gains. In addition, new neighborhoods were constructed west of the lake and along the southeastern shore of Little Long Lake. As in previous years, the center of settlement continued to shift toward the northwest and settlement began to expand beyond the shoreline to the inland areas.

Between 1965 and 1973, the growth rate dropped slightly to thirteen homes per year, for a total gain of 103 dwellings. Construction again predominated on the west side of the lake, particularly on the northern end. Several of the lakeshore areas experienced gains, as did the newer inland neighborhoods. In addition, a new subdivision appeared inland from the southwest shore, near Yorkville. The remaining neighborhoods gained only a smattering of new dwellings, and the major trend was again toward the northwest.

While the center of settlement is still located in the southern half of the lake, approximately one-quarter mile west of Oakwood Park, it is evident that there has
been a considerable shift in the location of the center of the Gull Lake settlement. In fact, it has migrated nearly one-half mile since 1920, indicating that settlement is no longer focused at the southern end of the lake. As the model predicted, settlement diffused outward from the original population node, with the most popular shoreline areas being settled first and the nearby, non-shoreline properties last.

An Analysis of the Gull Lake Neighborhoods

The thirty-nine neighborhoods studied in this survey vary greatly in the age, density, size and state of repair of their dwellings. In spite of this diversity, however, the spatial distribution of these four characteristics reveals a marked degree of similarity within certain "micro-regions." In order to emphasize these similarities and to facilitate spatial comparisons, three micro-regions were delineated (Figure 7). These micro-regions, based on all four dwelling characteristics, differ significantly from one another and reflect the differential influence of historical factors in the community's development. These spatial contrasts will be illustrated in the following discussions of the community's neighborhoods.
The age distribution of the dwellings.

Since it has been stated that historical factors were at least partially responsible for the present composition of the neighborhoods, it is logical to begin this portion of the chapter with a discussion of the age distribution of the dwellings. To facilitate this, the average years of construction for the homes in each neighborhood were calculated and the resultant thirty-nine means were ranked from low to high, divided into quintiles, and mapped accordingly. Both the quintile groups and their spatial distribution are depicted in Figure 7.

This map shows a concentration of quintile groups one, two, and three along the southern shore, indicating that most of the older dwellings are located here. The dwellings in this area, Micro-region I, have an average age of thirty-seven years, supporting the model's hypothesis that the oldest dwellings are located nearest the original population node. Along the western shore, in Micro-region II, are dwellings from quintiles two through five. Even though dwelling age varies considerably in this area, it is evident that significant construction here has continued for a longer time than in Micro-region I. The average dwelling age in this Micro-region is thirty-two years. Finally, Micro-region III, on the
FIGURE 7

MEAN DWELLING AGE
By
QUINTILE GROUP

Micro-region 3

Micro-region 2

Micro-region 1

AGE IN YEARS

- 54 to 78
- 29 to 53
- 19 to 28
- 9 to 18
- 0 to 8

1: 40,740

Miles

1973
northern shoreline, consists of neighborhoods which are predominantly in quintiles three, four, and five, with an average dwelling age of twenty-five years.

The map of the age distribution (Figure 7) reaffirms that many of the areas along the southern shores of the lake were among the first to be settled. It is not difficult to speculate on the reasons behind the location of these early neighborhoods along the southern shores. As discussed in Chapter 2, this area was the site of several resorts which were later replaced by privately-owned individual lots. The development of the area, both for resorts and for cottages, was largely dependent upon the transportation lines which passed the southern tip of the lake, connecting it with Kalamazoo and Battle Creek. Although there were several roads in the area by this time, the railroad was still the chief form of transportation. Consequently, the neighborhoods nearest the interurban depot in Allendale Park were settled first. With the introduction of the gas launch, however, proximity to the depot decreased in importance and aesthetic quality, rather than location, became the determining factor in site selection.

At the same time that the south end of the lake was being settled, land was being platted and sold near the resorts on the north shore. North End, then called Lake View, and Woodlawn (originally Oak Glen Farm) were among
the first neighborhoods to be settled, presumably because of their proximity to the settlement of Gull Lake, as well as to the railroad lines that passed north of the lake. These neighborhoods were a great deal smaller than those at the south end of the lake, most likely because of the increased distance from Kalamazoo and Battle Creek, which resulted in fewer people making the journey northward. In addition, the south shore of the lake, with its numerous resort facilities, was simply the more popular location. As a result, the south end of Gull Lake became populated much more rapidly than the north end, as is indicated by the concentration of quintile groups 1 and 2 in that area.

The fact that all of the neighborhoods in the two lowest quintiles were initially settled at approximately the same time, yet have different mean ages indicates that some of the neighborhoods continued growing long after the populations of others had leveled off. While there could be several reasons for this, such as a shift in popularity, it is probable that the most popular neighborhoods reached their maximum capacities early in the century. Additional growth would then have spilled over into the adjacent, less-popular neighborhoods, which would have reached their maximum capacities at a later date.

Another explanation for continued growth in some
areas is that several neighborhoods, such as Idlewild and North End, added large portions of land several years after the initial plats were surveyed, thus making population growth possible. Other factors, such as improved roads and the purchase of additional land by developers, may also have played substantial roles in the disparate growth of the first neighborhoods to be settled. Regardless, it is evident that both the southern and northern shores continued to be popular throughout the early decades of the Twentieth Century.

The locations of the neighborhoods in the third quintile group indicate that, in addition to continued growth along the shoreline, there was also limited growth inland, away from the lake. These inland areas, although initially settled in roughly the same period as the neighborhoods in the first two quintiles, experienced continued growth for a much longer time. Again, degree of popularity may have been a factor in the rate of settlement of the neighborhoods in this group, particularly in the case of the inland neighborhoods. Lacking lake frontage, these would surely have been less popular than those with frontage on the shoreline, in spite of the fact that they were less expensive.

An equally important factor, which encouraged continued expansion, is the degree of density in these neighborhoods. As a comparison of the maps of density
and age will demonstrate, all of the neighborhoods in the third quintile group exhibit either low or moderate densities. Thus, while lack of popularity may have been the reason for the low densities, the low densities themselves allowed continued expansion throughout the entire time span covered by the survey, resulting in a later mean age in spite of early initial settlement.

The fourth quintile group consists of four neighborhoods, three of which are located on the west side of the lake and the fourth on the eastern shore. Although initial settlement of all of these took place prior to 1945, they experienced increased growth during the 1960's and 1970's, which accounts for the late average age. The predominance of expansion on the west side of the lake is due to an increasing orientation toward Kalamazoo, as well as to the availability of lake frontage in that area.

The fifth quintile group is composed of only three neighborhoods, all of which are on the west side of the lake and possess no frontage on Gull Lake. Although one of them was settled sparingly early in the century, almost all of the population growth in these areas took place in the late 1960's and early 1970's, making them the most recently settled neighborhoods in the area. Again, they represent an orientation toward Kalamazoo, suggesting that the majority of new residents originated
from that direction and perhaps retain their dependence on that city.

An analysis of settlement density by neighborhood

The varied growth rates and variations in locational preference have resulted in a wide range of building densities in the Gull Lake Neighborhoods (Figure 8). As the map of dwelling density illustrates, there is a marked concentration of quintile groups three, four, and five along the southern shoreline (Micro-region I). This area, with an average density of 1.92 houses per acre, contains all of the high density neighborhoods in the community.

In contrast, Micro-regions II and III are composed almost entirely of neighborhoods with densities of less than two houses per acre (quintiles one and two). The average dwelling density in Micro-region II is 0.80 houses per acre, while Micro-region III has an average density of 0.73 dwellings per acre.

The period in which the dwellings were constructed has apparently had a significant effect on dwelling densities, since the older neighborhoods (Micro-region I) exhibit much greater densities than those which were settled more recently. In fact, there is a positive correlation coefficient of 0.54 between age and density, indicating that the greater the age of a neighborhood's
FIGURE 8

DWELLING DENSITY 1973

HOUSES PER ACRE

- less than 1.0
- 1.0 to 1.9
- 2.0 to 2.9
- 3.0 to 3.9
- 4.0 to 4.9

Micro-region 3

Micro-region 2

Micro-region 1

1:40,740

0 1/2 1

Miles
The primary importance of dwelling age in influencing density has been its relationship to lot size. Many of the areas that were platted in the early years of the Twentieth Century were designed to bring the greatest profit to the developers (assuming a sufficient demand for the properties). Consequently, scores of undersized lots were platted, paving the way for dense settlement in neighborhoods such as Midland Park, Crescent Beach, Grand View, and several others along the southeastern shores (Figure 8).

Conversely, low densities are found in the newer neighborhoods where lots are large and homes widely-spaced. This is the result of affluence, the preference for greater space and privacy, and the enactment of building codes and zoning ordinances in an effort to prohibit crowding (see Chapter V for discussion of zoning regulations).

The newer areas are not the sole possessors of low densities, however. Several of the older neighborhoods at the north end of the lake are characterized by spacious lots and luxurious homes. It is possible that the lots in that area were left large in anticipation that a few expensive lots sold to wealthy people would be just as profitable as a multitude of smaller (and cheaper)
### TABLE 4

**SIMPLE CORRELATION COEFFICIENTS**

**SHOWING THE RELATIONSHIP BETWEEN DWELLING CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Dwelling Characteristic</th>
<th>Dwelling Characteristics and Correlation Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age</td>
</tr>
<tr>
<td>AGE</td>
<td>-</td>
</tr>
<tr>
<td>DENSITY</td>
<td>0.54</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.33</td>
</tr>
<tr>
<td>STATE OF REPAIR</td>
<td>0.66</td>
</tr>
</tbody>
</table>

Source: Compiled by author.

*See Appendix, Part 2.*

lots. And perhaps the wealthy landowners were influential in maintaining their privacy and land values. In any case, most of the neighborhoods along the northern shores exhibit very low densities, in contrast to the high densities along the southern shores (Figure 8). Thus, although the northern and western neighborhoods have gained a large number of homes in recent years, they have demonstrated that growth and crowding no longer go hand in hand.

The size distribution of the dwellings

In the determination of dwelling size, each house
was categorized on the basis of the number of rooms it contained (Table 2). Means for each neighborhood were computed, divided into quintiles, and mapped accordingly (Figure 9). As was the case with the age means, the size means are based on the categories in the classification scheme. Thus, on the categorical scale of one to three, a mean of 1.75 indicates that the houses in a particular neighborhood, on the average, contain six or seven rooms (see Table 2).

The map of the neighborhoods according to mean dwelling size shows a concentration of the lower quintile groups along the southern shore, while the higher quintile groups (larger dwellings) predominate at the north end of the lake, in support of the model's predictions. The southeastern portion of the lakeshore, from Indian Point and La Belle Terrace to Fair Oaks (Micro-region I), is composed of neighborhoods in the three lowest quintile groups according to dwelling size. The average size of the dwellings in this micro-region is 1.67, or approximately five to six rooms.

Along the western shore, from Neighborhood #1 to Yorkville, is a group of subdivisions (Micro-region II) whose dwellings fall into quintile groups three and four, averaging 1.89 in size (approximately six to seven rooms). Finally, the entire northern portion of the area, from Gull Hills to Long Beach (Micro-region III) consists of
FIGURE 9

MEAN DWELLING SIZE
By
QUINTILE GROUP
Including
MICRO-REGIONS

NUMBER OF ROOMS

1 to 5
6
7
8
9 to 10

1: 40,740

0 1/2 1

Miles

1973
neighborhoods which are in quintiles three, four and five, with an average dwelling size of 1.95 (approximately seven rooms).

A comparison of the maps of size and density reveals that most of the smaller homes are found in high density neighborhoods. In fact, as Table 4 demonstrates, there is a negative correlation coefficient of -0.46 between dwelling size and density. Thus, the greater the density in a particular neighborhood, the smaller its dwellings are likely to be.

A brief comparison of these micro-regions with the age distribution shown in Figure 7 indicates that the homes in the newer neighborhoods are, generally speaking, larger than those in the older neighborhoods. There is a positive correlation coefficient of 0.33 between age and dwelling size (Table 4), suggesting that the more recent a dwelling's construction the larger it is likely to be. Although this is not a strong relationship, it is nonetheless significant, and easily lends itself to speculation as to the causal factors.

While there may be several reasons for the increase in dwelling size during the past several decades at Gull Lake, it is likely that the degree of residential seasonality has played an influential role. As was illustrated in Chapter II, most of the dwellings constructed at the lake during the late Nineteenth and early Twenti-
eth centuries were intended for use as summer cottages. Many of the lots in these early subdivisions were small and, since indoor living space was not a crucial factor, a great number of four- and five-room cottages were constructed.

As the lakeshore's metamorphosis into a dormitory community took place, the corresponding decrease in seasonality created a need for more year-around indoor living space. Thus, the size of new homes increased and many older cottages were insulated and expanded to prepare them for year-around use. It is evident, then, that the data continue to support the hypothesis that, like similar lakeshore resorts elsewhere, the Gull Lake area has metamorphosed into a thriving dormitory community.

The distribution of the dwellings according to state of repair

The state of repair of the dwellings in the Gull Lake community also reflects the influence of historical factors. This influence, however, is indirect; it stems from the aforementioned direct effect of historical events on dwelling age, size, and density.

Prior to measuring the degree of importance of each of these factors (age, size, and density) on the present state of repair of the dwellings, the mean states of repair in each neighborhood were grouped into sextiles
and mapped accordingly. The range of values in each sextile and the resultant spatial distribution of the neighborhoods can be seen in Figure 10. As was the case with age and size of houses, the state of repair means are based on the categories in the classification scheme and, therefore, have a possible range of values of from one (best) to eleven (worst) (see Table 2). Sextiles, rather than quintiles, were chosen because of the wide range of mean values.

Figure 10 shows that, in general agreement with the model's predictions, the highest states of repair are in the northern neighborhoods, and the lowest are in the southeastern ones, with those on the west exhibiting intermediate values. Micro-region I is composed primarily of dwellings from the three highest quintile groups. The average state of repair of the dwellings in this area is 4.72 (on the scale of one to eleven).

In Micro-region II, along the western shore, quintiles two, three and four predominate, and the average state of repair for the dwellings in this area is 3.59. Finally, the entire northern portion of the area, Micro-region III, consists chiefly of neighborhoods which are in quintiles one, two and three. The average state of repair of the dwellings in this northern micro-region is 2.95.

A comparison of the size and state of repair maps
FIGURE 10

MEAN STATE OF REPAIR of DWELLINGS
By
SEXTILE GROUP

Micro-region 3

Micro-region 2

1973

STATE OF REPAIR

1 to 2
3
4
5
6
7 to 11

1: 40,740

0 1/2 1

Miles
(Figures 8 and 10) indicates that many of the neighborhoods with high concentrations of small dwellings have poor states of repair. This is particularly noticeable in Micro-region I. The simple correlation coefficient of 0.72 between these two factors reveals a strong relationship. Although it can not be proven that this is a cause and effect relationship, it is evident that the larger homes are in better condition than are the smaller dwellings.

The average state of repair of the dwellings in each neighborhood also appears to be directly related to dwelling age. A comparison of Figures 7 and 10 shows that the older neighborhoods, in general, have a poorer mean state of repair, while the reverse is true of the newer neighborhoods. In fact, there is a positive correlation coefficient of 0.66 between age and state of repair (Table 4), indicating that the older the dwelling, the worse its condition is likely to be.

Of the several possible reasons for such a high degree of correlation, one of the most likely is that the older homes have simply had more time to deteriorate than the newer dwellings have. However, it is probable that poor materials and methods were used in the construction of the early dwellings since they were summer cottages, increasing the rate at which they deteriorated. In addition, the older a home gets, the more serious the defects
and the more costly repairs are. Thus major repairs may be prohibited by a lack of economic resources on the part of some of the community's residents.

Seasonality may also exert an influence on dwelling maintenance. Summer homes are frequently neglected throughout the winter months and, when summer arrives, their owners are more concerned with "getting away from it all" than with the repair and upkeep of their cottages.

Finally, there is a positive correlation coefficient of 0.61 between the state of repair of the dwellings and the density of settlement (Table 4). Thus, the more densely settled a neighborhood, the less well maintained are its dwellings. The close relationship between density and age suggests that the economic resources of the residents, seasonality, and dwelling age are the causal factors here, as has already been hypothesized. Density itself would probably have little influence if the homes were new and property values high.

Since the correlation coefficients only measure the degree of covariation of the variables and do not measure the extent to which any one variable is dependent upon the others, it is necessary to carry the correlations one step further. In this study, two or more variables appear to have an influence on a single dependent variable. Thus, the combined effect of the independent
variables must be measured as a unit. The resultant coefficient of multiple regression indicates the degree to which the independent variables have jointly influenced the dependent variable. It must be remembered that the coefficients of multiple regression merely indicate apparent influence; they cannot be interpreted as proving causation between the dependent and independent variables.

Three multiple regression coefficients were calculated for this portion of the study. The first of these measured the degree to which average age, size, and density of the dwellings in each neighborhood influenced their state of repair. The resultant coefficient of multiple regression was 0.87, indicating a high degree of correlation (Appendix, Part 3). The coefficients of partial correlation were: age, -0.45; size, +0.46; and density, -0.16, indicating that age and size were significant influential factors, while density apparently had little effect. This was not unexpected since, as was mentioned previously, the high degree of correlation between density and state of repair is probably spurious.

The residuals from regression were ranked, divided into quintiles, and mapped accordingly. All but eleven fell within the expected range and, as Figure 11 indicates, the neighborhoods which deviated from the expected range (shaded area on the map) are concentrated at the
FIGURE 11

RESIDUALS From REGRESSION of
STATE of REPAIR
on
AGE, SIZE,
and DENSITY
By QUINTILE GROUP

Coefficient of Multiple Regression: 0.87

RESIDUALS
1 -1.25 to -0.60
2 -0.59 to -0.40
3 -0.39 to 0.00
4 0.00 to 0.59
5 0.60 to 1.60

Shading Indicates Unexpected Deviation from the Mean
southern end of the lake.

While the reasons for these deviations are unknown, there are several possibilities. First, the unexpected positive deviations (state of repair higher than expected) in some areas may indicate that many of the homes have been remodeled, giving them a better state of repair than would be expected of homes in their age categories. In addition, Yorkville and the two inland neighborhoods are composed of homes from a variety of age groups and it appears that such neighborhoods have an unusually good state of repair relative to age and size. In contrast, the deviant neighborhoods in the lowest quintile groups may represent areas where there is a higher concentration of seasonal homes. Or they may represent neighborhoods whose residents are unwilling, or financially unable, to maintain their homes properly.

The second regression analysis measured the degree to which the average age and size of the dwellings influenced the density of settlement. The resultant coefficient of 0.60 indicates a strong relationship between these variables although, as the coefficients of partial correlation indicate, the age factor was unquestionably the stronger of the two. The size coefficient of -0.26 is not particularly significant, although it does indicate a negative relationship, as expected. Thus, as dwelling size increases, density decreases. The age
coefficient of +0.45 indicates that age has a relatively strong degree of influence on the density of settlement. Accordingly, an increase in dwelling age was frequently accompanied by an increase in density. This, too, was expected and supports the results of the simple correlation analysis.

The residuals from regression were mapped according to the same format used previously (Figure 12). As the map indicates, there is a concentration of the positive residuals in the southeastern portion of the community, while most of the negative residuals are located on the north and west. This may be due to the subdivision of some of the original plats at a later date, causing a high density in relation to the average age of the dwellings. The one positive deviant on the north shore is a very small, secluded neighborhood, composed of large, well-maintained and relatively new homes, making it an exception to the general rule.

The three unexpectedly negative-residual neighborhoods are composed of two areas of somewhat dispersed dwellings of varied size and age, and a third area of very large but old homes with spacious, secluded lots - clearly another exception to the rule and not indicative of any trends. However, it should be noted that the neighborhoods with higher than expected densities are concentrated on the southeastern shoreline, while those
RESIDUALS From REGRESSION of DENSITY on AGE and SIZE By QUINTILE GROUP

FIGURE 12

RESIDUALS

-1.55 to -0.60
-0.59 to -0.30
-0.29 to 0.19
0.20 to 0.69
0.70 to 1.90

Shading Indicates Unexpected Deviation from the Mean

Coefficient of Multiple Regression: 0.60

1: 40,740

1 2 3 4 5

0 1/2 1 Miles

1973
with unexpectedly low densities are located on the north and west.

Finally, the degree to which age and density influence dwelling size was measured, with a resultant coefficient of 0.47. This indicates that age and density have a moderate, but still significant, influence on the size of dwellings in the community. The partial correlation coefficient for age was -0.22 and that for density was -0.31. Thus, an increase in age and density was frequently accompanied by a decrease in dwelling size. Again, the coefficients of simple correlation suggested that this might be the case.

The residuals were mapped and twenty-five of the thirty-nine were found to deviate beyond the expected range. As Figure 13 indicates, these deviations are well-distributed around the lake, although there is a slight concentration in the southeastern portion of the area. The large number of deviations is partially due to the weakness of the correlation. However, it also indicates that a variety of dwelling sizes were constructed throughout the entire period of the community's development. As a result, the older homes are not necessarily smaller, even though they may be located in high-density neighborhoods. In addition, some of the newer neighborhoods exhibit very large lots and low densities, but the dwellings are of medium size (Quintile 3, Figure 9). This has
FIGURE 13

RESIDUALS From REGRESSION of SIZE on AGE and DENSITY By QUINTILE GROUP

Coefficient of Multiple Regression: 0.47

RESIDUALS

1  -1.00 to -0.25
2  -0.24 to  0.00
3   0.00 to  0.14
4  0.15 to  0.29
5  0.30 to  1.00

Shading Indicates Unexpected Deviation from the Mean

1: 40,740

0  1/2  1

Miles

1973
resulted in smaller than expected homes in some of the newer neighborhoods.

* * *

It is evident that the development of the Gull Lake community, traced through a study of dwelling characteristics, has adhered closely to the sequences outlined in Chapter I and has supported many of the model's predictions. In addition, it has been shown that this development has had a great impact on the character of the present community.

The age, size, and state of repair characteristics of the dwellings have revealed several patterns concerning the community's development. When combined, these patterns yield the following description of the present community:

1) The southern and eastern neighborhoods, where settlement originated, are composed of predominantly older, smaller homes. These dwellings, many of which were resort cottages in the early years of this century, are spaced closely together on small lots. The dwellings in several of these neighborhoods are poorly maintained and, as a result, the neighborhoods are beginning to suffer from "urban" blight.

2) The northern neighborhoods, some of which were settled more recently, are composed of larger homes which vary substantially in age. While a number of these
dwellings were once summer cottages, the majority were built to serve as year-around homes. These neighborhoods have lower settlement densities and exhibit a much better level of home maintenance than those on the southeastern shore.

3) The neighborhoods on the west side of the lake contain the newest homes in the community. Often located inland, away from the lakeshore, none of these dwellings are remnants of the resort era. These western neighborhoods, with large lots, low densities, and well-maintained homes, were constructed in recent years to serve as residential "suburbs."

The present community of permanent residents has no industry and only a few business establishments. It is a dormitory community whose residents commute to Battle Creek, Kalamazoo, and other neighboring towns for employment and/or goods and services.

The heterogeneous nature of the present community indicates that its function has changed a great deal since its beginning as a resort. Variations in density, state of repair, and in the size and style of dwellings, reveal that diverse historical factors played vital roles in the community's development. Unfortunately, planning was not one of these factors and, as a result, the community is encountering serious problems. These problems, and proposed solutions, will be discussed in the following chapter.
The lakeshore dormitory community at Gull Lake is a unique form of rural-nonfarm settlement. While it has experienced many of the developmental phases that are characteristic of the entire rural-nonfarm group, its development has also been influenced by factors which are confined to lakeshore settlements. In this respect, it exemplifies the typical lakeshore-oriented bedroom community outlined in the model.

It is evident from the preceding chapters that the development of the Gull Lake area has had far-reaching effects on the present form and function of the community. Additionally, as Chapter I suggests, this uncontrolled and unguided development has led to the untimely deterioration of the physical and cultural environments of many lakeshore communities. Gull Lake, it will be seen, is no exception. In fact, it exhibits many of the typical problems resulting from over-development without foresight and planning.

Current Environmental Problems in the Community

The growth of the Gull Lake community and resultant "urbanization" of the lakeshore have had serious detri-
mental effects on the area's environment. The high settlement densities and deterioration of housing in several neighborhoods have already been mentioned as contributing to poor living conditions in certain portions of the community. An even more serious problem, however, is the accelerated eutrophication of the lake due to the introduction of domestic effluents. These effluents, containing high percentages of nitrogen, phosphorus, and a number of other plant nutrients derived from lawn fertilizers and septic tanks, bear the primary responsibility for the advanced deterioration of the lake. They have induced the growth of microscopical organisms in the water which, in turn, limit light penetration, decrease photosynthesis, and reduce the oxygen supply below the surface (Tague and Lauff, 1973).

For both the lake and the community, the results may be devastating if nutrient input remains uncontrolled. The fish population is already being affected by changes in oxygen levels, the appearance of the water is being spoiled by unsightly algae blooms and weed growth along the shore, and swimming may have to be curtailed if the water becomes infested by "swimmers' itch" (Tague and Lauff, 1973).

In Gull Lake, phosphorus has been the primary catalyst responsible for the increased rate of eutrophication in the past few decades. The uncontrolled flow of
phosphorus into the lake has led to an increase in the number of algae and zooplankton suspended in the water. The result has been a decrease in the water's transparency from fifteen feet in 1941 to five feet in 1972 (Tague and Lauff, 1973). High levels of phosphorus input have also caused "blooms" of blue-green algae to appear during the summer months, in the form of an obnoxious green scum on the water's surface. These blooms limit light penetration to the water's depths, thus curtailing photosynthesis and causing rapid oxygen depletion in the poorly-lighted waters below.

The over-fertilization of lawns during the summer months has contributed substantially to the flow of nutrients into Gull Lake. Not only do the excess nutrients pollute the lake by draining into the ground water, but they also prevent the nutrient-saturated soil from absorbing phosphorus from septic system drain fields. Thus, the excessive use of lawn fertilizers compounds an already serious problem -- the seepage of phosphorus and other nutrients from domestic sewage systems into the lake via ground water flow (Tague and Lauff, 1973).

The community's metamorphosis from a summer resort into a year-around settlement was accompanied by the installation of modern bathroom and laundry facilities in existing dwellings, as well as in those built more recently. This, in addition to the simultaneous intro-
duction of lawn fertilization, has resulted in the mod-
ification of the lake's environment in response to the
increased nutrient input from these sources. Thus,
eutrophication has been greatly accelerated in Gull Lake
and will ultimately destroy it if nutrient input is not
brought under control.

The Future: A Search For Solutions

As the urbanization of the Gull Lake community has
increased in recent years, the drainage of nutrients from
septic systems and lawn fertilizers into the lake has
become an increasingly serious problem. Since continued
population growth in the community is virtually inevi-
table, it is necessary that steps be taken immediately
to stem the flow of nutrients into the lake.

The probability of continued population growth is
suggested by Kalamazoo County's 1990 Land Use Plan,
which shows a sizable increase in the land area devoted
to residential use (Kalamazoo Metropolitan County Plan-
ing Commission, 1969). Even though the rate of growth
may decline due to the scarcity of lakefront property,
it is estimated that the population of the area in 1985
will be approximately 6,000 persons — nearly double the
While densities in existing neighborhoods will probably
not increase, the increase in the amount of nutrients
seeping into the lake as a result of population growth would hasten the lake's already imminent death.

The reduction of nutrient input from lawn fertilizers is relatively simple, since it requires only the voluntary limitation of fertilizer usage by the residents. The reduction of septic system runoff is a much more complicated problem, however, because it can only be effectively solved by the construction of a public sewage disposal system.

With this realization in mind, a water supply and sewer system was designed by Ayres, Norris, Lewis and May at the request of Kalamazoo County's Department of Public Improvements (now the Department of Public Works). The proposed system would provide the entire community with a safe water supply and with sewage disposal and treatment facilities. Unfortunately, the initial expenditure of nearly three million dollars, at a cost of approximately five hundred dollars per customer, has to date been deemed prohibitive by the residents.

The residents, however, have formed several organizations in an effort to promote the implementation of the water and sewer system. The recently-formed Gull Lake Pollution Control Committee is soliciting contributions from the community's residents for the Ross Township Sewer Fund. The funds received will be used to sponsor a detailed study of the engineering feasibility and costs
involved in the construction of a sewage disposal system. Following the completion of the feasibility study, the Gull Lake Pollution Control Committee will petition the Michigan Department of Natural Resources to match whatever federal funds may be allocated with an equal sum from the state's coffers.

Another group which has been active in getting support for the sewer system is the Gull Lake Quality Organization. It is composed of one representative from each neighborhood and its primary function is the dissemination of information on the state of eutrophication in the lake.

In addition to the construction of a water and sewer system to inhibit eutrophication of the lake, there are a variety of other measures which can be taken to preserve the quality of the community's environment. A brief list includes: land use control and planning, education and information dispersal, research in environmental and community affairs, control of nuisance weed and algae growth in the lake, control of lake levels, the construction of public access sites, the preservation of natural beauty and open space, lake renewal and restoration, and watershed management and regional planning (Fulton & Say, 1971). While some of these factors are beyond the community's control, the majority involve practical measures which would be most effective if undertaken on the com-
The residents of the Gull Lake community have been highly responsive to the need for inhibiting the pollution and eutrophication of the lake. They have already taken many of the steps outlined above, including the dissemination of information and education of the residents via public meetings. The residents have also worked cooperatively with researchers at the Michigan State University Biological Station (located on the eastern shore of the lake) in their data collection and publication programs.

Action to protect and preserve the area's environment has also been forthcoming on the township and county levels. As noted previously, the proposed water and sewer system was designed at the request of Kalamazoo County's Department of Public Improvements. In addition, the Kalamazoo Metropolitan County Planning Commission, in its Comprehensive Planning Program, has prepared a long-range plan for the development of the entire county (Schellie Associates, 1965). Hopefully, this will provide the necessary guidance which has been lacking in the past.

On the township level, the major action to date has been in the area of land use zoning and building restrictions. Zoning ordinances for both Ross and Richland townships were established in 1955 and 1957 respectively.
The primary impact of these upon the Gull Lake community has been in the prevention of further residential crowding and in the restriction of land use and construction types in the residential areas.

In an effort to prevent over-crowding, Ross Township requires a set-back (the distance from house to street) of at least twenty-five feet on both lakefront and non-lakefront property (Ross Township Zoning Ordinance, Sec. 13, 1955). In addition, a sideline distance of not less than five feet is required for non-lakefront property. The area requirements of the ordinance specify that dwellings can occupy no more than twenty-five per cent of their lots, and lots must be at least one-quarter acre in size (Sec. 14, 1955). Thus, small lots and high densities will no longer be allowed to occur.

Richland Township has enacted similar, although stricter, ordinances. A set-back of at least fifty feet is required for all new dwellings and sideline distances must be at least twenty feet (Richland Township Zoning Ordinance, Sec. 17, 1957). With respect to area requirements, the twenty-five-percent-one-quarter-acre restriction initiated in Ross Township also holds true in Richland Township (Sec. 18, 20, 1957). In addition to controlling land use and construction, Richland Township prohibits the maintenance or establishment of any "publicly owned or operated boat launching site, fishing
site, recreation area, park or playground which has facilities for boat launching" (Sec. 20, 1957).

Although steps are being taken to slow further eutrophication of the lake and to control land use and development, there is also a need for the preservation and restoration of the community's other aesthetic resources. In a community with several crowded, deteriorating neighborhoods, the necessity for preserving natural beauty and open space cannot be over-emphasized.

While most of the steps that have been taken to date have been necessary and valid ones, a great many changes still need to be made. If the lake and the community are to be rejuvenated, drastic measures are called for. It is apparent that, if this goal is to be accomplished, changes must be made not only in the physical characteristics of the community, but in the thinking of the residents and government officials, as well.

One measure that would help improve the aesthetic environment is the strict enforcement of building codes. There has apparently been a lack of enforcement in the past, which has contributed significantly to the present level of deterioration in several neighborhoods. Increased vigilance on the part of township authorities and/or the addition of enforcement personnel could vastly improve the quality of the community's environment.

Zoning regulations, although well-intended, should
be revised to keep pace with future growth. The limitation of residential structures to single-family dwellings is no longer practical in light of the area's projected population growth. In addition to single-family homes, plans should be made for the development of multiple-family units of varying densities. In this way, the additional population can be accommodated without permitting unsightly urban sprawl to do further damage to the community's aesthetic environment. Once the sewage disposal system is installed, the increased densities would not pose a threat to the lake or the community.

Rezoning is also advisable with respect to public parks and open space. Although there are currently two public parks on the lakeshore, they will become grossly inadequate if the community's development continues on the projected course. The existence of several neighborhoods with run-down and dilapidated dwellings, when coupled with a need for more open space, suggests that the community could benefit doubly from a land acquisition and urban renewal program. If undertaken on the township or county level, such a program would remove undesirable structures and replace them with public parks or open areas. Thus, not only the immediate community, but the entire tri-county area (Kalamazoo, Barry, and Calhoun counties) would have access to the lake and its amenities.
Public access to the lake may become a key factor in future development of the Gull Lake community. The era of the privately-owned lakeshore is rapidly becoming anachronous. At a time when the future of the lake has become a public issue via requests for government funds, one wonders how much longer the public can be denied access to the lake's amenities. Public parks, picnic areas, and boat-launching facilities would make the lake available to a larger number of people – both residents and nonresidents. With caution, planning, and regulation, this could be accomplished without endangering the quality of the lakeshore environment.

It is apparent that all plans for the renewal of the Gull Lake community's environment hinge on the construction of the water and sewage disposal system. Without this, any efforts to preserve the community's aesthetic environment are superfluous. The estimated cost per dwelling of $500 (1964 figure) is not out of line when compared with construction costs in similar locations elsewhere. In the Haslett-Lake Lansing area northeast of Lansing, the cost of a connection with the sewer and water system is $1,700 per dwelling (Meridian Township Engineering Department, 1974). In the long run, the expense would most likely be off-set by the resulting increase in property values. Since the future of the lake and the community depends on the construction of
the sewage disposal system, it is imperative that construc-
tion begin soon, regardless of the expense. The fu-
ture of the lake will have to be given priority over mo-
netary considerations, particularly if government funds
are not forthcoming.

Thus, the last stage outlined in the model - one
which is marked by environmental deterioration - is
exemplified by the Gull Lake community. Having experi-
enced periods of discovery and growth, the community is
now faced with the results of exploitation and a lack of
planning during these periods. With immediate decisive
action, the deterioration of the lake and the community
can be halted, and a period of rejuvenation can begin.
If environmental renewal is undertaken by enough commu-
nities, a new chapter can be added to the life-cycle of
the model lakeshore dormitory community.
BIBLIOGRAPHY


Gull Lake, Michigan. *An Ideal Place for a Summer Vacation. A Place to Own a Summer Home*. Augusta, Mich.: C. E. Cleveland, 1904.


Richland Township Zoning Ordinance. Richland Township, Kalamazoo County, Michigan, 1957.


APPENDIX

PART I - The Areal Mean (Hart, 1955):

The Areal Means were calculated according to the following formula:

\[
\bar{y} = \frac{\sum y_i z_i}{\sum z_i} \quad \text{and} \quad x = \frac{\sum x_i z_i}{\sum z_i}
\]

where:  
- \( x \) = longitudinal cartesian co-ordinate  
- \( y \) = latitudinal cartesian co-ordinate  
- \( z \) = magnitude of variable at location \( i \)

A one-inch grid was placed over a map of the dwellings which were in existence during each time period, establishing a system of horizontal and vertical tiers. There were five such maps (one for each time period) and five Areal Means were calculated.

The total number of homes in each horizontal tier was computed and multiplied by the number of the tier, resulting in a Tier Moment. The sum of Tier Moments was subsequently divided by the total number of dwellings on the map, resulting in a horizontal areal mean.

The same procedure was subsequently followed in determining the vertical areal mean for each map (time period). The final areal mean was then located at the intersection of the two individual means. Since this procedure was used for each time period, the areal means reflect the migration of the center of settlement from one period to the next.
PART II - Simple Correlation Coefficient (King, 1969):

\[ R = \frac{\sum xy}{\sum x^2 \cdot \sum y^2} \]

PART III - Multiple Correlation Coefficient (King, 1969):

\[ R = \frac{\sum y^2}{\sum x_1^2} + \frac{\sum y^2}{\sum x_2^2} \ldots \]

Where: \( \sum y^2 \) = sum of squares for regression

Partial Correlation Coefficient (King, 1969):

\[ R_{ij,k} = \frac{R_{ij} - (R_{ik} R_{jk})}{(1-R_{ik}^2) \cdot (1-R_{jk}^2)} \]

Regression Residuals (King, 1969):

\[ y - y_c \]

where: \( y \) = observations

\( y_c \) = computed from the regression equation