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A Study of the Growth and Decline of North Dakota Towns, 1920-1970

Christopher Troseth

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A STUDY OF THE GROWTH AND DECLINE OF NORTH
DAKOTA TOWNS, 1920-1970

by
Christopher Troseth

Bachelor of Arts, North Dakota State University, 1968

A Thesis
Submitted to the Graduate Faculty
of the
University of North Dakota
in partial fulfillment of the requirements
for the degree of
Master of Arts

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This thesis submitted by Christopher Troseth in partial fulfillment of the requirements for the Degree of Master of Arts from the University of North Dakota is hereby approved by the Faculty Advisory Committee under whom the work has been done.

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This thesis meets the standards for appearance and conforms to the style and format requirements of the Graduate School of the University of North Dakota, and is hereby approved.

A. William Johnson
Dean of the Graduate School

Permission

Title A STUDY OF THE GROWTH AND DECLINE OF NORTH DAKOTA TOWNS, 1920-1970

Department Geography

Degree Master of Arts

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ABSTRACT

Differences in percentage population change among North Dakota incorporated places of 250 to 2,500 inhabitants for the period 1920-1970 were first explained statistically by means of spatial and economic variables. Additional insight concerning town population change was gained by a more detailed examination of selected towns, in which the number and type of business functions were stressed.

For each decade in the period 1920-1970, the relationship between percentage population change of towns with populations between 250 and 2,500 and four independent variables was measured by means of a stepwise multiple correlation and regression procedure. It was found that a positive relationship significant at the 5% level or better existed between population change of towns and distance to the nearest town of equal or larger population for the first four decades studied. Distance to the nearest urban center had a positive relationship to town population change in the 1920s and 1930s; a negative one in the 1950s and 1960s. Town population size was related to population change only during the two most recent decades. Change in value of farm land and buildings had a significant, positive relationship to population change during the 1920s and 1930s.

Additional variables tested included per capita retail sales tax receipts of towns, which were positively related to town population change in the 1950s and 1960s. Status as a county seat was

determined by Chi-square tests to have been related to population gain during the 1930s, 1940s, and 1950s. Although many significant relationships were found, the low degree of explanation provided by the variables (generally less than 20%) suggested that town population change is a complex phenomenon.

Case studies of four North Dakota towns were made in which the varying economic bases of the towns were stressed. Two of the towns, Maddock and Hunter, were found to be farm trade centers whose businesses and ultimately population were based on providing goods and services to the surrounding farm population. Beulah was shown to depend both on agriculture and on mining. Marmarth, a former railroad division point in an area with sparse farm population, lost most of its inhabitants because it had no economic base to replace the railroad.

CHAPTER I

INTRODUCTION

This study is an examination of the population changes which occurred in the small towns of North Dakota between 1920 and 1970 and an attempt to explain these changes both quantitatively, in terms of factors such as size, distance, and economic conditions, and by means of case studies of individual towns. Understanding of the forces which contributed to the growth or decline of these North Dakota places is an important part of understanding the geography of this region. Small towns contain about one-fourth of the state's population and almost all function as market places for the farmers who live nearby. Thus the majority of North Dakota people conduct their economic and social activities here.

In addition, this study may contribute to an understanding of towns in general. North Dakota conforms more nearly than most areas to the requisites of central place theory. Yet central place theory is static in its concepts; it does not allow for change with time. Many previous studies of population change have been confined to a single decade. The 50-year period utilized here covers a large part of the history of most North Dakota towns, and allows changing spatial relationships to become manifest.

Setting

North Dakota is often divided into three regions. The Red River Valley lies along the state's eastern border with Minnesota and is twenty to thirty miles wide in North Dakota. It is actually not a valley but the almost flat bottom of former glacial Lake Agassiz. Sugar beets and potatoes are grown and processed here, as well as sunflowers, pinto beans, and some small grains.

To the west, the Drift Prairie extends to the Missouri River. This is a land of low, rolling hills and numerous small lake-filled depressions, a legacy of recent glaciation. Small grains are the predominant crops in this region.

Beyond the Missouri River, in the southwestern part of the state, the landforms were not smoothed by the last glaciation. This is the area of greatest local relief in the state, containing the Badlands of the Little Missouri River. Cattle and sheep ranching are more important than crop farming here.

Most North Dakota towns share certain characteristics. Among them are age, size, and economic base. There were virtually no towns in the northern half of Dakota Territory until the arrival of the Northern Pacific railroad in the early 1870s. A possible exception is the settlement at Pembina, at the northeastern corner of the state. Conversely, almost no permanent settlements were established after 1920, following the cessation of railroad building.

Another shared characteristic of most North Dakota towns is their small size. By 1970 only fifteen of them had grown to urban size, i.e., a population of 2,500 or greater. At the other end of

the scale, few North Dakota towns have ceased to exist, at least if we limit this statement to places which at one time had a population of 250 or more. A notable exception is Omamee, in Bottineau County, whose population decreased from over 300 in 1910 to 5 in 1970.

In no state is agriculture a more important part of the economy than in North Dakota. Conversely, North Dakota employs few in the manufacturing industries, although food processing and the manufacture of farm equipment are locally important. Almost all North Dakota towns have been dependent on agriculture, serving as trade centers for the local farm population. Their well-being has fluctuated with the fortunes of the farmer. In some towns mining, manufacturing, or the railroads have also been important sources of employment.

Background

It was little more than a century ago that white settlers began to arrive in North Dakota in any appreciable numbers. The first railroad to reach the state (then the northern part of Dakota Territory) was the Northern Pacific, which crossed the Red River at Fargo in 1872. This transcontinental line was continued to Bismarck, on the Missouri River, in 1873, but financial difficulties delayed its completion across the state until after 1879.

A second transcontinental railroad, the Great Northern, was constructed across the northern part of the state in the 1880s. North Dakota's largest settlements subsequently developed along these two routes. With the exception of two places, not a single town in the state that was not located on one of these two lines has ever recorded a population of 3,000 or more. The two exceptions, Grafton and

Wahpeton in the Red River Valley, were also early centers of rail traffic, in addition to being county seats and sites of state institutions.

In the 1880s the railroad companies built several branch lines in, and just west of, the Red River Valley. These branch lines made settlement of the area possible during the first boom period. By 1890 the new state had a population of 191,000, over five times the number present in 1880. Townsites were laid out at intervals of five to ten miles along these early rail lines. Many became prosperous trade centers, for farmers needed an accessible place to market their crops and obtain supplies. Some townsites failed to develop and eventually disappeared under the grass or were plowed up.

Railroad building, and settlement, progressed westward across the state until about 1915. The region west of the Missouri River was the last to be served by branch lines, and has the lowest density of rail mileage. A statewide study of settlements cannot properly begin until 1920, for the reason that many of the towns were not founded until after 1910.

North Dakota recorded a population of 646,000 in 1920. Since then the total has remained within 6% of this figure. The composition has changed markedly, however. In 1920 only 13% of the population lived in places of over 2,500 and so was classified as urban. About one-quarter lived in towns of under 2,500 population; the majority lived on farms. By 1970 the urban share of the population had increased to 44%, and the farm population had decreased by about half. The total number of people living in towns remained fairly constant, although great changes in population occurred in some individual places.

In 1920 the dependence of towns on the railroads was great. While unimproved roads enabled farmers to travel a few miles into town and back, long-distance road transport was impossible. Almost no towns not served by a railroad developed. Over the next fifty years, however, dirt roads were replaced in turn by gravel and pavement. By 1970 trucks had taken over a large share of the business of supplying towns, and almost all state highways were hard surfaced. The improved road network, and the almost universal ownership of motor vehicles, enabled rural consumers to widen their shopping trips beyond the local community. This development affected the vitality, and eventually the size, of many small towns.

Format

The body of this study is comprised of three chapters. Chapter II is a literature review on the subject of small towns and population change. It includes works on the theory of central places, studies of central place systems in the United States, and analyses of rural population change in twentieth-century America. Central place studies provide a rationale for the selection of many of the independent variables used in this study. Previous studies of population change suggest that a long-term examination of the towns in an area might be profitable.

Chapter III is concerned with the analysis of data. A time span of 50 years is covered by the analysis. In this way the study differs from others on population change, which are often confined to a single decade. The year 1920 was chosen as a starting point; nearly all towns now existing in North Dakota had been established by then. Each decade is considered separately, so that any noteworthy changes

in the influence of the factors through time will be apparent.

The analysis is restricted to incorporated places having a population of at least 250 but less than 2,500 at any given census. It was thought that the dozen or so places in the state of urban size were affected by other factors besides those important to smaller places. There is a rather definite gap between the urban places of North Dakota and the smaller towns. Only two towns grew to urban size between 1920 and 1960, and neither had as many as 3,000 inhabitants in 1970.

A lower limit to the size of towns considered was also set. Many settlements in North Dakota have populations of less than 250. Some of them are incorporated, but a great many are not. Since census data are published only for incorporated places, it would be unwise to include incorporated places with fewer than 250 inhabitants in the analysis and omit those that were unincorporated. Data from the 1930 and 1940 censuses on rural non-farm population by townships revealed that few unincorporated places in the state had more than 250 inhabitants.

The principal method of data analysis used is multiple correlation and regression. In this procedure the values of the dependent variable, population change, and those of the independent variables are entered for each town. A calculation is then performed which determines (1) the degree of relationship existing between each independent variable and the dependent variable, (2) the probability that such a relationship is a chance result, (3) the percentage of the variation in the dependent variable which can be explained by variations in the independent variables, and the probability that this is a chance result, (4) an equation which expresses the value of the

the years 1920-1970, but extends from the town's founding, which invariably coincides with the arrival of the railroad, to the present.

CHAPTER II

LITERATURE REVIEW

Geographical literature important to this study may be divided into three categories. The first belongs to that branch of geography known as central place theory, which attempts to describe the distribution of settlements in an ideal landscape. A second consists of studies of actual settlement patterns and associated economic phenomena. In the third category are studies which emphasize population change in towns and its possible causes.

Each of these categories is important to this study. Central place theory provides insight into some of the forces which establish and maintain a system of different-sized towns. The studies of actual town systems confirm some of the theoretical expectations, but also tend to show how much more complex is reality. Together, these two types of study assist the researcher in the selection of suitable variables. Some previous studies of population change reveal methods of approach which have proved fruitful, while others warn against making unjustified assumptions.

Central Place Theory

A milestone work on the theory of central places, Christaller's Central Places in Southern Germany, first appeared in 1933 (Christaller 1966). To Christaller it was clear that economic factors were responsible for the establishment of towns and their subsequent growth or

decline. According to Christaller, a central place can be distinguished from any other location by the existence at that place of centrality. Centrality is related to the importance of a place, which is measured in terms of the total output of goods and services of the people living there. After one subtracts that part of a place's importance which represents what is necessary merely to supply its own population, a part remains, which is the importance of a place in relation to the area surrounding it, and constitutes that place's centrality.

Christaller then discussed central functions, which involve the provision of various goods and services that an individual is not generally able to furnish for himself, and therefore must purchase from another. These goods and services are provided by stores which are not scattered haphazardly over the countryside, but tend to be clustered in the business districts of communities. Smaller communities offer a small selection of goods and services when compared to larger ones, and the selection is much the same in communities of similar size.

Christaller next developed the concept of the complementary region, or the area for which a central place is the center. He admitted that it is difficult to determine its extent, because this varies with each good. Nevertheless, he considered the complementary region of a given center to remain relatively constant in size, because its dimensions are strongly influenced by the distance between a central place and others of similar or larger size.

One of the most important concepts introduced by Christaller was the range of a good, or the greatest distance a consumer is willing to travel to purchase that good. Beyond this distance a consumer will either not buy the good at all or, more likely, will purchase it from

a nearer central place. In addition to the range or upper limit to the distance people will travel to buy a good, there is a lower limit, a threshold, determined by the need to sell the product to at least a minimum number of people in order to make a profit. This may be viewed either as a minimum distance within which the requisite number of consumers lives, or as the number of consumers itself.

Utilizing the concept of the range of a good, Christaller developed his theoretical system of central place distribution, which is characterized by its interlocking networks of hexagonal trade areas of standardized sizes surrounding central places which are equidistant from their neighbors of similar size and at the same time nested in a hierarchy (Figure 1). The system begins with a supposed central place which Christaller designated B. Place B offers a good whose range is 21 kilometers, and is the only place in its region offering this good and others with smaller ranges. Supplying these other goods only from B, however, leaves a ring at the edge of B's region unsupplied with these goods, so it is necessary to have three smaller places, equidistant from each other, to supply them. Six more central places of B's size may be equally spaced on a ring around B. Then it is reasonable to suppose that the smaller places will be located at the centers of the triangles determined by the B places. These smaller K places can supply their regions with goods having ranges of at least 12 kilometers. For goods with still smaller ranges, Christaller envisaged two classes of smaller central places.

In turn, those goods with a large enough range require only one centrally located place to supply the B places around it, and

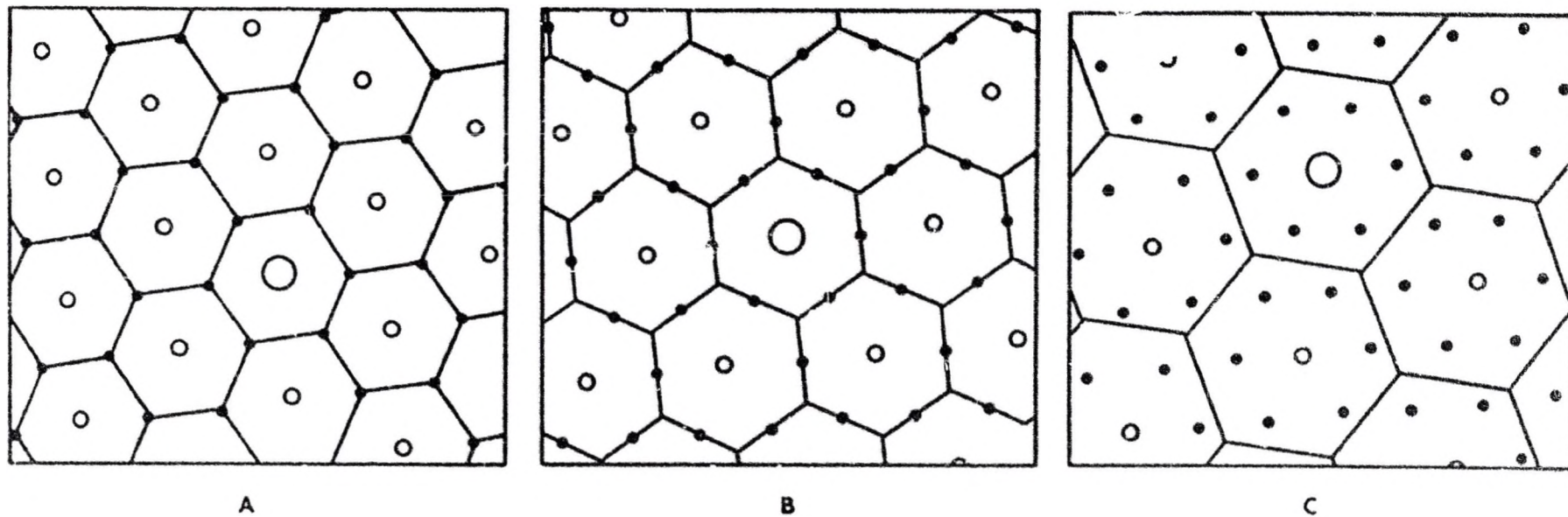


Fig. 1. Christaller's Central Place Systems.

Adapted from Christaller 1966.

Christaller provided for classes of larger central places, culminating in a single metropolis which would supply the entire country with goods of the highest order. Each central place in the system supplied not only those goods with ranges equivalent to its size class, but also all goods with smaller ranges.

Christaller realized that such a perfectly proportioned system of interlocking trade regions did not conform to reality. He recognized that factors such as population density, terrain, transportation facilities, and the presence of industry would influence the pattern of central place distribution.

This system of central places, in which there are three places of a given size for each one of the next larger size (Figure 1a), was based on what Christaller termed "the supplying or market principle." He gave it this name because "all parts of the region are supplied with all conceivable central goods from the minimum possible number of functioning central places" (Christaller 1966, p. 72).

Christaller also devised two other systems, which kept the hexagonal structure of town distribution. In one, as many places as possible were on the main transport routes between large centers (Figure 1b). The other required six smaller places for each one of a higher order, and placed them within rather than on the regional boundaries (Figure 1c).

Christaller realized that, while railroads favored the growth of centers, the greater flexibility and pervasiveness of the automobile would lead to decentralization. He also noted that certain factors could act as restraints to rapid change in the importance of a central

place. These included traditional patronage of certain businesses, adjustment by the inhabitants to changed economic conditions, and the ability of entrepreneurs to maintain a community spirit.

The next important work dealing with the theory of central places also appeared in Germany (Losch 1954). Losch emphasized the advantages of agglomeration as a basis for the formation of towns. These advantages would accrue to every aspect of the economy, from site, supply and production (economies of scale), to sales and consumption.

Although the factors favoring the formation of towns act in the beginning at every point in a region, they become fixed once the political center has been chosen and the routes of the chief roads located. While these may be placed in an arbitrary manner, the position of all additional settlements is then determined.

According to Losch, the development of a system of central places begins on a homogeneous plain, equally endowed in all parts with natural resources, and containing nothing but regularly distributed farms. Like Christaller, Losch believed the hexagon to be the most efficient shape for a market area, but he proceeded to elaborate the theoretical distribution of central places beyond the limits of Christaller's three systems. Since population is discontinuously distributed, whether viewed in terms of farms or of towns, Losch reasoned that the possible size of a market area also had discrete values. He discovered a whole series of market areas, all resembling the smallest possible area in having each settlement equidistant from the settlements surrounding it and in the boundary of the trade area forming a hexagon. The difference between large and small market

areas lay in the greater number of smaller settlements which were tributary to a single larger settlement in a large market area. The three smallest market areas are equivalent to those envisaged by Christaller (Figure 1).

Isard suggested that Losch's hexagonal trade areas be modified so that they decrease in size as one approaches the central city (Isard 1956, pp. 271 and 273). This reduction in size is necessary because greater population density near the central city enables a threshold population to be contained in a smaller area.

Kolb, an American sociologist, disagreed with Christaller's views on the form of trade areas in a hierarchy (Kolb and Brunner 1952, pp. 231-236). According to Kolb (Figure 2), a large center, designated C, has three concentric circular trade areas: a small one for primary goods, which Christaller would call goods of the lowest order, a larger one for secondary goods, and the third and largest for specialized goods.

Smaller B centers are located on the periphery of the C center's specialized trade area. While the equivalent trade areas of different-sized places were of equal area in Christaller's view, Kolb made them smaller for the B centers than for the C center, a result of the greater attraction exerted on consumers by the larger center's greater number of stores.

In turn, the smallest or A centers, which have only a primary trade area, exist on the peripheries of the B and C centers' secondary areas. Their primary trade areas are smaller than those of the B centers. As a result of their unfavorable position, the smaller centers tend to develop closer to one another than to larger centers.

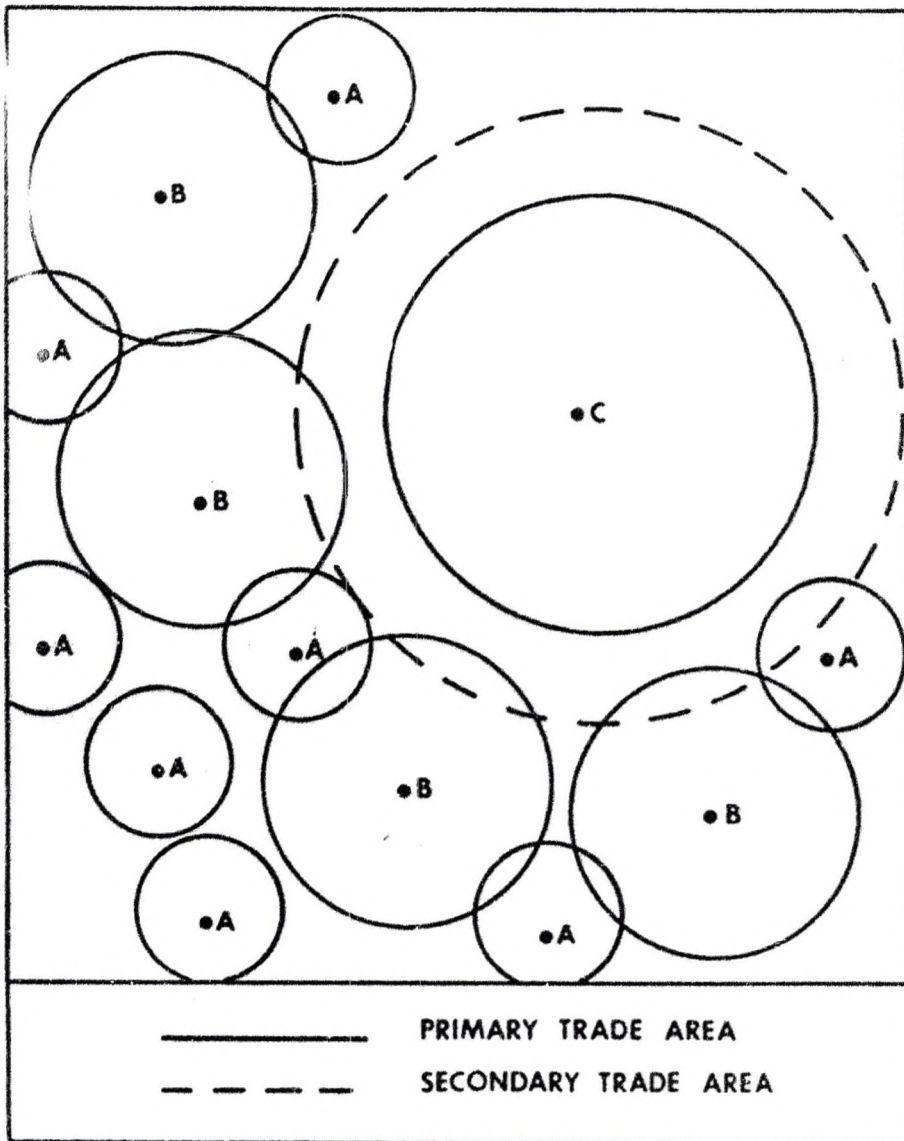


Fig. 2. Kolb's View of Trade Center Distribution.

Adapted from Brush 1953.

A less rigid theory was presented in "The Nature of Cities," by Harris and Ullmann (1945). The authors recognized three major types of cities, each with its own distribution pattern. These types included (1) central place cities, which tend to have an even distribution, (2) cities specializing in transportation and arranged in lines along transport routes, and (3) cities specializing in activities such as mining or manufacturing. Since cities of the last type often owe their existence to nearby resources, they may occur in clusters. By combining a possible distribution of these three city types, Harris and Ullmann achieved a pattern that resembled an actual distribution more closely than did the patterns developed by Christaller or Losch.

Studies of Actual Central Place Patterns

In the second part of Central Places in Southern Germany, Christaller attempted to delineate a hierarchical pattern of towns centered on Munich. As a criterion of centrality he used the number of telephones in a place, a practice not followed by later researchers. The usual procedure since Christaller's study has been to establish a scale of functions, beginning with those common even to the smallest hamlet and proceeding through those requiring ever greater threshold populations. An attempt is then made to define classes of town size based on differences in the number and type of functions and thus establish a hierarchy of central places.

A study by Brush (1953) is frequently referred to by geographers. The study area in southwestern Wisconsin consisted of six counties and parts of four others in a dairying region lying west of the American Manufacturing Belt. Brush found three classes of central places in

this area: hamlets, villages, and towns.

A hamlet had to contain at least five structures which were being used either as residences or for "commercial or cultural purposes." These structures must contain a total of at least one but no more than nine retail and service units, the word unit implying that more than one could be found under the same roof, as in a combination of grocery store and filling station. The criteria for a village required a number of specific functions in addition to the existence of at least ten retail and service units. Status as a town required a total of 50 retail units; at least 30 could not be taverns, filling stations, or grocery stores. Seven specific requirements included a bank, a weekly newspaper, a high school, a doctor, a dentist, a lawyer, and a veterinarian.

Brush found a total of 19 towns, 73 villages, and 142 hamlets in the study area. His criteria illustrate the difficulty of finding a logical classification of places by size which will divide the types clearly from one another.

Brush thought he found confirmation of Kolb's views in the spacing of the settlements. The average distance of hamlets from other hamlets was less than that from villages or towns. Villages grouped in rows or clusters were more common to one another than were villages and towns. The local tributary areas of towns, based on a study of traffic flows, were not equal to those of the villages but four times the expected size.

Having found a linear pattern of villages and towns, Brush attributed it to the influence of the railroads. The more scattered distribution of hamlets reflected their origin prior to the building

of railroads, when a dispersed farm population was served by wagon roads. Thus the pattern of settlements was based on the transport system of the late nineteenth century.

Two American geographers, Berry and Garrison (1958), made a determined effort to prove statistically that a hierarchy of central places did indeed exist, and not merely differentiation along a continuum. The study area of Snohomish County, Washington contained 33 central places.

Berry and Garrison constructed diagrams for each of 52 functions relating population (P) and number of stores (N). They next found the best fitting curves to satisfy the equation $P = A(B^N)$ and ranked the functions in order of the threshold population for one complete store, that is, the value of P where N would equal 1. Using these results, they were able to group the functions into seven classes by threshold population. The central places, in turn, were divided into three classes with differing groups of functions present. An analysis of variance demonstrated that significant differences existed between the groups, and the authors concluded that they had confirmed the existence of a hierarchy.

Stafford (1963) examined the trade functions of 31 sample towns of southern Illinois, ranging in population from 40 to 3,700 with an average of 552. When the population of the towns was compared with the number of business establishments and the number of functional units represented by them, very high positive coefficients of correlation were found, 0.929 and 0.934 respectively.

King (1961) studied the relation between the distance of 200 places in all parts of the United States from towns of similar size

and six population or economic factors. He hypothesized that distance between towns would be positively related to (1) their population and (2) the average size of farms in their area, but negatively related to (1) the density of rural farm population, (2) the total density of population, (3) the value per acre of agricultural land and buildings, and (4) the percentage of the employed population (by county) engaged in manufacturing.

King divided his sample of towns among five regions with different types of farming. For the extensive farming region, which consisted of "wheat and small grains" and "range livestock" farms and included North Dakota, the multiple coefficient of correlation was 0.81. Two of the six factors contributed significantly to this high correlation: town population and rural farm population density. Thus North Dakota, on the basis of these data, would seem to be one of the states where the spacing and size of towns are related, as central place theory insists they are.

A report by Borchert and Adams (1963) attempted to classify the towns of the Midwest and defined five classes of retail trade centers: hamlets, minimum convenience centers, full convenience centers, partial shopping centers, and complete shopping centers. Larger cities were distinguished on the basis of their wholesale trade functions.

To qualify as a hamlet, a place merely required trade functions which were listed in the January 1961 edition of the Reference Book of Dun and Bradstreet and a population of at least 50. This second requirement must have been relaxed, however, as the minimum population of the hamlets in North Dakota was 30.

A minimum convenience center had to have each of these six "essential" functions: service station, grocery store, hardware store, bank, eating or drinking place, and drugstore. In addition it had to have two or more of four supplemental functions. Full convenience centers, partial shopping centers, and complete shopping centers, in turn, were expected to provide an ever greater choice of specialized stores.

Borchert and Adams stressed the importance of both locational and non-locational factors in contributing to the vitality or decay of individual trade centers. In all parts of the Upper Midwest, trade centers which were within 20 to 25 miles of larger centers offering similar services were losing business to the larger place. Factors which could not be ascribed to the town's location included the aggressiveness of merchants and the presence of recreational facilities.

Borchert and Adams noted a large variation in the amount of farm income per trade center in the area. Those parts of North Dakota and South Dakota east of the Missouri River, where this amount was especially low, could be expected to experience disruption in the pattern of trade centers. The large number of farm trade centers, and of farms, when compared to the land's productive capacity was a relic from pioneer days which developed "largely because of a unique combination of rich soil and a climate prone to drought" (Borchert and Adams 1963, p. 12).

Relevance

The two types of studies discussed above show that certain variables may be helpful in explaining the population change of towns in North Dakota. These include some of the very factors which Christaller and others held to be constant and equal, such as size of place, distance

from similar-sized places, and distance from larger places. Since central place theorists have placed great importance upon these factors in the construction of their ideal landscapes, which are not subject to change, it may be that these same factors are of importance to an actual, dynamic collection of places

The assumption of a homogeneous landscape of equal productivity throughout, made in many theories of central place distribution, suggests that differences in actual productivity may be related to changes in the system. This study substitutes for productivity the value of farm land and buildings.

The role of towns as market places for the nearby farm population, both in theory and in actual systems, suggests that trade functions may be important in population change. Since reliable data could not be obtained to coincide with the five decades of this study, the number of trade functions exercised by a town is not included as an independent variable in chapter III but will be examined as part of the case studies of individual towns, which appear in chapter IV. Another measure of the economic vitality of towns might be the total volume of retail sales per capita generated by its businesses, as measured by sales-tax receipts. This variable is included in the analysis of data for the two decades it was available.

Studies of Village Population Change

Whether or not village populations are declining is a question which has sparked much controversy among rural sociologists. The first edition of Gillette's Rural Sociology contained a chapter on the "Declining Villages of America," indicating by its title what the

author saw the trend to be (Gillette 1922). He noted that the proportion of small places losing population had increased each decade from 1890 to 1920, and proceeded to paint a dismal picture of decaying buildings and dying communities.

By continually stressing the negative, Gillette distorted the true picture of village population change. While correctly noting that 40% of the villages of under 500 lost population between 1910 and 1920, he chose to ignore the obvious fact that almost 60% of them must have gained population. Gillette also ignored the amount of population loss; he made no distinction between a place losing 1% of its population and one losing 30%.

Gillette found several causes which could account for the decline of villages, including by-passing of villages by railroads; decline in the number of farms in areas of uncertain rainfall, such as the Great Plains, and consolidation of farms in rich agricultural areas, both resulting in fewer people to support the villages; and unequal competition between villages and larger places for the trade of farmers.

The pessimistic tone of Gillette was countered by Fry (1926) in a book in which the pertinent chapter was entitled "Are Village Populations Declining?" Fry noted that while the total population of the United States increased only 39% between 1900 and 1920, the population of villages had increased 41%. In the seven West North Central states village population increased 37%, the total population only 21%.

Fry also considered the population change of those villages which existed in 1900 and defined three categories on the basis of

the percentage change in population between 1900 and 1920. Those villages which had neither gained nor lost as much as 20% were considered to be stationary in population. Few of the villages were declining, as defined by Fry. In the West North Central states just under half of all villages were in the stationary category.

Brunner and Kolb (1933) took care to stress the positive side of village population change in a work on rural society. Thus they did not, as some earlier researchers had done, exclude towns which were urban at the time of the last census but had previously belonged to the rural category. Such exclusion would bias the findings by eliminating many growing villages. In fact, the authors noted that about 1,000 places had grown from rural to urban size between 1910 and 1930.

Brunner and Kolb used three measures of growth. The first was simply the percentage change in population of the 8,900 incorporated places of village size in 1910. In the United States, villages grew at a rate of 15%, nearly identical to that for the total population, in each of the decades 1910-1920 and 1920-1930.

An analysis like Fry's, using growth classes, was done for the period 1910-1930. Comparison with Fry's figures for 1900-1920 showed many fewer growing villages in the later period but also fewer that were declining. Most striking was the preponderance of villages with stationary populations, particularly in the West North Central states, where over three-fourths of villages with 250 to 1,000 inhabitants were in that category.

The third measure of growth utilized by Brunner and Kolb involved grouping the villages into size categories, such as 250-349.

The villages were next classified on the basis of change from one category to another. It was found that of the villages existing in 1910, almost 52% had moved up one or more categories by 1930. Almost 25% remained in the same category, and only 23% fell into lower categories.

Ratcliffe and Ratcliffe calculated the percentage of villages in three population classes which lost population during the two decades 1920-1930 and 1930-1940 (Ratcliffe and Ratcliffe 1932; Ratcliffe 1942). In all three classes nationwide the percentage was lower in the later decade. This reversed a trend which had been continuing since 1890.

Two brief articles by Brunner analyzed the population change of the 1940s (Brunner 1951; Brunner 1952). He considered only non-suburban places and recognized two size classes: 250-999 and 1,000-2,499. Brunner concluded that (1) there was more divergence in growth rates between large and small centers during the 1940s than in the previous decade because the influences of the Great Depression which had driven many farmers into the small towns had ceased to operate, and (2) population decline was associated with an increase in the size of farms if the change was great enough to lower farm population density.

Zelinsky (1962) made a study of rural population changes in the United States covering the entire period for which census returns were available. Of the 53 counties in North Dakota, nearly half had their greatest rural population in 1920 or earlier, including three counties, Pembina, Grand Forks, and Traill, which peaked in 1900. An additional 24 counties reached their maximum rural population in 1930, the year when the total state population was greatest. Only four counties showed later maxima: Rolette and Mercer in 1940; Cass and McLean

in 1950. These later maxima were due not to a growing number of farms but to the influence of the non-farm population.

Zelinsky attempted to classify the nation's counties by the historic pattern of their rural population level. He classified all but seven of North Dakota's counties as ones which had experienced a period of growth followed by a period of decline.

Four of the seven counties were of a type that had undergone growth followed by decline and then a period of relative stability. It is noteworthy that three of the four counties of this type were Williams, McKenzie, and Mountrail, whose towns had benefited from the discovery of oil in the 1950s.

Two counties, Grand Forks and Ward, were of a type in which a cycle of growth and decline had been followed by renewed growth. These were the counties where large Air Force bases were under construction by the time of the 1960 census. It was this activity that accounted for the "renewed growth" of the rural population there.

Gibbs' analysis of census data attempted to discover a series of stages in the relative population change of cities and countryside (Gibbs 1963). In his opinion, stages in the evolution of population concentration within each state could be distinguished. When cities first appeared, their population increase was less than that of the countryside. This period was followed by one in which the urban population increased faster than the rural. Later, an absolute decline in rural population occurred. Finally, the population of small cities also declined.

Gibbs' conclusions show the necessity of distinguishing between the populations of individual places and the total population of places

in a given size category. He noted that in North Dakota and several other states the population of small cities had declined before there was a drop in the rural population. Gibbs considered small cities to have populations between 2,500 and 5,000. Since the total population of cities in this size category was less in 1930 than in 1920 in North Dakota, he concluded that the population of small cities in North Dakota had undergone an absolute decline. In reality, all six of the North Dakota places of this size in 1920 grew during the next decade. Four of them grew out of that size category and so were not included in the 1930 total.

Fuguitt (1965) approached small town population change by considering the likelihood that towns in a given size category would remain in that category from one census to the next, or move into either larger or smaller categories. He found that for towns in Wisconsin from 1880 to 1960 there was a shift of places toward the larger size categories in each decade. Thus the decline in the number of small towns in Wisconsin was a result of population growth, not loss.

Hart and Salisbury (1965) examined population change of incorporated places under 1,000 population in the nine states of Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, Kentucky, and Ohio. Of 3,697 villages in this area, nearly 30% gained in population by 10% or more between 1950 and 1960; only 24% lost population by that amount. Only among the smallest villages were there more losses than gains.

The relationship was tested between village population change and (1) village population size and (2) the road distance from the village to the nearest city of 25,000 or larger. It had been noticed

that the areas of village growth showed a "striking congruency" to areas that were within 25 miles of such a city. While variations in population size explained only 8% of the variation in population change, population size and distance from the nearest city combined could explain 22% of the variation.

Hart and Salisbury also examined long-term population change in a sample of 400 villages, which they divided into four groups on the basis of their population in 1960. Villages of 500 or more population showed a pattern of almost continuous growth since 1890, and villages of 250 to 499 population had been very stable in terms of their average population. Only those villages with fewer than 250 inhabitants in 1960 had shown a steady decline.

Hassinger (1956) made use of the distance factor to explain differential population change among 351 incorporated trade centers in southern Minnesota. He chose to dichotomize the data and use Chi-square tests to determine significant relationships. Of the places in his study area, 306 had populations of under 2,000 in 1940. Slightly more than half of these had population increases of 5% or more during the 1940s; therefore the towns were divided into categories with this level of population change forming the boundary.

A second division was based on distance of the towns from a larger center, defined as one with a 1940 population of 2,000 or more. Those towns which were less than ten miles from a center of 2,000 or more were in one category, those more than ten miles away in the other. Hassinger obtained a Chi-square of 5.7, which was significant at the 5% level. Places more than ten miles from a larger center were more likely to have grown by 5% or more.

Next Hassinger separated the smaller towns into two groups, depending on whether the closest large center had a population of 2,000 to 5,000 or was larger. The relationship between population change and distance from centers of 5,000 or greater was not significant at the 5% level. However, a relationship significant at the 1% level was found for those towns closest to a center in the 2,000 to 5,000 size range.

In an attempt to find a reason for the different test results, Hassinger speculated that centers of 2,000 to 5,000 population might be more competitive with the smaller places, that is, they would restrict the trade of the smaller places by offering the same goods and services, and additional ones, at a convenient distance. Centers over 5,000 in size, wrote Hassinger, might dominate rather than rival smaller places. He did not explain why the larger centers would not merely be more effective rivals. A second explanation was that there might be suburbanization of many small places near the larger centers, so they would be more likely to show population increases.

The use of distance as a variable to explain population changes, as in Hassinger's study, was extended to Wisconsin for the decade of the 1950s by Butler and Fuguitt (1970). The state was divided into three areas for the study: a farming region similar to that studied by Hassinger, a remote region with few cities in the northern part of the state, and the strongly urbanized southeast.

Butler and Fuguitt obtained results similar to Hassinger's for their farm region in the 1940s; the remote northern region showed a less pronounced relation. In both these regions during the next

decade, however, and during both decades in the urbanized region, there was either no relation or a negative one. They concluded that the data might reflect the increased importance of commuting in all parts of the state. Thus distance to large towns would be negatively associated with population change, as it was in the urban part of the state even in the 1940s.

Durrenberger (1977) applied Hassinger's methods to North Dakota for the decade 1960-1970 and found that North Dakota towns were more likely to grow if located within 20 miles of an urban center. He chose to include all incorporated places of under 2,500 population in the analysis. Of these, 132 had fewer than 200 inhabitants in 1960, while many unincorporated places of similar size were not included. Like Hassinger, Durrenberger then separated the large centers into two size categories, under 5,000 and over 5,000. This division may not have been advisable in North Dakota, which in 1960 had only two non-suburban places of 2,500-5,000 population.

Hodge (1966) found that in Saskatchewan during the period 1951-1961 small centers declined more rapidly the closer they were to large centers. Using the same retail trade center classes as Borchert and Adams, Hodge concluded that for full convenience centers and partial shopping centers, but not for smaller places, either one or both of a pair of centers in the same class declined if their separation was less than the average for the class. In an earlier article, Hodge (1965) had found what he called a "zone of attrition" for smaller centers within ten miles of larger centers.

Summary

Studies of central place theory and of actual central place distributions emphasize certain aspects of towns which suggest useful variables in a study of population change. These include the size of a place, its distance from neighbors of similar size, its distance from larger neighbors, number of trade functions, and the population density and productivity of the rural market area surrounding the town.

Among the many previous studies of population change, there is a large variation in their contribution to the understanding of this phenomenon. The question of whether small towns as a group are growing or declining, which has been often investigated, seems to have no simple solution. The conclusions reached often reflect the preconceptions of the researcher through the definitions used.

Studies such as those of Fuguitt (1965) and Hart and Salisbury (1965), which cover an extended period of time, are able to reach more firmly based conclusions. Many profitable studies have examined population change in the light of the variables suggested by central place theory and studies. A study which combined an extended time span with the proper variables might be better able to explain some aspects of the population change of small towns. This is attempted as described in the following two chapters.

CHAPTER III

DATA ANALYSIS

Several hypotheses concerning factors which may contribute to change in the population of towns in North Dakota will be tested. First, however, a definition is given of the limits set to the size of towns included in the study. This is followed by a section on methodology, which describes the types of analysis used, the selection of variables, and the sources of data. The results of the initial analysis are then discussed, together with their implications. Residuals, or deviations from the expected population change, suggest the individuality of towns as well as the importance of regional variations. Some additional variables are then introduced in an attempt to improve the explanation.

Definition

To qualify for inclusion in this analysis, a North Dakota town had to be incorporated and have a census population of at least 250 but less than 2,500. In addition to forming the census boundary between rural and urban places, the 2,500 population level has been attained by very few North Dakota communities since 1920. That is, while the 12 North Dakota places which were urban in 1920 have grown substantially, only Rugby and Bottineau among those that were smaller then had grown to urban size by 1960. West Fargo is not included, as it is a suburb of Fargo. With the exception of Rugby and Bottineau,

the North Dakota urban places of 1960 (i.e., all those of 1920) were found to be at least complete shopping centers by Borchert and Adams (1963), while all smaller places were at most partial shopping centers.

The lower population limit was selected to approximate complete coverage within the limits set. While a number of incorporated places in North Dakota have had populations of under 250, many places of that size have remained unincorporated. Unincorporated places of under 1,000 population are, unfortunately, not enumerated separately by the census, so that their population is a matter for conjecture. However, the censuses of 1930 and 1940 enumerated the rural farm population of townships separately, enabling one to subtract this from the total to obtain a close estimate of the size of an unincorporated place in that township. For example, the census gives the 1940 population of Mabel Township, Griggs County, as 330. Of those, 184 were classified as rural farm, leaving 146 who lived in the unincorporated village of Sutton.¹

It was found that very few of these unincorporated places in 1930 and 1940 were above 250 in population. In 1940 there were only about five such places in the state, exclusive of places on Indian reservations, which were not included in the analysis. Based on this assurance that few places would be excluded, the lower population limit was set at 250.

For each of the five census years from 1920 through 1960, those towns which met the criteria discussed above were selected. Thus there

¹There are very few townships in the state with two unincorporated places to confuse the allocation of population. The 1930 census listed separately only those townships which were organized; the 1940 census was all-inclusive except for some townships on the Standing Rock and Fort Berthold Indian Reservations.

was a different set of towns for each year, with the addition of places which incorporated or simply grew to 250 or more in population and the deletion of towns whose population fell below this level. Only two towns, Rugby and Bottineau, grew beyond the population range considered.

Since inclusion of towns in the study was based on their population size, the first data to be collected were the number of inhabitants in the incorporated places of North Dakota at each of the six censuses from 1920 through 1970 (U.S. Bureau of the Census 1921, table 53; 1931, N.D. table 4; 1942a, N.D. table 4; 1952a, table 6; 1963, table 7; 1973, table 6). The percentage change in population between censuses was next calculated from the above data.

Methodology

Most of the analysis described in this chapter was done by a procedure known as multiple correlation and regression. The packaged computer programs utilized were the GLM and Stepwise procedures of the Statistical Analysis System (SAS) package (Barr, Goodnight, Sall, and Helwig 1976). After the numerical data for all the towns included had been collected, these were put on computer cards, with one card for each town in a given decade. The first task was to determine the degree of relationship between each independent variable and the dependent variable. A second task was to establish the significance of each independent variable with respect to changes in the dependent variable. This was done by calculating the probability that the degree of relationship between an independent variable and the dependent variable could have been equalled or bettered by picking numbers at random to represent the independent variable instead of going to

the trouble of measuring a selected quantity for each town. If the probability was less than 10%, when an independent variable was considered in conjunction with the other variables (in a procedure termed stepwise regression), it was considered that a significant relationship existed between that variable and population change, and the variable would be termed significant at the 10% level.

A third task was to find how much of the variance of the dependent variable could be explained by the independent variables. For the decade of the 1920s, the stepwise regression procedure determined that three of the independent variables, distance to nearest urban place (URB), distance to nearest place of at least the same size (SAME), and change in value of farm land and buildings (FARMVAL), were significantly related to population change (CHANGE). Population of the towns at the beginning of the decade (POP) was not significantly related to population change during the 1920s. The independent variables were able to explain 38% of the variation in population change. That portion of the variance which can be accounted for, or explained, by the independent variables is termed the coefficient of determination (R^2).

The fourth task was to calculate the multiple regression equation, $y = a + bx_1 + cx_2 + dx_3 + ex_4$, where y is the dependent variable (population change), x_1 , x_2 , x_3 , and x_4 are the independent variables, and a , b , c , d , and e are coefficients peculiar to the formula. The formula using the three independent variables found to be significant during the 1920s which would best fit the actual pattern of change was calculated and took the following form: $CHANGE = 9.97 + 0.23 URB + 0.32 SAME + 0.64 FARMVAL$.

A second method of analysis, the Chi-square test, was used to determine the relationship between population change and county seat status. Since a town either is or is not a county seat, the variable can only be measured on a nominal scale, and the Chi-square test is suitable. Towns were dichotomized according to county seat status and population gain or loss for each decade. Expected values for the number of towns in each category were first calculated, assuming no relationship between the variables. Then a Chi-square value was calculated from the difference between expected and actual values, and the significance was found.

Since the study is concerned above all with change in the size of town populations, the dependent variable was the percentage change in population of each town from one census to the next, a ten-year period. The value of this variable was usually between -20 and +40, although a few places experienced population losses of over 50% in a single decade. At the other extreme, there was one instance (Tioga in the 1950s) of a town more than quadrupling in population in ten years. Figures 3 through 7 show the population change of towns for each of the five decades from 1920 to 1970.

What independent variables would be appropriate to correlate with population change? One obvious choice was simply a town's population at the beginning of the decade (POP). It was hypothesized that there would be a positive correlation between population change and initial population, that is, larger towns would increase in population at a higher rate than smaller ones.

Distance from other towns was thought to be an important factor in a town's rate of population change. But from what towns would

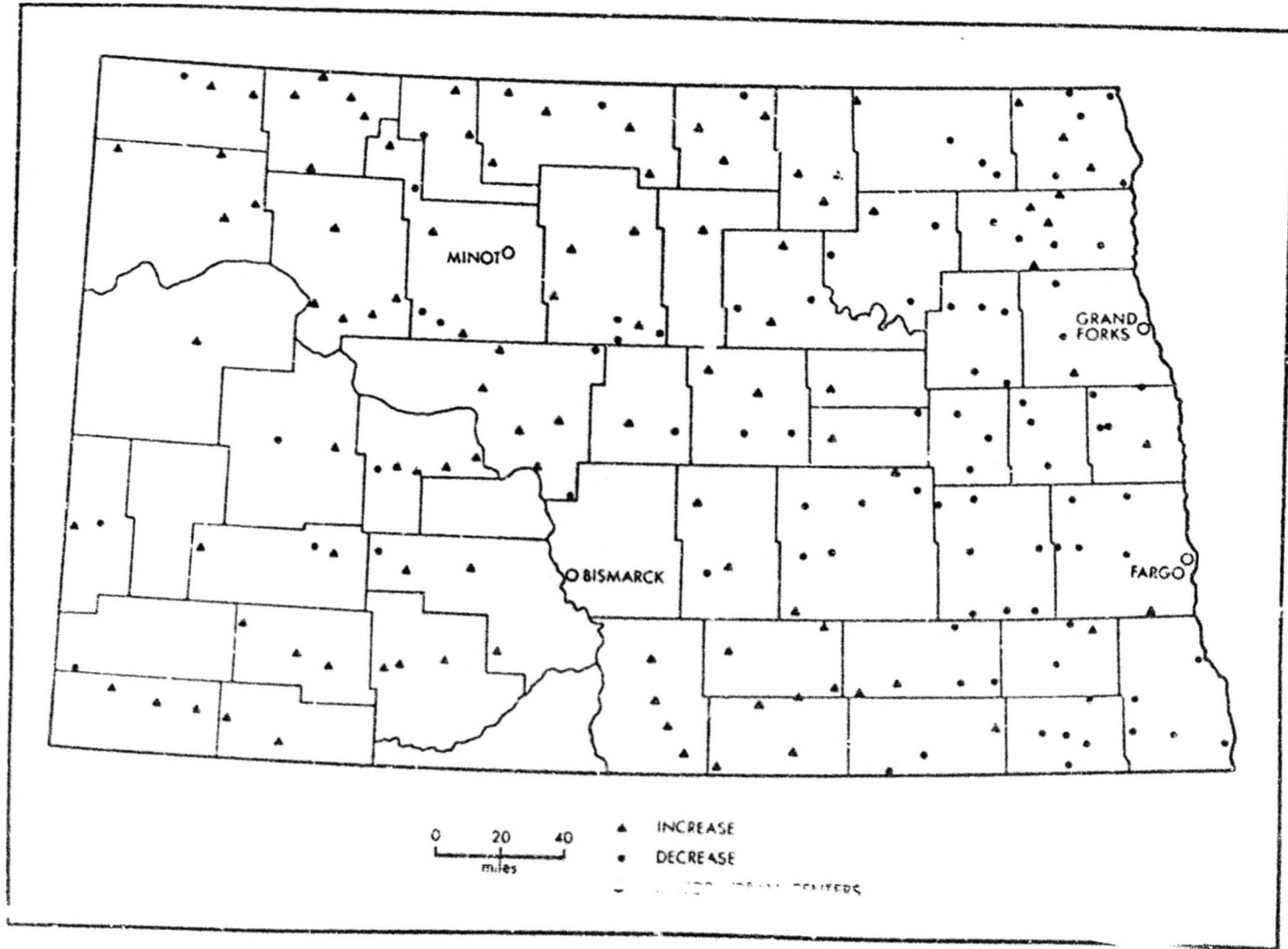


Fig. 3. Population Change of North Dakota Towns, 1920-1930.

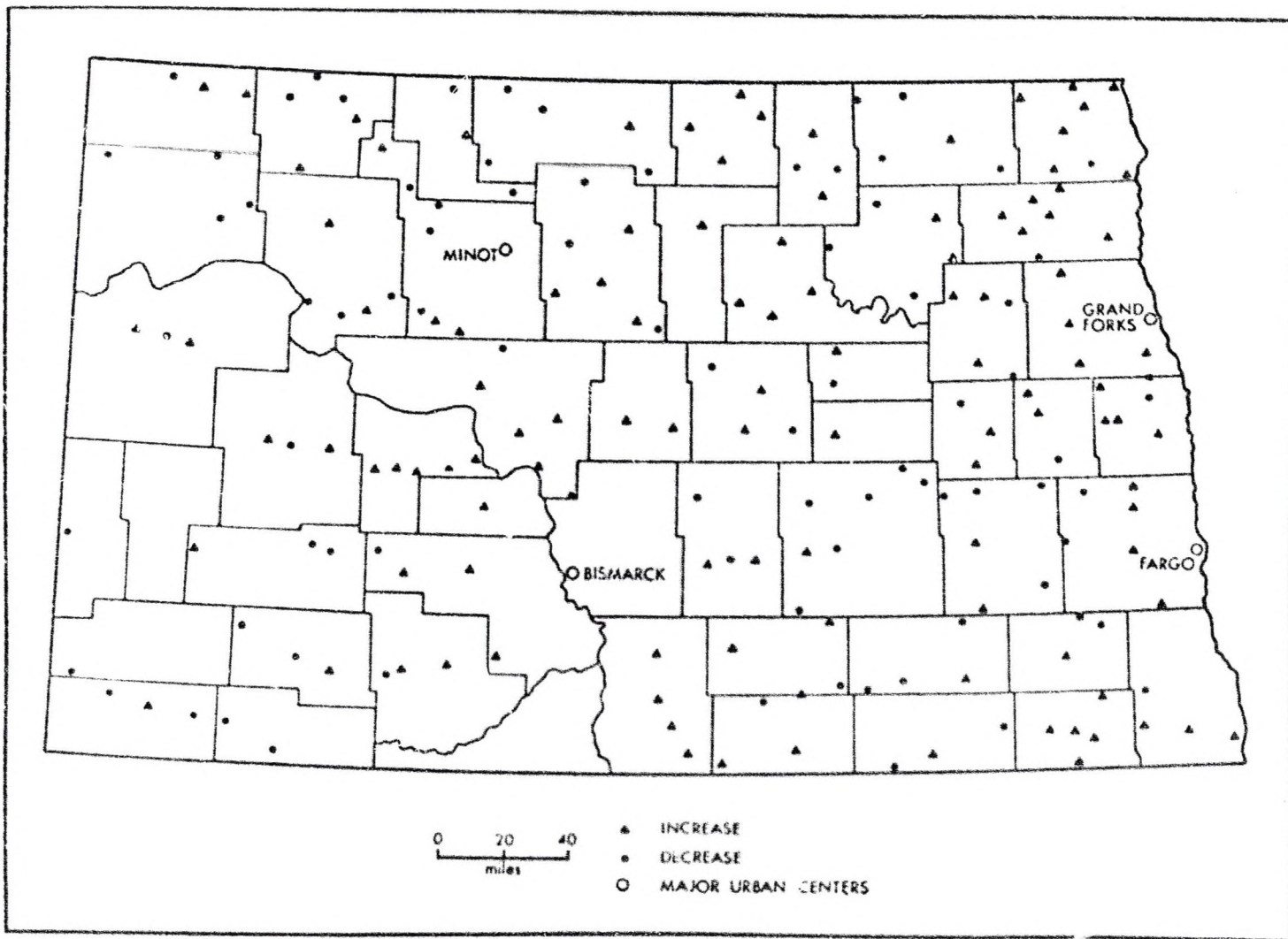


Fig. 4. Population Change of North Dakota Towns, 1930-1940.

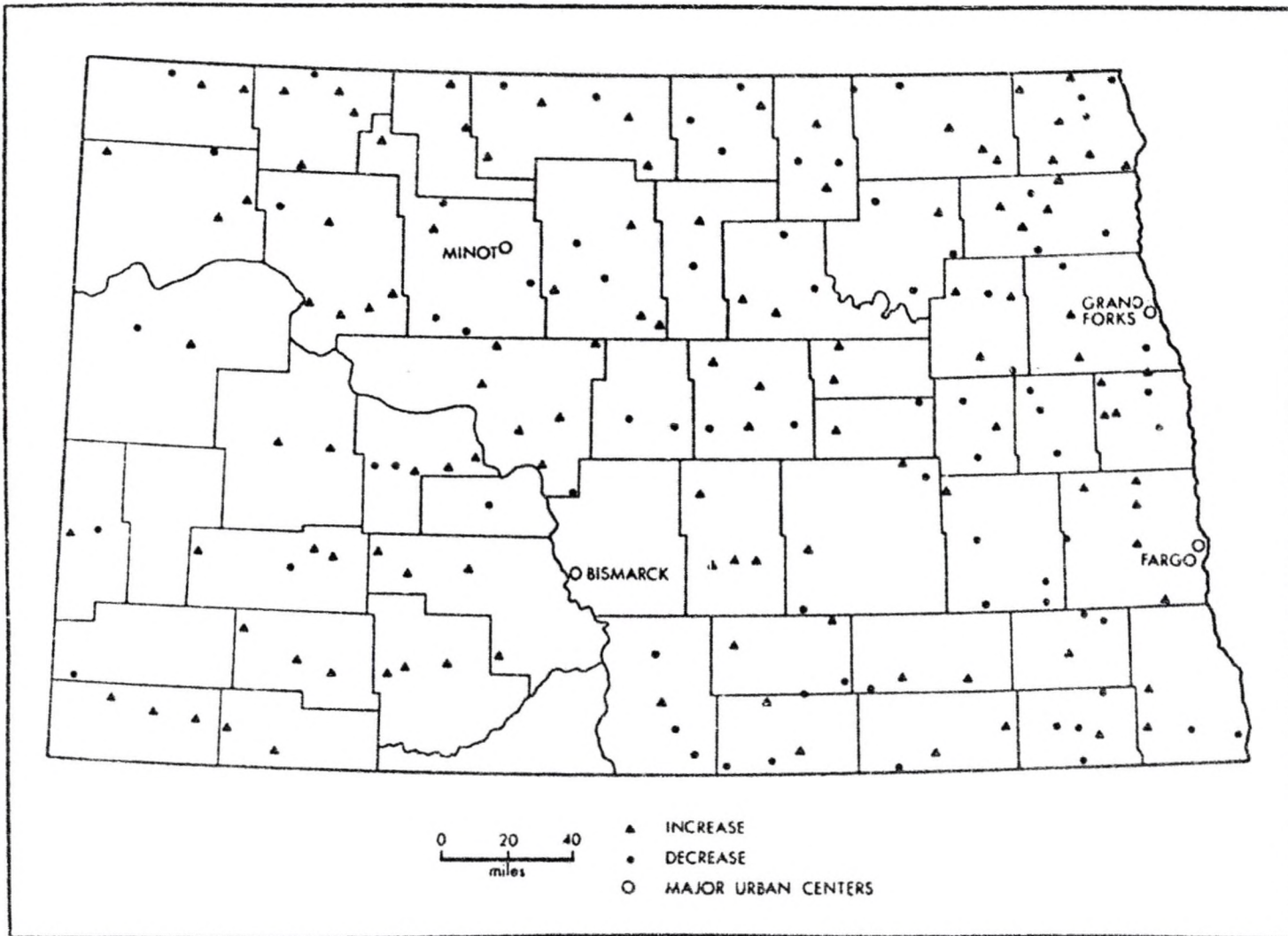


Fig. 5. Population Change of North Dakota Towns, 1940-1950.

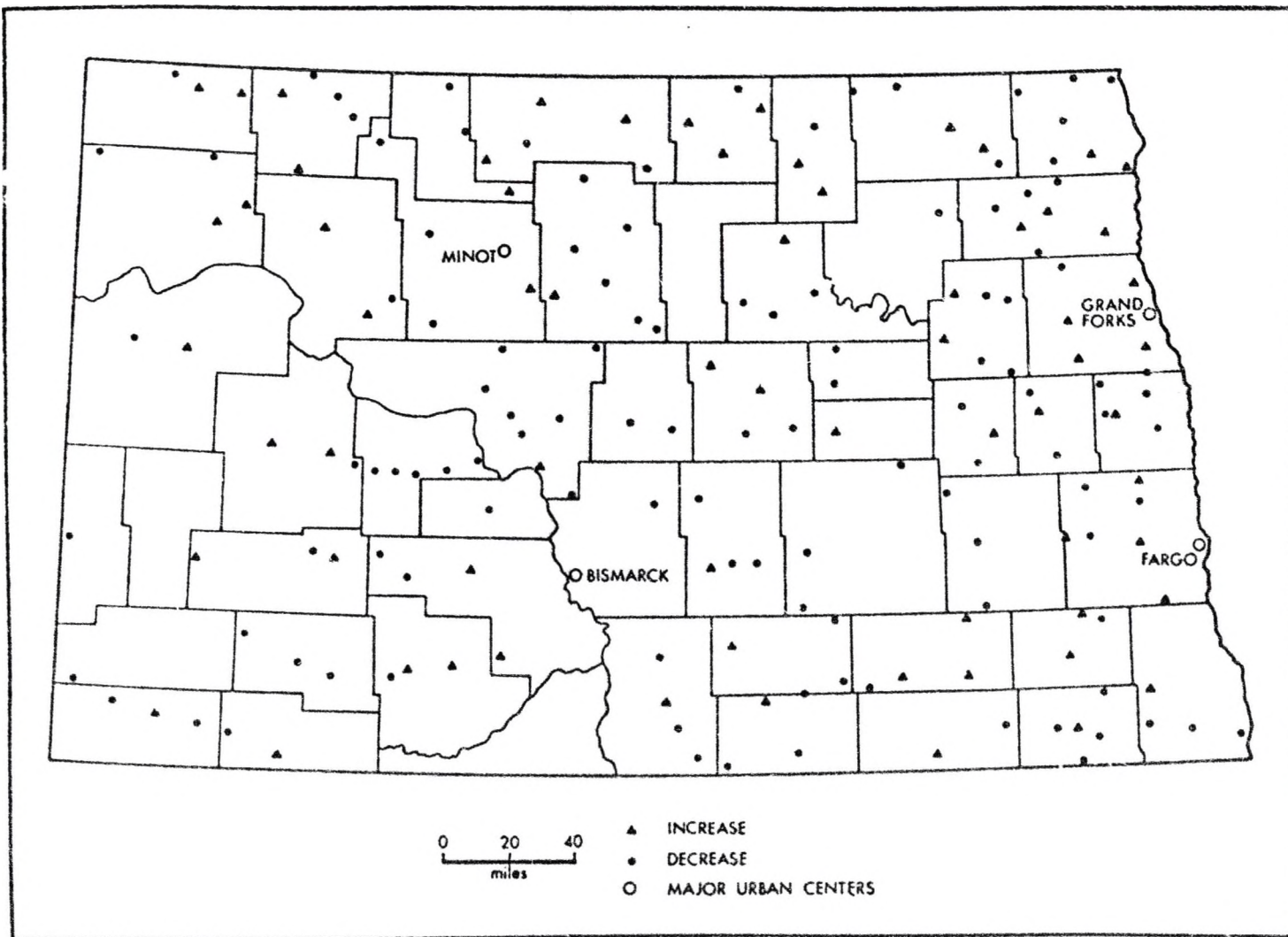


Fig. 6. Population Change of North Dakota Towns, 1950-1960.

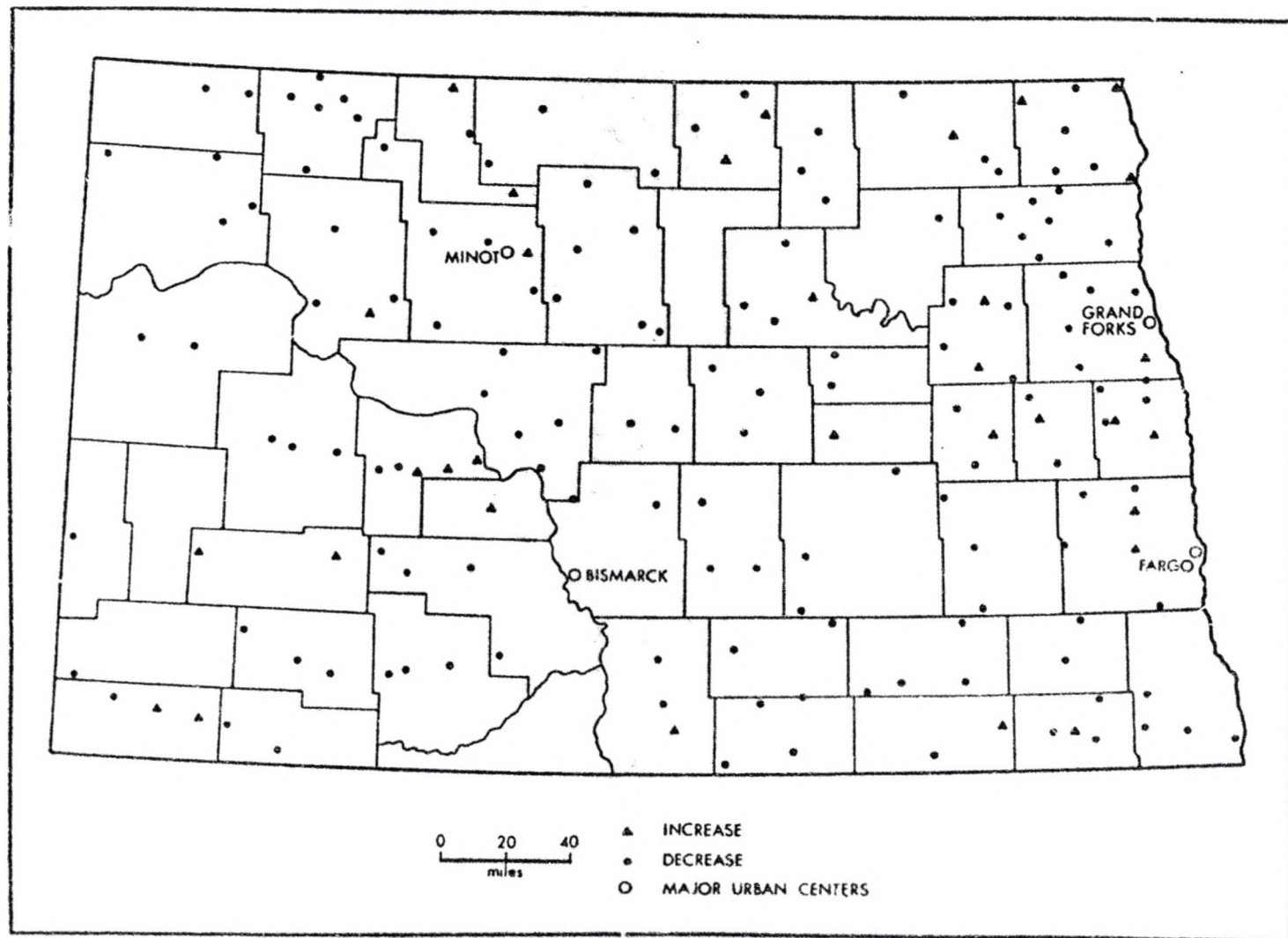


Fig. 7. Population Change of North Dakota Towns, 1960-1970.

the distance be measured? Two distances were chosen as being of importance, and were measured as straight lines to the nearest half mile on the 1977 North Dakota highway map.

Since urban centers are widely recognized as having an influence on the smaller places in their vicinity, distance to the nearest urban place was chosen as the second independent variable (URB). This study used the definition of the United States Bureau of the Census, that an urban place is one whose population is 2,500 or more. All urban centers, regardless of size, were assumed to have an equal influence on neighboring towns. While no firm hypothesis as to the nature of the relationship between population change and distance to the nearest urban place was formulated, it was considered likely that the relationship would change during the 50-year period as the small towns and the cities became mutually more accessible.

A second variable involving distance was the linear separation between a subject town and the nearest place of the same or greater population (SAME). The term "same population" was used literally, thus if town A had a population of 650, the distance to the nearest place of 650 or more inhabitants was measured. Competition among neighboring towns for the business of the rural populace was assumed, as was the competitive disadvantage of the smaller place and a consequent inhibition of growth. This inhibitory effect would be greater the closer the larger place was to the smaller one. A positive correlation was therefore hypothesized; those towns at a greater distance from places of the same or greater population would show a larger increase in population than those which were closer to such places.

The fourth independent variable, percentage change in the value of farm land and buildings (FARMVAL), was chosen to reflect the differences within the state in the prosperity, and consequent ability to support trade-center businesses; of the farm population. A positive correlation of this variable with population change was hypothesized. Data were available only at the county level, so the variable assumed the same value for all the towns in a given county.

Obtaining values for the distance to the nearest urban place and the nearest place of the same or larger size was a tedious process. It was necessary first to measure the distances (on the 1977 North Dakota highway map) from a given town to those neighboring places which might qualify in either the "urban" or "same size or larger" category at the time of any of the five censuses. Then the nearest place in each category was chosen, with notes taken about the change in absolute and relative size from census to census of the towns involved. Places in the three states bordering North Dakota also had to be considered. For instance, the nearest urban place to Beach throughout the period was Glendive, Montana. The Canadian border was assumed to be an effective barrier to interaction between towns, so cities and towns in Manitoba and Saskatchewan were excluded from the measurements.

Change in value of farm land and buildings was obtained by comparing the figures in the Census of Agriculture at ten-year intervals (U.S. Bureau of the Census 1922, N.D. county table 1; 1932b, N.D. county table 3; 1942b, N.D. county table 1; 1952b, N.D. county table 1; 1960, county table 1; 1972, chapter 2, table 1). For the censuses of 1950 and later years, average values per farm based on a sample were given, instead of total amounts, so it was necessary to multiply this average

value by the number of farms in the county. The values derived for each county were assigned to all the towns lying within that county. For those five towns which lie on the borders of counties, Lehr, Reynolds, Sarles, Tower City, and Wilton, an average value was assigned.

Results

Table 1 shows which of the variables were significantly related to population change during the five decades covered by this study. Some comments on the changing pattern of relationships may be helpful.

TABLE 1

SIGNIFICANCE OF VARIABLES RELATED TO POPULATION CHANGE, 1920-1970

Variable	1920s	1930s	Decade 1940s	1950s	1960s
POP				*	***
URB	***	**		<u>***</u>	<u>*</u>
SAME	*	**	***	**	
FARMVAL	* . *	***			<u>*</u>
R ²	0.07 ***	0.06 ***	0.13 ***	0.17 ***	0.12 ***
Mean change in population	3.5%	5.3%	6.0%	-3.1%	-10.4%

Key: * = significant at 10% significance level.
 ** = significant at 5% significance level.
 *** = significant at 1% significance level.
 underlining indicates a negative relationship.

NOTE: In the 1920s excludes Watford City, which almost tripled its population, and Marmarth, whose population decrease was 45%; in the 1950s excludes Tioga, which more than quadrupled in population.

Contrary to the hypothesis, population size was not related to population change in the 1920s; small towns were as likely to grow as larger ones. It is possible that this lack of a significant relationship statewide could be attributed to the fact that a number of the smaller places were relatively new towns in the western part of the state and experienced conditions favorable to rapid growth. Yet this would not explain the continuation of this lack of a significant relationship between population size and population change through the next two decades.

As hypothesized, distance to nearest place of the same or larger size was significantly related to population change during the 1920s. This probably shows the effect of competition among small towns, many of which had been established too close to other similar-sized places, given the relative sparseness of the rural population. Indeed, the rural population, never very dense, began a decline in the 1920s which continued throughout the period studied. Distance to nearest urban place was also significant, as the state's cities were also in a competitive relationship with nearby towns.

Change in value of farm land and buildings was significant at the 1% significance level. The values decreased in all counties but one; the Great Depression began ten years early in North Dakota. Towns in counties whose farm value decreased the most were more likely than other towns to lose population. This probably reflects the importance of a relatively prosperous farm population in supporting small-town business activities.

There is a striking similarity between the results for the 1920s and the 1930s; the second decade was one of depressed economic

conditions nationwide. In the 1930s the faster growing towns were no longer so concentrated in the western part of the state. Many were found in south-central counties which, paradoxically, saw some of the greatest decreases in farm value, a variable that again showed a strong positive relation to population change.

During the 1940s only the variable SAME showed a significant relationship to population change. Distance from cities was no longer important; perhaps this was a time of flux in the influence of urban places on towns. Change in farm value also was no longer significant. By 1950 the statewide value of farm land and buildings was more than 2.4 times that of 1940. At the same time the size of the farm population decreased and farms grew larger. Thus while the farm population may have been better off economically, there were fewer patrons for farm trade centers.

A pronounced change in the relationship of the independent variables to population change was evident in the 1950s. For the first time, population size was significant. Larger towns had an advantage over smaller ones. This could be the result in part of changing consumer behavior and increased mobility, both favoring the patronage of businesses in larger towns at the expense of their smaller neighbors. This was also a time of many school district consolidations, and larger towns likely had an advantage in attracting rural territory into their districts. Larger school enrollments, both from consolidation and from the first wave of the postwar "baby boom," would result in the employment of more teachers, especially in the larger towns.

Distance to nearest urban place was significant at the 1% level in the 1950s, but in contrast to the relationship that existed between

1920 and 1940 it was proximity and not remoteness that favored small-town growth. One may attribute this to the onset of suburbanization in North Dakota, with employees of city businesses residing in the surrounding small towns and driving to and from work daily. While relatively few of the towns in this study are so near to urban centers that they would seem likely to house many commuters, one must remember that the retention of even a few families could have a noticeable effect on the rate of population change in a town of only 300 inhabitants.

Population size was even more significant during the 1960s, a time when few towns gained population and many of the smaller ones declined by more than 20%. It is likely that many businesses long established in the smaller communities no longer had sufficient patronage to continue. The rural population continued to decline, and at the same time both farm and village dwellers made more shopping trips by car to larger centers, where the selection of goods and services was greater.

Distance to the nearest city continued its significant relationship of the previous decade, but for the first time the other distance factor was not important. It would seem that small towns were not so much competing with nearby places as being made obsolescent by increased consumer accessibility to larger towns.

Residuals

Greater understanding of the pattern of small town population change may be gained from a study of the residuals of individual places. A residual is the difference between the predicted amount of population change from the multiple regression equation and the actual amount of

change. For example, during the 1940s the town of LaMoure, if it had performed exactly as predicted by the equation, would have grown by 11%. Since the actual gain was only 2%, the residual is -9.

If the towns with large residuals (either positive or negative) are plotted on a map, they may form patterns which emphasize economic factors that only affected certain portions of the state. For the 1950s there was a concentration of positive residuals in the northwestern part of North Dakota. This is not surprising if one knows that the production of petroleum began in that area in the early 1950s. Comparison with a map of the 1960s shows that two of the towns most affected by the oil boom, Tioga and Ray, had large negative residuals as the boom subsided.

One project which had a major impact on the population of several towns was the construction of Garrison Dam, completed in the early 1950s. Towns in McLean and Mercer counties had high positive residuals for the 1940s, when there was a large influx of construction workers. Conversely, in the 1950s several places in the same area had negative residuals as the dam was completed and the workers moved away.

Indeed, changes from high positive residuals in one decade to high negative ones in the next, and vice versa, are not uncommon. Explanation may be elusive, however. Many towns in the south-central portion of North Dakota had high positive residuals during the 1930s and high negative ones in the next decade. This contrasts with other areas of the state, such as the southwestern corner, where many towns declined during the drought-stricken 1930s but rebounded in the 1940s.

With the exception of a catastrophe such as drought, which may affect certain areas more than others, the explanation of large

residuals must come from factors not directly related to agriculture. This is particularly true if the residual pertains to only one community while other towns in the area perform in accordance with the formula or have residuals of the opposite sign. These factors include, in addition to activities such as mining and public works construction, manufacturing, military bases, and even nursing homes.

The impact of the establishment of nursing homes on the population of small communities may be quite large. Those residents of the home who did not previously live in the community add to its population. In addition such facilities employ a sizeable number of people. Nursing homes probably explain the large positive residuals at Arthur and Strasburg in the 1960s.

Military bases had an influence on two of the study towns during the 1950s. By 1960 construction of the Grand Forks Air Force Base was underway, and the nearby town of Larimore experienced a temporary increase in population of over 200. A radar station built just west of Finley likely accounted for the high residual of that community in the 1950s.

Manufacturing has had an impact on several North Dakota communities. The best known example is probably that of the Melroe plant at Gwinner. However, until that town's rapid growth in the 1960s it had a population of under 250 and so was not included in the study. Two other places where manufacturing was an important factor in population growth during the 1960s are Drayton and Pembina, both of which had high positive residuals for that decade. A sugar beet processing plant was built near Drayton, while Pembina was selected as the site of a factory assembling buses.

Large residuals in a single decade, or distinctive patterns of residuals through time, applying to individual towns may be explained by yet other factors peculiar to a given town. Some of these will be noted in the next chapter, where certain towns will be considered individually. Let us now turn to other ways whereby population change statewide may be better understood.

Use of Size Classes and Additional Distance Variables

The towns were next divided into three classes according to population size: 250-399, 400-999, and 1,000-2,499. It was thought that towns in the different groups would be affected differently by their location relative to other towns. In addition two more distance variables were added to the analysis.

The first additional distance variable was added in the belief that small towns were competing not only with nearby towns of at least their own size but also with those that were nearly as large. This variable (ALMOST) was thus defined as the distance to the nearest town of at least two-thirds the population of the subject town. For the same reason that the lower population limit of towns in the study was set at 250, this variable was not applied to towns of under 400 population, i.e., those in the smallest size class.

A second additional variable applied only to towns of under 1,000 population (THOU). This was distance to the nearest town of 1,000 or more population. For towns in the 400-999 size class, therefore, there were now as many as four distances to take into account.

Processing the data with these additional variables for the three different size classes gave results that were, on the whole, inconclusive. Table 2 shows the variables that were significant for each size class.

TABLE 2
SIGNIFICANCE OF VARIABLES RELATED TO POPULATION CHANGE, 1920-1970,
BY SIZE CLASS AND DECADE

Variable	Decade				
	1920s	1930s	1940s	1950s	1960s
A. 250-399 Population					
POP			**		
URB	***		**	<u>***</u>	<u>**</u>
SAME	***				
THOU	(not significant in any decade)				
R ²	0.30 ***	0.00	0.15 **	0.27 ***	0.13 *
B. 400-999 Population					
POP		**	**		
URB	***				
SAME	***		**		
THOU				**	
ALMOST	(not significant in any decade)				
R ²	0.24 ***	0.07	0.11 *	0.06	0.03
C. 1,000-2,499 Population					
POP	(not significant in any decade)				
URB			**		
SAME			*	***	
ALMOST	***				
R ²	0.42 ***	0.20	0.27 **	0.13	0.05

Key: * = significant at 10% significance level.
 ** = significant at 5% significance level.
 *** = significant at 1% significance level.
 underlining indicates a negative relationship.

Not surprisingly, population differences within the narrower ranges of the three classes were not significant in the 1950s or 1960s, when they were for the entire range of towns. Less understandable is the earlier significance of population size in the two smaller classes.

Distance to nearest urban place seems to have most strongly affected places of the smallest size. The trend for towns of 250 to 399 population is very similar to that seen for the study towns as a whole.

One might speculate that the pattern for the variable SAME, with the significance appearing later in places of larger size, is a reflection of increased consumer mobility. Since larger towns tend to be more distant from each other than do smaller towns, it may have taken longer before rural dwellers had the same opportunity of selecting among them that they obtained earlier in the case of the smaller places.

The two added distance variables showed almost no significant relationships to population change. It would appear that the two original variables, URB and SAME, were sufficient for the study.

The Sales-Tax Variable

While the variable FARMVAL could be said to reflect changing economic conditions, it did not apply directly to towns themselves. Moreover, the data were on a county level and unavoidably masked variations within the counties.

A variable was found which overcame these limitations. This was the per capita amount of retail sales tax collected in each town. It was hypothesized that there would be a positive relationship between

population change and per capita retail sales-tax collections. High collections in a town would be indicative of a greater than average amount of business activity, probably because such a town attracted more than a normal share of business from farms and other towns in its area.

Use of the sales-tax variable was restricted to the decades of the 1950s and 1960s, since data were not available for earlier periods. There were also no data for several places, chiefly smaller ones, for 1950, but the 1960 data included virtually all the towns in the study.

Per capita sales-tax receipts for 1950 had a positive relationship with population change during the 1950s that was significant at the 1% level, and the coefficient of determination, with the variables POP, URB, and SAME included, was 0.19, which was also significant at the 1% level. The positive relationship of 1960 per capita sales-tax receipts with population change during the 1960s was significant at the 5% level. In this case the coefficient of determination was 0.14 and was significant at the 1% level. The results indicate that a low level of business activity in a community leads to population decline.

County Seats and Population Change

County seat status was the final factor considered. A Chi-square test was used; the towns were divided first into county seats and non-county seats, then into those that gained and those that lost population in each decade. Since almost all incorporated county seats have populations of over 400, towns in the 250-399 population range were not included.

It was hypothesized that county seats would be more likely to gain population than non-county seats because possession of the governmental function ensures a steady flow of consumers from outlying parts of the county and also provides employment for a number of people. The results of the tests are shown in the following table.

TABLE 3
SIGNIFICANCE OF COUNTY SEAT STATUS ON POPULATION GROWTH

Decade	Value of Chi-square*	Level of significance
1920s	2.52	not significant at 10%
1930s	9.52	1%
1940s	4.01	5%
1950s	5.93	5%
1960s	1.40	not significant at 10%

*degrees of freedom = 1

County seat status was most significantly related to population growth during the decade of national economic depression. Because most of the county seats measured (22 of 35 in 1960) had populations above 1,000, while most of the non-county seats (52 of 78) were in the 400-999 population range, it might be questioned whether the test was biased by differences in population. That this was not the case is shown by the fact that, in the previous analysis, population size was not significant during the 1930s when county seat status was highly related to population growth. In the 1960s, however, when population size was significant at the 1% level, the test of county seat status produced its lowest value for the whole period.

Summary

Analysis of population data for incorporated North Dakota places of 250 to 2,500 inhabitants has revealed several variables to have been significantly related to population change during one or more of the five decades from 1920 to 1970. Of the independent variables tested, distance to the nearest place of the same or larger size had the most consistent relation to population change. The positive relationship was significant at the 5% level or better for the first four decades of the period. This probably reflects the fact that widely spaced towns could draw on larger trade areas than closely spaced ones and in turn could maintain the businesses which provided employment for the towns' people.

Another variable, distance to nearest urban place, was also significantly related to population change in four of the five decades, yet in a quite different manner. During the 1920s and 1930s North Dakota towns were more likely to grow if they were relatively distant from a city. In the last two decades under study, however, the opposite was true. This may be the indication of a suburbanizing effect, whereby city workers have their residences in small towns.

Change in value of farm land and buildings was significantly related to population change at the 1% level during the first two decades, when almost all parts of the state suffered huge decreases in farm value. It is likely that farmers in those areas which experienced the greatest losses were less able to support their local farm trade centers. This economic variable was not again significant, except for a negative relationship at the 10% level in the 1960s.

Contrary to expectations, the size of a place did not influence its population change until the 1950s. During the 1960s, however, smaller places were much more likely to lose population. This is probably because many of the smallest towns in the study simply could not compete with their larger neighbors for the patronage of the farm population, who could now easily drive to a larger town.

A study of the residuals showed that many large deviations from the population change predicted by the model could be explained by local variations in the economy. These variations included large scale construction projects such as Garrison Dam and the two Air Force bases, the discovery of petroleum in northwestern North Dakota, and the establishment of manufacturing plants in several localities. If the activity was one which brought an influx of workers for only a short time, the town was likely to record first a positive residual when the additional workers were present and then a negative one following their departure.

Additional variables were tested for their relationships to population change. Two more distance variables were included in an analysis which also divided the towns into three size classes. It was found that these new variables did not contribute to the understanding of population change. Towns of 1,000-2,499 population showed the fewest significant relationships between the variables. A change in the relation between population change and distance to nearest urban place, like that for the group as a whole, from positive to negative, also occurred among the smallest towns (250-399 inhabitants).

Retail sales-tax receipts, when computed for towns on a per-capita basis, were found to be significantly related to population

change in the 1950s and 1960s, the only decades for which a test could be made. Towns which had a high amount of retail activity for their size were also likely to experience above average population growth. Status as a county seat was related to population growth in the 1930s, 1940s, and 1950s.

This analysis may provide some insights into the causes of population change in North Dakota towns. Since each town is unique in some respects, however, it might be profitable to examine a few towns in detail for factors in their growth or decline that could not be analyzed at the statewide level. This is done in the following chapter, where we will focus particular attention on local business activity.

CHAPTER IV

STUDIES OF INDIVIDUAL TOWNS

This chapter will examine the development of four North Dakota towns: Maddock, Hunter, Marmarth, and Beulah (Figure 8). While the previous chapter treated these towns as so many pieces of data to be analyzed, we will now focus on their individuality.

Of the four towns considered here, all have been in the size range 250-2,500 since shortly after their founding, with the following exceptions: Beulah has in 1979 grown to urban size, while Marmarth declined to a population of under 250 by 1970. The other two communities have maintained very stable population levels, Maddock having between 600 and 800 residents since 1930 and Hunter close to 400 since 1900.

Two of the towns examined in this chapter, Hunter and Maddock, belong almost exclusively to the farm trade center category. Manufacturing activities produce goods which are destined to be sold to farmers, although their market area is wider than that for the towns' retail businesses. Beulah represents a combination of a farm trade center and mining town, destined soon to be a center for the large-scale conversion of lignite to electricity and gas. Marmarth is a former railroad town which is now merely a population node, with very little commercial activity.

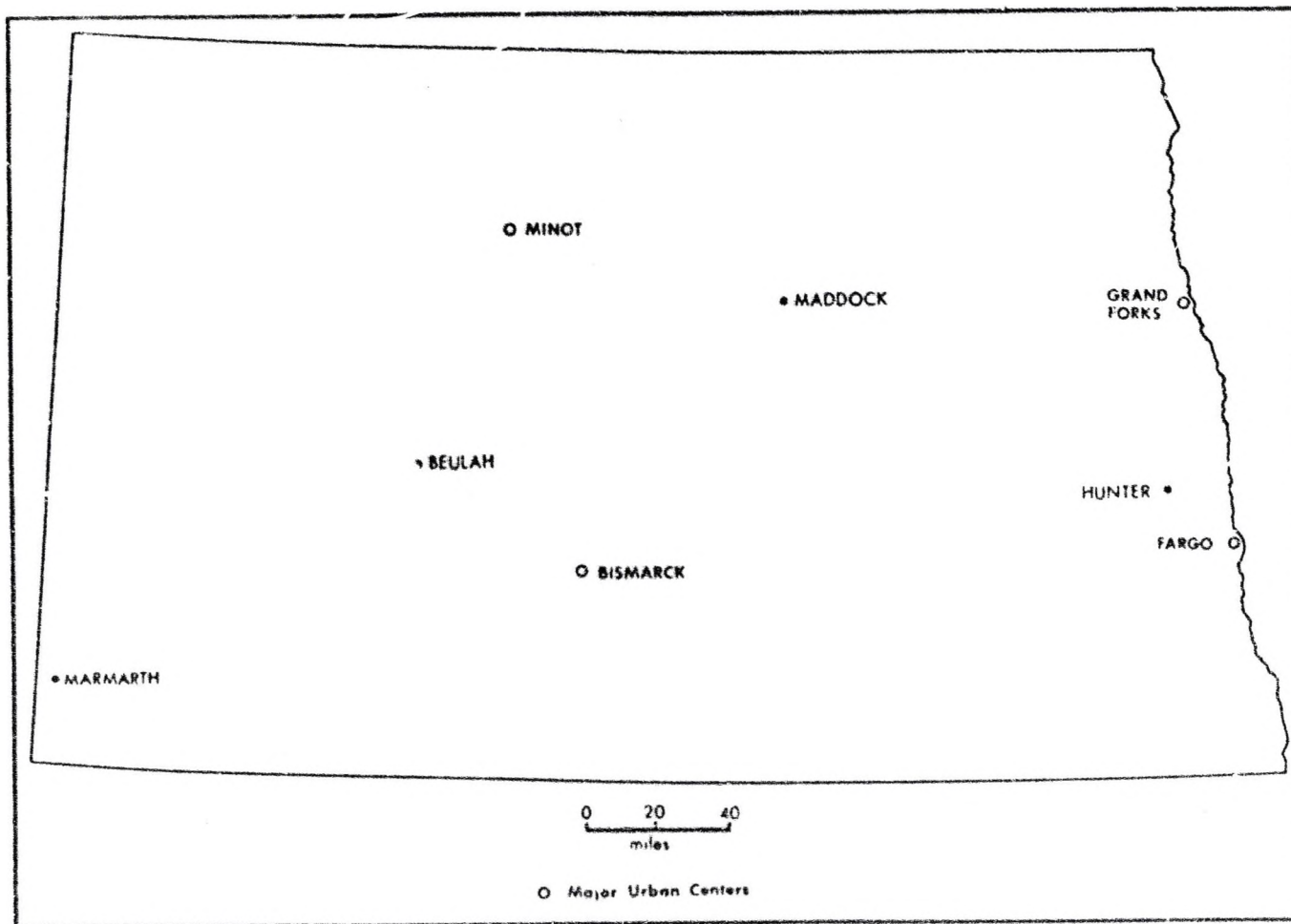


Fig. 8. Location of Maddock, Hunter, Marmarth, and Beulah, North Dakota.

In addition to the populations of the towns themselves, we will consider the farm population of neighboring townships. This constitutes the source of patronage for the towns' existence, insofar as they are farm trade centers. The areas chosen to represent the hinterlands were arbitrarily defined as those neighboring townships whose centers were closer to the subject towns than to other nearby places. No change was made from census to census in the townships included in each area.

While inexact, this method gives a generally accurate view of (1) the varying sizes of the hinterland populations of different towns, and (2) the great decrease in farm population that has occurred in the last few decades. Change certainly has occurred in the extent of trade areas, in fact, it varies at any given time with the type of product or service being considered. The closest correspondence to actual trade areas by the townships selected is probably for the years 1920 to 1940. Although population figures were not available for the unorganized townships in the vicinity of Beulah and Marmarth for 1960 or 1970, the numbers were estimated from county population trends.

The number of businesses present in each town at various times is shown in the graphs (Figures 10, 12, 14, and 16) which appear within each town's section. These numbers are approximate, their accuracy depending on the thoroughness of the source. One should not conclude that a greater number of businesses at an early period in a town's history necessarily indicates more business activity than at a later time. Businesses vary a great deal in size and complexity, even though they may belong to the same category.

A good example of this variation is the grain elevator. Most North Dakota towns had several elevator companies at one time; today

few have more than one or two. Yet the storage capacities of today's elevators are often much greater than those of the 1920s.

Certain functions were chosen to represent the relative vitality of the towns as farm trade centers. These are listed in a table for each town. Some of the functions depend entirely on farmers for their existence, others could be patronized by town dwellers as well.

More information was available about the history of Maddock, particularly in its first years, than about the other three towns. Even if similar information were at hand for the other towns, it might become tedious if repeated. Thus more details are supplied on the development of businesses and civic improvements in Maddock.

Maddock

Located in southwestern Benson County, Maddock, with a 1970 population of 708, is 34 miles from the nearest urban center, Devils Lake (Figure 9). Since 1930 the nearest place of the same or greater population has been Fessenden, 23 miles distant. Over the 50-year period of the statistical analysis, Maddock had a net population increase of 27%. The town's population, population change, and the residual based on the model are shown for each decade in table 4.

Settlement of the Maddock area began about 1885, when a railroad reached Minnewaukan, some 15 miles to the east, connecting it with the main line of the Northern Pacific at Jamestown. At about the same time, the main line of the Great Northern railroad was built across the state. It passed through Benson County about 25 miles to the north of the site of Maddock (Stiles and Stiles 1956, p. 5). Farmers living in the area had to haul their grain 10 to 20 miles

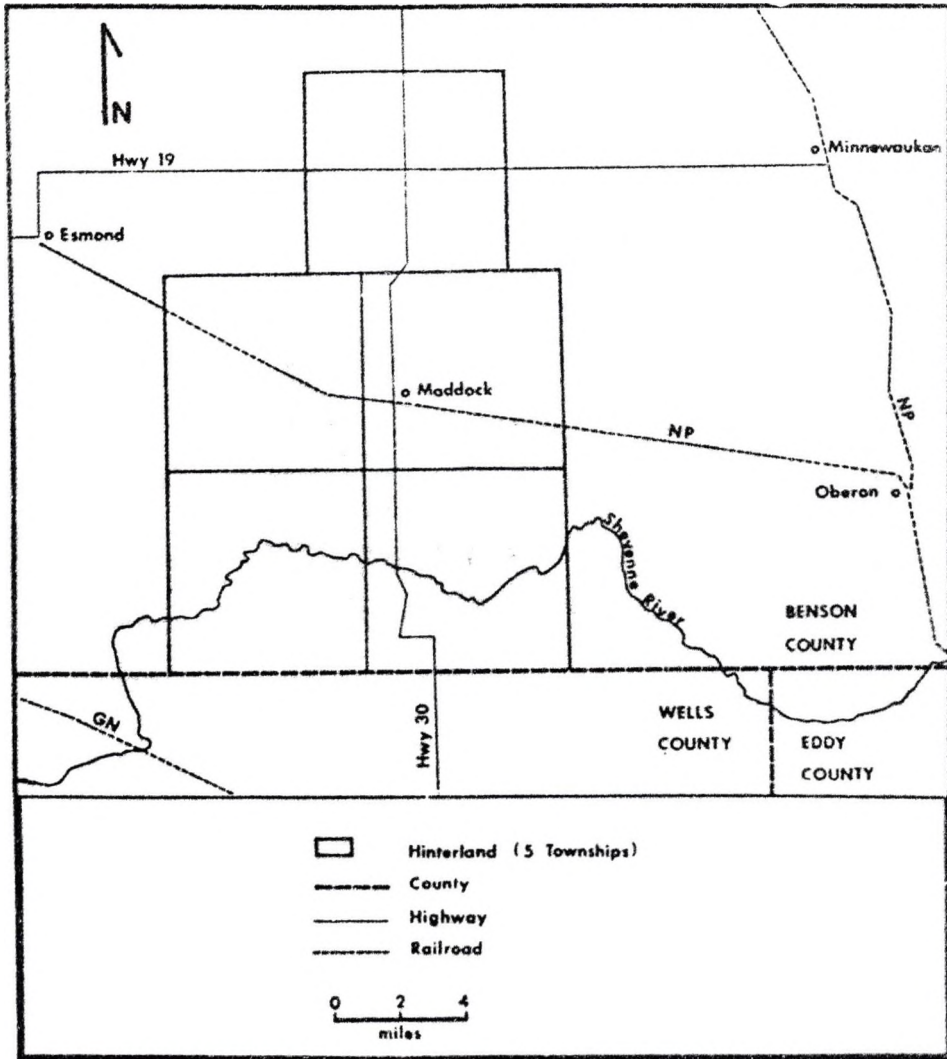


Fig. 9. Maddock and Its Vicinity.

TABLE 4

POPULATION DATA FOR MADDOCK, NORTH DAKOTA, 1910-1970

Year	Population	Percentage change	Residual
1910	374	--	--
1920	557	48.9	--
1930	631	13.3	7
1940	691	9.5	5
1950	741	7.2	0
1960	740	- 0.1	0
1970	708	- 4.3	7

SOURCES: U.S. Bureau of the Census 1913, N.D. chapter 1, table 1; 1921, table 53; 1931, N.D. table 4; 1942a, N.D. table 4; 1952a, table 6; 1963, table 7; 1973, table 6.

east to reach the railroad (Stiles and Stiles 1956, p. 76), yet the population of five townships around the site of Maddock had reached 1100 by 1900 (Figure 10). While no towns developed until the arrival of the railroad, small general stores, blacksmith shops, and post offices were established at farmers' homes (Stiles and Stiles 1956, p. 6).

In the spring of 1901 the Northern Pacific surveyed the route of a short branch line which was to extend west through Benson County from Oberon on the Minnewaukan branch. The Maddock Townsite Company, owned by two men from Minnewaukan and one from St. Paul, Minnesota, purchased the land along the route on which the town of Maddock would be built. A crop of flax was harvested from the land before the railroad arrived on August 12 (Stiles and Stiles 1956, p. 74).

Even before the railroad reached the site, there was much activity. The land company had sold 52 town lots by the beginning

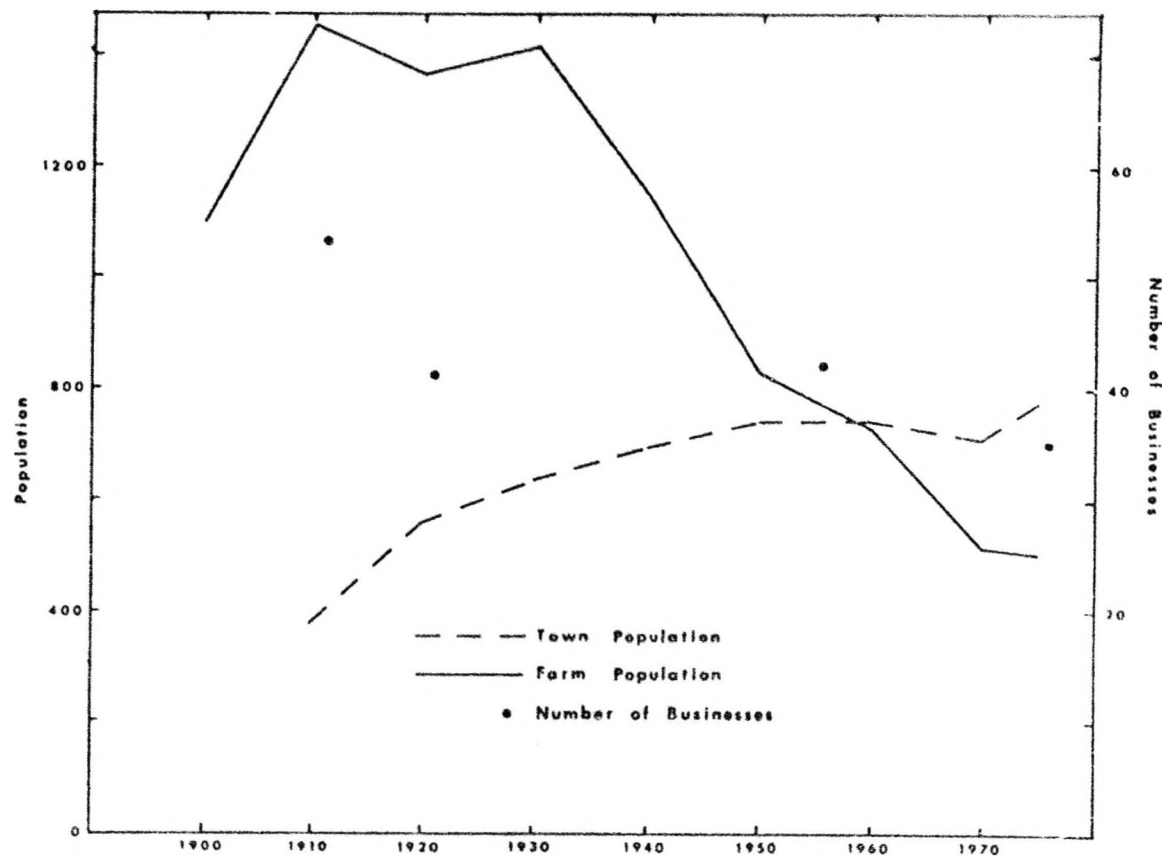


Fig. 10. Town Population, Farm Population, and Number of Businesses, Maddock, North Dakota: 1900-1976.

SOURCES: Population. U.S. Bureau of the Census 1913, N.D. chapter 1, table 1; 1921, table 53; 1931, N.D. table 4; 1942a, N.D. table 4; 1952a, table 6; 1963, table 7; 1973, table 6; 1977; U.S. Census Office 1901, N.D. table 5. Business functions. History Book Committee 1976, pp. 88-111; R. L. Polk & Co. 1921, pp. 256-57; Stiles and Stiles 1956, pp. 56-72, 74.

of August, and there were numerous businesses, including a bank, two lumberyards, two blacksmith shops, two implement dealers, and a newspaper. Two grain elevators were built in anticipation of the railroad (Stiles and Stiles 1956, pp. 75-76).

On August 16 the newspaper reported that the first freight had arrived by rail, most of the shipment being lumber. Six lumberyards were in business by the fall, and many new houses were being built, not only in town but also on nearby farms. By December 1901 the town had a second bank, a hotel, an express agency, a dray line, passenger service three times a week, and daily mail service from Minnewaukan (Stiles and Stiles 1956, pp. 76-78).

Thus within a few months another farm trade center had established itself on the North Dakota prairie. The numerous farm population of the surrounding townships now could market its grain and procure supplies with much less effort. In turn the many town businesses it supported provided a livelihood for the residents of the growing village. By 1905 the town had five elevators; about 500,000 bushels of that year's wheat crop was marketed through Maddock (Stiles and Stiles 1956, p. 89). A creamery opened for business the next year (Stiles and Stiles 1956, p. 88). Maddock merchants were aware of the importance of farmers to the town's existence. The program of the Maddock Business Men's Association, formed in 1911 to replace the defunct Commercial Club, included joint action with local farmers (Stiles and Stiles 1956, p. 92).

Businesses changed owners very frequently in these first years of the town. Another frequent event involved a transfer of stores from one building to another with no change of ownership. This often

happened when the owner of a flourishing business built new, larger quarters on a vacant site. He would then sell his old building to another businessman, who in turn would vacate his old premises. Thus the ownership and location of stores changed more rapidly than the trade functions performed in them.

Sometimes a new business could not afford to build its own quarters, but rented space within a building being used by another firm. In May 1902, for example, a jewelry shop was opened in the drug store (Stiles and Stiles 1956, p. 79).

Depending on its nature and size, each business employed a certain number of workers and indirectly supported many more dependents. Continued growth in either the number or size of businesses would thus result in the growth of town population as well.

By July 1902, less than a year after the railroad had arrived, Maddock had 31 business places, including three elevators and two hotels. Besides the jewelry shop, new businesses in 1902 included a shoe repair shop and a bowling alley. The Maddock Implement Company began selling furniture. Deposits exceeded \$20,000 at each of the town's two banks, and one of them moved into a new brick building (Stiles and Stiles 1956, pp. 78-80).

November 1902 saw a shortage of coal in Maddock. When a carload of hard coal arrived, it was rationed, one ton to a customer (Stiles and Stiles 1956, p. 88). A more severe shortage occurred in February 1907, a result of the blocking of the railroad by snow. To save fuel many businesses were partially closed; others doubled up, with one merchant moving his goods into another's building (Stiles

and Stiles 1956, p. 90). This situation exemplifies the dependence of the town on the railroad for its supplies.

A new school building was ready in November 1903 (Stiles and Stiles 1956, p. 81). School had previously been held in rented buildings. Six years later the building was already too crowded, and a new one was built in 1914. At first there was only a grade school, but high-school courses were added beginning in 1911 (Stiles and Stiles 1956, pp. 91-93).

In addition to having its town high school, Maddock was the site of the Benson County Agricultural and Training School. Maddock outbid the other towns of the county to obtain the school, which opened in 1915 (Stiles and Stiles 1956, pp. 42-44, 93). Both schools functioned separately until 1948, when the town high school was closed (History Book Committee 1976, p. 158). The county school, in turn, closed in the 1960s, and all students attended a newly built town high school (History Book Committee 1976, p. 315).

Possession of the county school served to increase Maddock's population. It provided employment for the faculty and other personnel needed and also attracted students from other parts of Benson County. There were dormitories for the boys and girls attending the school. The number of graduates was few until 1922, when it reached 20. From 1923 until the Maddock high school merged with the county school in 1948, the average size of the graduating class was 33, with a peak of 52 in 1940 (Stiles and Stiles 1956, pp. 45-51). Since there were three other grades, the total number of students at any one time was over 100.

A small hospital was built in Maddock in 1906 but was closed in 1914 and converted into a rooming house (Stiles and Stiles 1956, pp. 89-90, 93). There was a rapid turnover of doctors in the early years. In 1950 a new hospital was constructed but was forced to close in 1974 because it could not meet state requirements. It became a home for the aged in 1976 (History Book Committee 1976, pp. 115-16, 19).

Maddock installed a town water and sewer system in 1949 (Stiles and Stiles 1956, pp. 106-7); all homes were required to be connected to the sewer system in 1963. In 1973 city garbage collection began; the same year an underground power system was installed, replacing the old above ground lines (History Book Committee 1976, pp. 83-84).

Although roads into town were being "improved" as early as 1903, at the same time that the village streets were graded (Stiles and Stiles 1956, p. 81), the result was probably a passable dirt road replacing a trail. Not until the early 1930s was State Highway 30 through Maddock graveled (Stiles and Stiles 1956, pp. 95-96). Five blocks of the main street were paved in 1940, but for want of maintenance had deteriorated to a graveled surface by the early 1950s (Stiles and Stiles 1956, p. 98). Highway 30 was paved in 1958, and the town's streets were paved five years later (History Book Committee 1976, pp. 309, 312). The improvement of rural roads enabled Maddock's trade area to expand at the expense of smaller towns in the area, and contributed in this way to the maintenance of Maddock's population.

By the summer of 1911, when it celebrated the tenth anniversary of its founding, Maddock had a total of 53 businesses (Stiles and Stiles 1956, p. 74), as shown in Figure 10. Table 5 lists certain businesses which were present in Maddock at various times. These businesses were

TABLE 5

SELECTED MADDOCK BUSINESSES, 1911-1976

1911:	1 bank 2 blacksmith shops 6 elevators 1 feed mill 2 hardware stores	1 harness shop 2 implement dealers 2 lumberyards 1 veterinarian
1921:	2 banks 1 blacksmith shop 1 creamery 4 elevators 1 feed mill	1 hardware store 1 implement dealer 2 lumberyards 1 veterinarian
1955:	1 bank 1 creamery 2 elevators 2 hardware stores	3 implement dealers 1 iron works 1 lumberyard
1976:	1 bank 2 elevators 2 hardware stores	2 implement dealers 1 implement manufacturer 1 lumberyard

SOURCES: History Book Committee 1976, pp. 88-111; R. L. Polk & Co. 1921, pp. 256-57; Stiles and Stiles 1956, pp. 56-72, 74.

chosen to reflect the town's status as a farm trade center. Maddock actually had two banks for most of this period, but there was only one for about a year in 1910 and 1911 (Stiles and Stiles 1956, p. 92).

The town's population had grown considerably by 1921, but there were a dozen fewer businesses (R. L. Polk & Co. 1921, pp. 256-57).

Rural population had declined slightly from its peak in 1910, although farmers likely were able to get to town more often as the rural roads slowly improved. There was now only one blacksmith shop, as motors replaced horses. The number of elevators also declined. This decline

in the number of elevators was usually accompanied by periodic increases in the storage capacity of those which remained, however. A new business on the list was the creamery, which became one of the town's more important employers.

More than 30 years later, in the mid-1950s, Maddock had virtually the same total number of businesses as in 1921 (Stiles and Stiles 1956, pp. 56-72). The town's population had continued to increase slowly, while a precipitous drop occurred in the farm population of five nearby townships, from 1400 in the 1920s to fewer than 800 in the mid-1950s. This decline in farm population, which continued until 1970, was probably offset by an increase in trade area size, as Maddock, the largest town for 20 miles in any direction, became more accessible. Main country roads were graveled and some eventually paved. By 1955 the number of elevators had declined to two, but capacity kept increasing. When both structures were destroyed by fire in 1957, each was rebuilt the same year with twice its previous capacity (History Book Committee 1976, p. 308).

During the next 20 years Maddock's population first declined slightly and then grew to a record level. By 1976 there were still fewer businesses than in 1955 (History Book Committee 1976, pp. 8-11). Two major changes during this period were the closing of the creamery and the growth of Summers Manufacturing Company. The creamery ceased operations in 1968 because it could not obtain enough milk from its supply area (History Book Committee 1976, p. 97). Loss of jobs from this closing was balanced by the growth of the Summers company, which is a successor to the Maddock Iron Works and manufactures harrows and hoists (History Book Committee 1976, p. 88).

Maddock has maintained its status as a farm trade center. Its population level has been remarkably stable during the last 50 years, and its population change has conformed closely to the values predicted by the model. Those businesses which are highly dependent on farm trade, while fewer in number now than 50 years ago, are for the most part larger and more firmly established.

Hunter

Hunter is located in the Red River Valley in northern Cass County, only 31 miles from Fargo, the state's largest urban center (Figure 11). Hunter's 1970 population of 362 represents a net decrease of 15% since 1920. The town of Arthur, which was smaller than Hunter until 1970, lies only six miles south. Prior to 1970 there was no larger town within 16 miles.

Hunter had a very constant population total from 1920 to 1960, but declined considerably in the 1960s, as shown in table 6. A major

TABLE 6

POPULATION DATA FOR HUNTER, NORTH DAKOTA, 1900-1970

Year	Population	Percentage change	Residual
1900	407	--	--
1910	365	-10.3	--
1920	424	16.2	--
1930	406	- 4.3	3
1940	414	2.0	- 7
1950	417	0.7	- 1
1960	446	7.0	11
1970	362	-18.8	- 8

SOURCES: U.S. Bureau of the Census 1913, N.D. chapter 1, table 1; 1921, table 53; 1931, N.D. table 4; 1942a, N.D. table 4; 1952a, table 6; 1963, table 7; 1973, table 6; U.S. Census Office 1901, N.D. table 5.

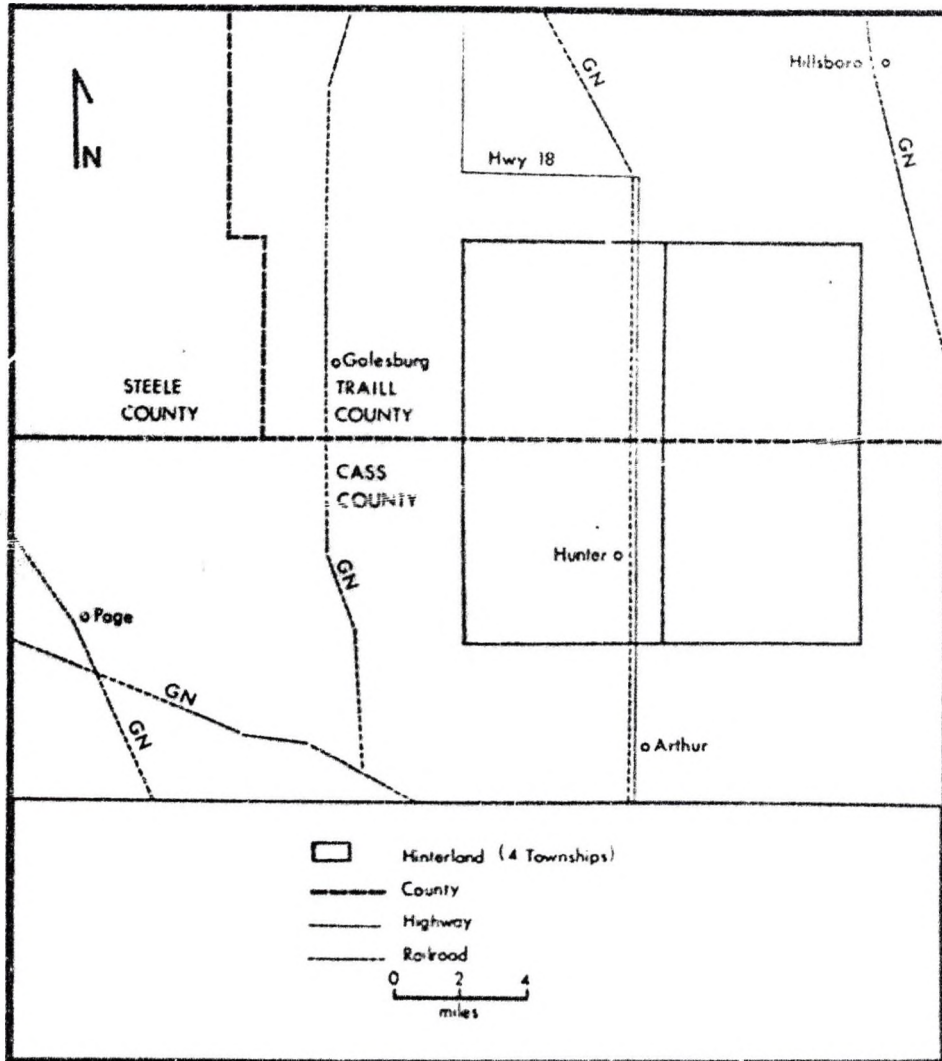


Fig. 11. Hunter and Its Vicinity.

change for the town in that decade was the closing of the high school (Battagler 1976, n.p.). Consolidation with Arthur's school system meant that only the first six grades would be taught in Hunter.

Hunter began in 1880, when a branch line of the Northern Pacific railroad (soon transferred to the Great Northern) was constructed north from Casselton. Like Maddock it has always depended for its continued existence upon patronage of its businesses by area farmers. By 1887 Hunter had 30 businesses (Figure 12), including four elevators and three implement dealers (Battagler 1976, n.p.). This is an extraordinary number of firms, considering the town's population of less than 200 three years later, unless a sudden drop in population took place in the period after the Great Dakota Boom. Selected businesses present in Hunter in 1887 and later years are shown in table 7.

As the turn of the century approached, Hunter had doubled its population, and the number of businesses reached 40. The number was soon reduced, however, by a fire which destroyed all but one of ten stores on a downtown block (Cass County Historical Society 1976, p. 459). The rural population density around Hunter reached its maximum in 1900, and has been declining steadily since.

By 1976 great changes in the types of businesses found in Hunter had taken place, yet the town's population was about the same as in 1900. There was one elevator company left, but its storage capacity exceeded that of the six 1899 elevators. Two implement dealers remained. The Nodak Bag Company, which began making burlap bags in 1967 and converted to woven polypropylene bags in 1973, provided employment for 6 to 15 workers, depending on the season (Battagler 1976, n.p.). Hunter is

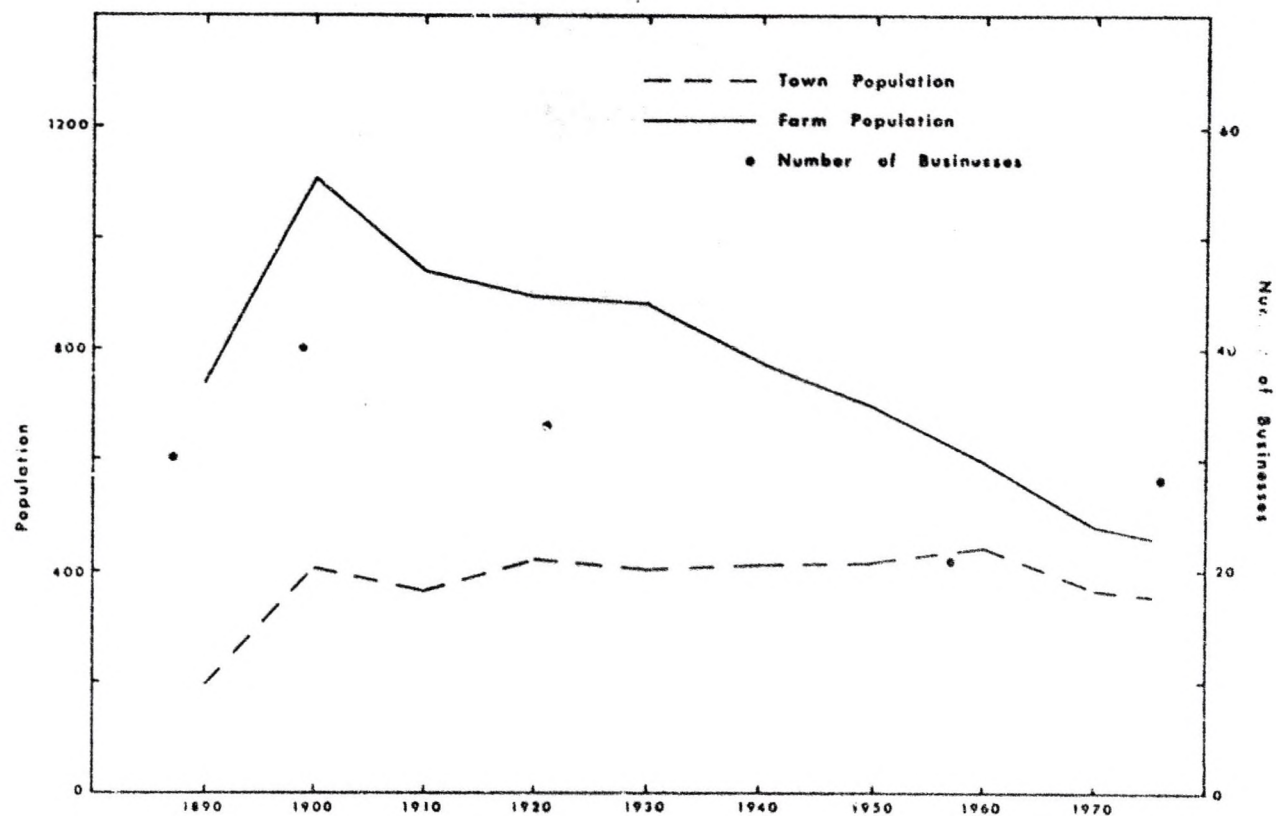


Fig. 12. Town Population, Farm Population, and Number of Businesses, Hunter, North Dakota: 1887-1976.

SOURCES: Population. U.S. Bureau of the Census 1913, N.D. chapter 1, table 1; 1921, table 53; 1931, N.D. table 4; 1942a, N.D. table 4; 1952a, table 6; 1963, table 7; 1973, table 6; 1977; U.S. Census Office 1901, N.D. table 5. Business functions. Battagler 1976; Cass County Historical Society 1976, p. 459; Crothers 1958, p. 79; R. L. Polk & Co. 1921, p. 227.

TABLE 7

SELECTED HUNTER BUSINESSES, 1887-1976

1887:	1 bank	1 hardware store
	2 blacksmith shops	3 harness shops
	1 carriage and wagon maker	3 implement dealers
	4 elevators	1 lumberyard
1899:	3 blacksmith shops	1 harness shop
	6 elevators	2 implement dealers
	1 foundry	1 veterinarian
	1 hardware store	
1921:	2 banks	1 implement dealer
	2 blacksmith shops	2 livestock shippers
	4 elevators	2 potato shippers
	1 harness shop	1 veterinarian
1957:	1 bank	1 hardware store
	1 blacksmith shop	2 implement dealers
	1 creamery	1 lumberyard
	1 elevator	
1976:	1 bank	1 lumberyard
	1 elevator	2 manufacturers
	2 implement dealers	

SOURCES: Battagler 1976; Cass County Historical Society 1976, p. 459; Crothers 1958, p. 79; R. L. Polk & Co. 1921, p. 227.

still a viable farm trade center, although its trade area is restricted by the proximity of other small towns.

Marmarth

The unique town is situated in southwestern Slope County on U.S. Highways 2 and 12 and the line of the Chicago, Milwaukee, St. Paul and Pacific railroad, better known as the Milwaukee Road (Figure 13). Its 1970 population of 247 represents a decrease of 81% from the 1920 figure (table 8). Glendive, Montana, 67 miles to the northwest, is the

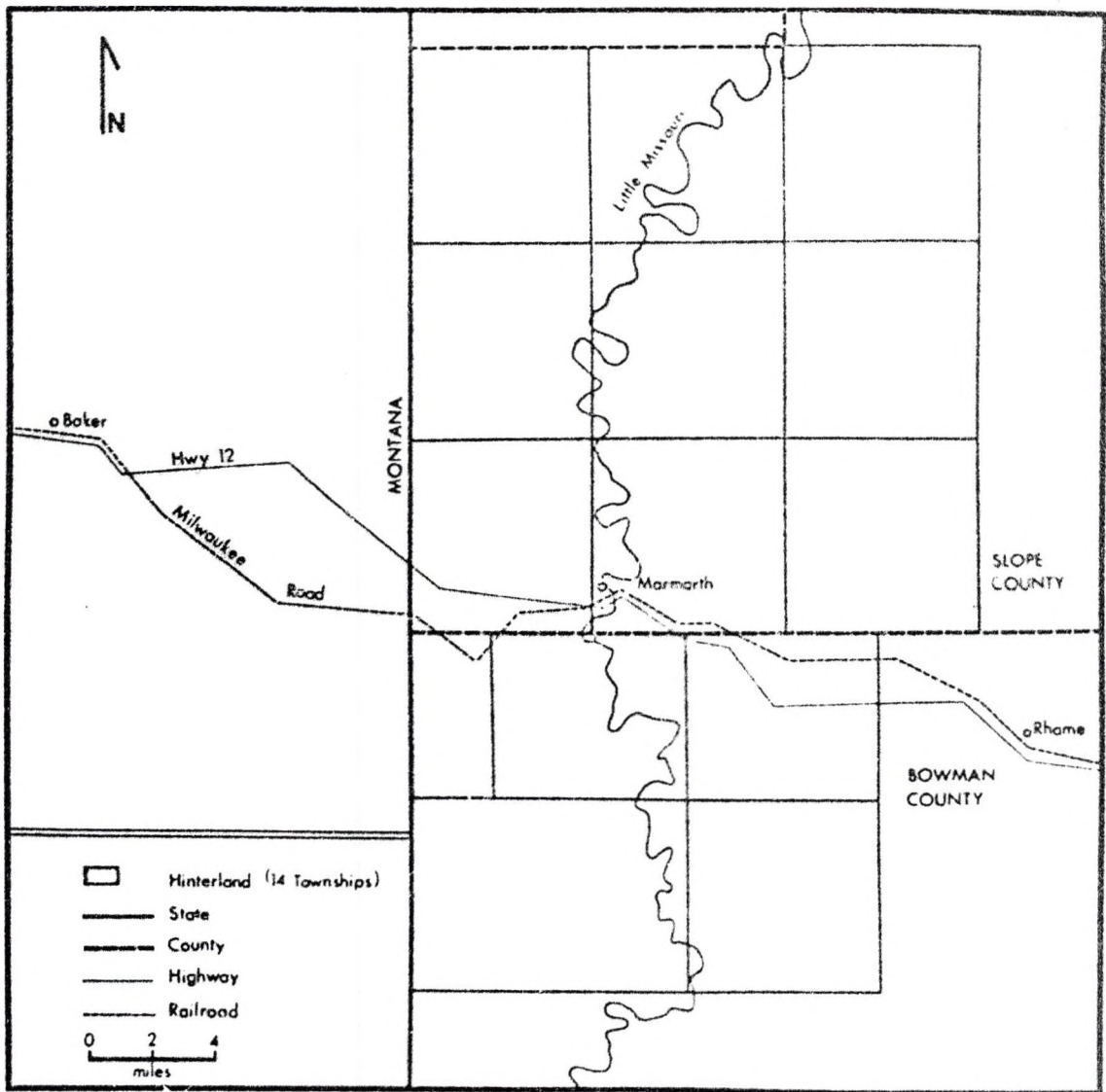


Fig. 13. Marmarth and Its Vicinity.

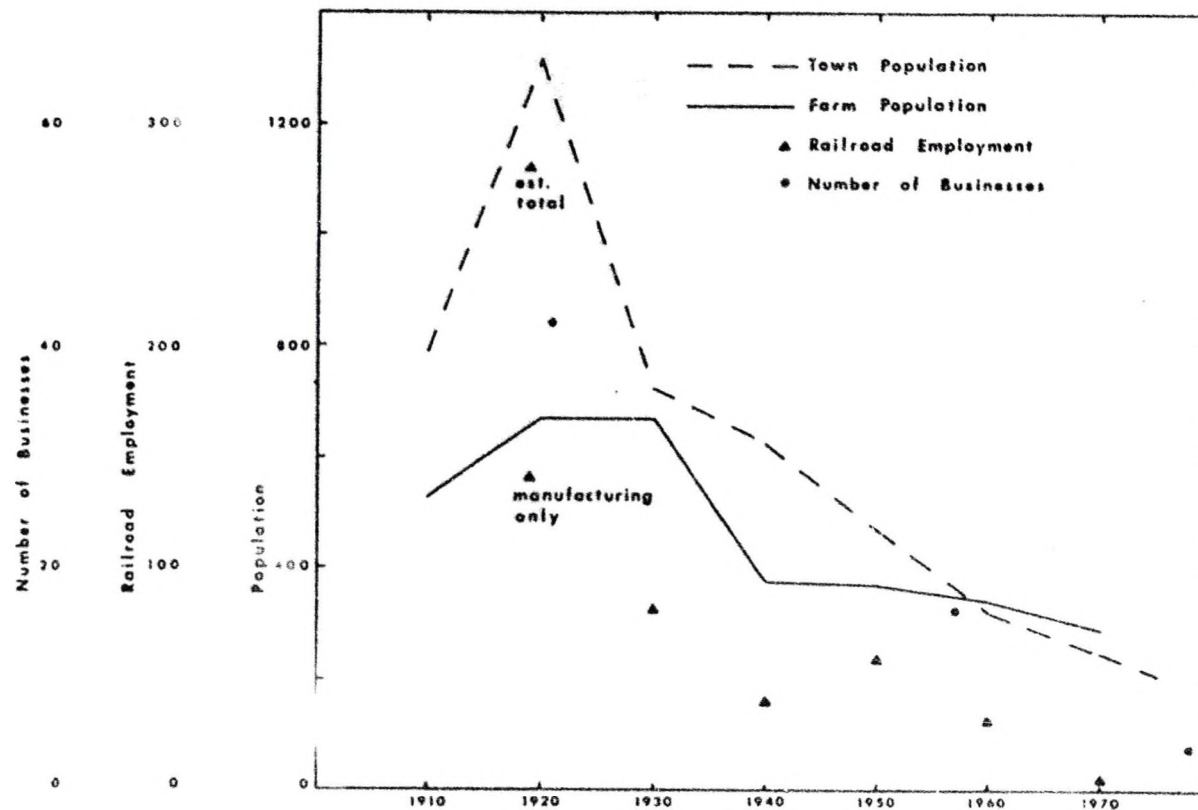


Fig. 14. Town Population, Farm Population, Number of Businesses, and Railroad Employment, Marmarth, North Dakota: 1910-1978.

SOURCES: Population. U.S. Bureau of the Census 1913, N.D. chapter 1, table 1; 1921, table 53; 1931, N.D. table 4; 1942a, N.D. table 4; 1952a, table 6; 1963, table 7; 1973, table 6; 1977. Business functions. Crothers 1958, p. 97; Northwestern Bell Telephone Co. 1978, pp. 77-78; R. L. Polk & Co. 1921, p. 263. Employment. U.S. Bureau of the Census 1923; N.D. tables 2 and 3; 1932a, N.D. table 20; 1943, N.D. table 23; 1952a, table 43; 1963, table 85; 1973, table 123; Hope Saga Committee 1976.

employees whom the census classified as engaged in manufacturing, that is, in the category of "cars and general shop construction and repairs by steam-railroad companies."

No figures were available for the number of other employees, but it must have been substantial. A great many of the Marmarth family histories in a recent Slope County compilation (Slope Saga Committee 1976, pp. 462-530 *passim*) mention family members employed in a variety of railroad occupations, including engineer, brakeman, fireman, conductor, clerk, switchman, and telegraph operator. One young man employed as a call boy had the duty of summoning 24 engine crews to work during his 12-hour shift. The total number of railroad employees in 1919 was probably double the number employed in "manufacturing," or about 280. When one adds to this figure the dependents that many of the men had, it is clear that the majority of Marmarth residents depended directly upon the railroad for their livelihood.

Marmarth was certainly prosperous from 1915 to 1920. The town could boast of one of the state's first water and sewer systems, built in 1918. An electric light plant began operation in 1915, the same year that one Marmarth entrepreneur began a taxi service. In 1916 a highway bridge was constructed across the Little Missouri, making the town accessible from the east by road (Slope Saga Committee 1976, pp. 423, 461).

Farm trade was not very important to Marmarth, to judge from its businesses (table 9). There was but one elevator in 1921, and not a single implement dealer. In part, however, this reflects the difference between the needs of ranchers and those of crop farmers.

TABLE 9
SELECTED MARMARTH BUSINESSES, 1921-1978

1921:	1 elevator 1 bank	2 hardware stores 1 lumberyard
1957:	1 elevator	1 lumberyard
1978:	none	

SOURCES: Crothers 1958, p. 97; Northwestern Bell Telephone Co. 1978, pp. 77-78; R. L. Polk & Co. 1921, p. 263.

While the town was for a time a shipping point for sheep and cattle, and also had feeding facilities for livestock being shipped from the west by rail, ranching never supported a large population such as that which lived on the croplands around Maddock and Hunter (Figure 14). Rural population density near Marmarth was only 1.4 per square mile in 1920 and 1930, dropping to 0.8 in 1940. Thus to a very great extent the railroad kept the town going.

During the 1920s there was a sharp decrease in the number of railroad employes (Figure 14). The decade was punctuated by a strike of the carmen and machinists' union in 1922, after which many of the workers were never rehired (Slope Saga Committee 1976, p. 423). A few years later Marmarth was eliminated as a division point; many residents moved to Mobridge, South Dakota, where the railroad continued to have a major facility (Slope Saga Committee 1976, pp. 462-530 passim).

As railroad employment continued to decline in the following decades, more families moved away. By 1978 there were only four places of business: two taverns, a cafe, and a service station (Northwestern

Bell Telephone Co. 1978, pp. 77-78). In 1950 and again in 1960 Marmarth had one of the lowest levels of per-capita retail sales-tax receipts in the state. The sparse farm population could easily drive on U.S. 12 west to Baker, Montana or east to Bowman, both thriving trade centers, to satisfy its shopping needs.

Beulah

Beulah is both the youngest and the largest of the towns examined in this chapter. Its 1970 population of 1,344 was nearly two and one-half times that of 1920. In the last few years the population has increased rapidly. An estimated 3,400 people lived in Beulah in October 1979 (Rogers 1979). Located in Mercer County, Beulah is situated about 60 miles northwest of Bismarck-Mandan, the nearest urban center. Hazen, Beulah's rival in Mercer County, is only eight miles to the east (Figure 15).

Determination of the town's population total is complicated by the presence of numerous residents outside the city limits in 1930, 1940, and 1950. Township 144 North, Range 88 West, from which Beulah is incorporated, had a population of 801 in 1940, far more than would be expected in a North Dakota township if it consisted entirely of farms (U.S. Bureau of the Census 1942a, N.D. table 4). There was no separate, unincorporated town nearby, and the 1940 census listed only 246 farm residents of the township (U.S. Bureau of the Census 1943, N.D. table 28). The remaining 555 people may be considered as part of Beulah's population, in addition to the 913 who were living within the incorporated area.

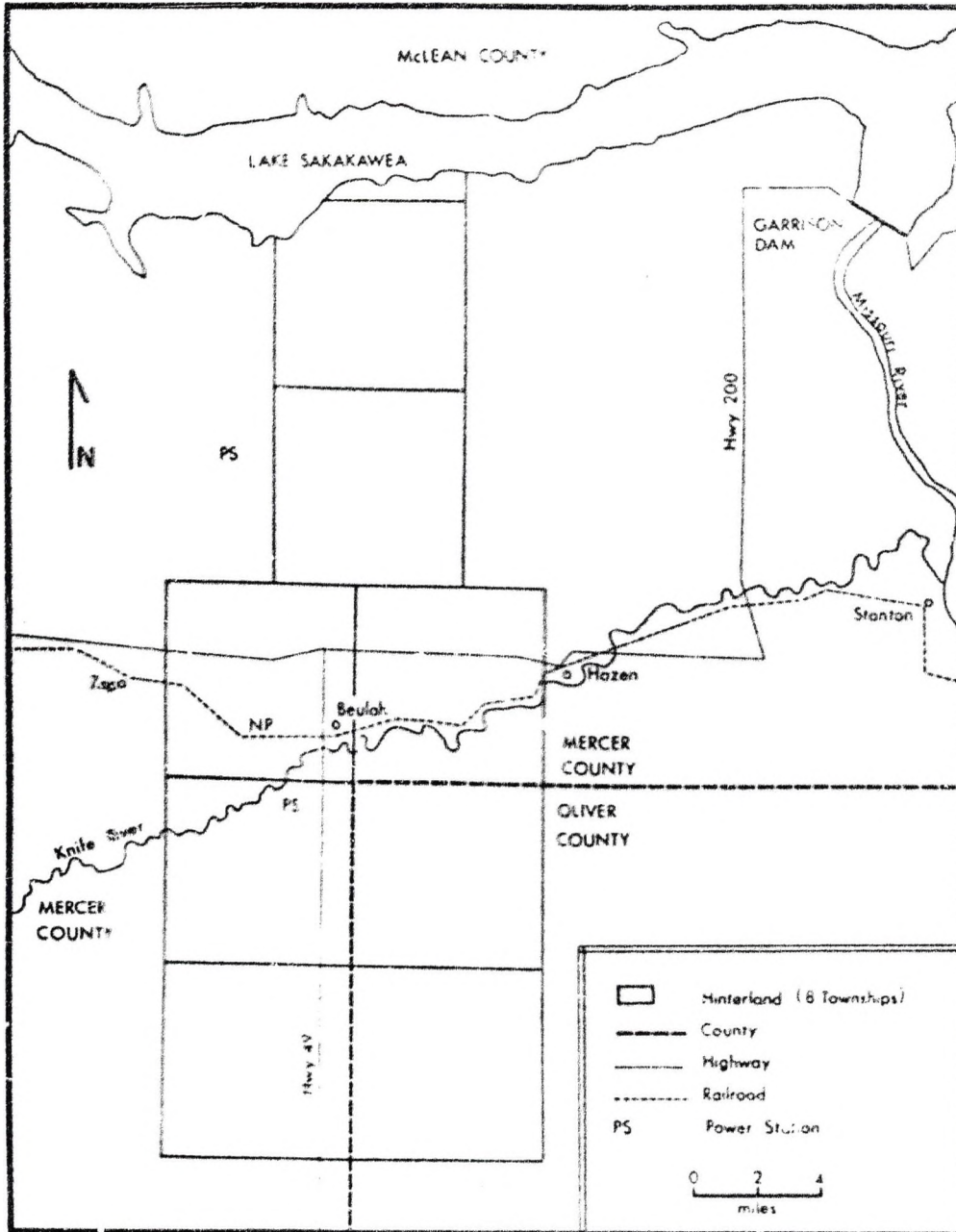


Fig. 15. Beulah and Its Vicinity.

Similarly, the 1930 census recorded 640 residents in Township 144-88 (U.S. Bureau of the Census 1931, N.D. table 4). This census did not enumerate the farm component of the population for unorganized townships, however. One may estimate this component to be equal to the average of the populations of three neighboring townships: 144-87, 145-87, and 146-87. This procedure may also be used for the 1950 census figures, but later censuses did not give separate population figures for unorganized townships, so one must assume the official town population to be inclusive. Population data for Beulah is summarized in table 10. The estimated total population, shown in parentheses for 1930, 1940, and 1950, includes the non-farm component of Township 144-88.

TABLE 10

POPULATION DATA FOR BEULAH, NORTH DAKOTA, 1920-1979

Year	Population	Percentage change	Residual
1920	552	--	--
1930	913 (1300)	65.4	38
1940	942 (1500)	3.2	- 5
1950	1501 (1800)	59.3	41
1960	1318	-12.2	-14
1970	1344	2.0	10
1977*	1611	--	--
1979**	2311	--	--

*March

**January

SOURCES: Energy Development Board of Mercer County 1979, p. 6; U.S. Bureau of the Census 1921, table 53; 1931, N.D. table 4; 1942a, N.D. table 4; 1952a, table 6; 1963, table 7; 1973, table 6; 1978.

Railroads, other than the main line of the Northern Pacific, were not built west of the Missouri River in North Dakota until the twentieth century. The branch from Mandan serving Mercer County was laid in 1913, but it did not come to an unpopulated land (Figure 16). Even in 1900 the townships near the Missouri River had a substantial farm population, probably a result of accessibility to water transport. By 1910 the townships in the vicinity of Beulah had a population density of more than five per square mile; this would not increase much in the next two decades.

There were no towns except Stanton, the county seat of Mercer County on the Missouri River, until the railroad arrived. Beulah grew rapidly as a trade center for farms to the north and south. Its trade area likely was elongated in a north-south direction because of the proximity of Zap to the west and Hazen to the east.

The continuing importance of agriculture to the town is apparent from the lists of businesses (table 11). While the farm population in nearby townships has decreased by more than 60% since 1930, Beulah's trade area has probably expanded westward into an area which has no towns of comparable size, but its eastward expansion is blocked by Hazen.

Another important factor in the local economy has been mining. The Beulah Coal Company was established in 1917 and employed 25 men that year. Five years later it was reorganized as the Knife River Coal Company (Heinemeyer 1932, p. 57). Mining was carried on underground until 1952, when a stripping operation was begun at the North Beulah Mine. A second operation, the South Beulah Mine, began

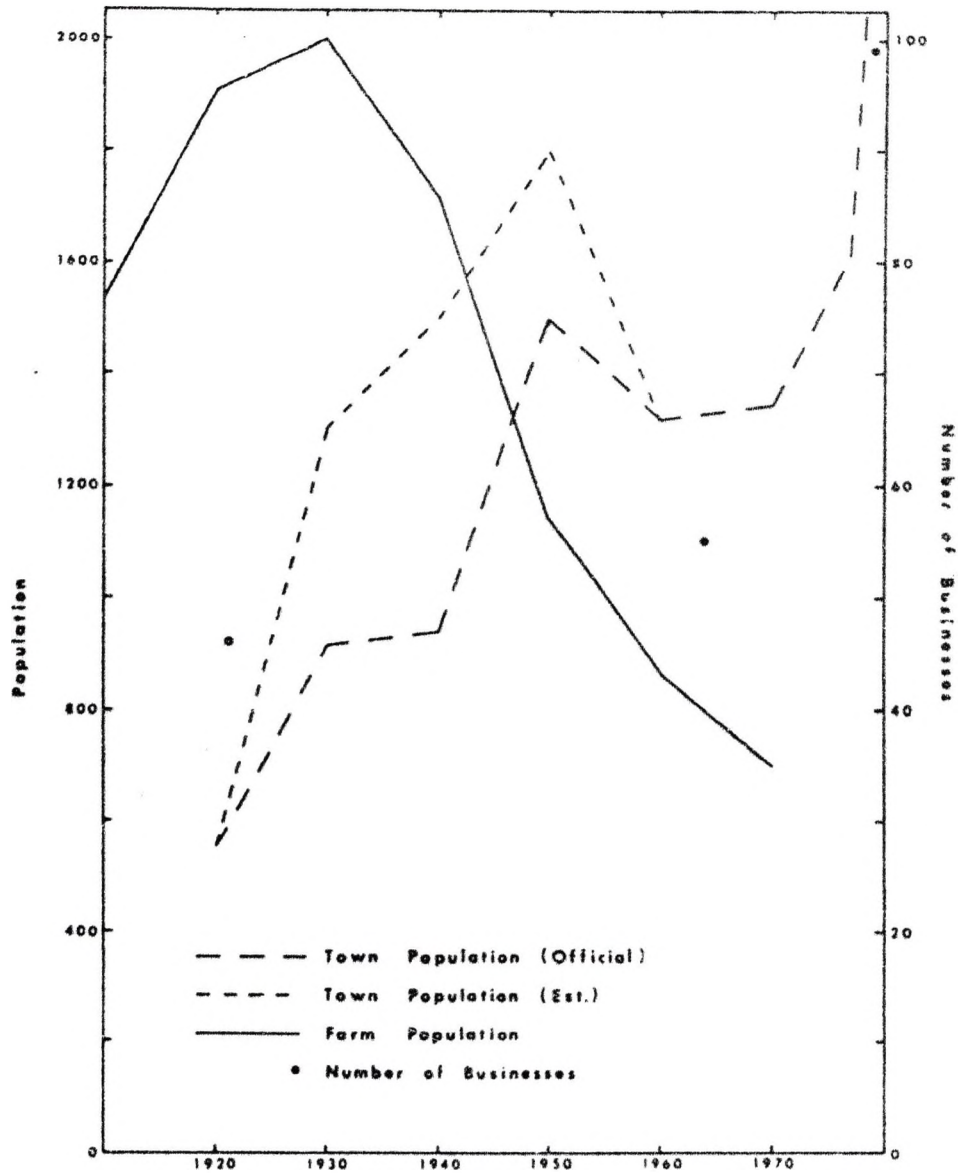


Fig. 16. Town Population, Farm Population, and Number of Businesses, Beulah, North Dakota: 1920-1979.

SOURCES: Population. Energy Development Board of Mercer County 1979; U.S. Bureau of the Census 1913, N.D. chapter 1, table 1; 1921, table 53; 1931, N.D. table 4; 1942a, N.D. table 4; 1943, N.D. table 23; 1952a, table 6; 1963, table 7; 1973, table 6; 1977; 1978. Business functions. Beulah, North Dakota Jubilee Book Committee 1964, passim; R. L. Polk & Co. 1921, p. 112; West River Mutual Aid Telephone Corporation 1979, pp. 10-15.

TABLE 11

SELECTED BEULAH BUSINESSES, 1921-1979

1921:	2 banks	1 hardware store
	1 blacksmith shop	2 implement dealers
	4 elevators	2 lumberyards
	1 feed mill	1 poultry breeder
	1 feed store	
1964:	1 bank	1 hardware store
	1 blacksmith shop	4 implement dealers
	1 creamery	1 livestock auction market
	2 elevators	1 lumberyard
1979:	1 bank	1 livestock exchange
	1 elevator	1 lumberyard
	1 fertilizer plant	1 savings and loan association
	3 hardware stores	1 veterinarian
	3 implement dealers	

SOURCES: Beulah, North Dakota Jubilee Book Committee 1964, passim; R. L. Polk & Co. 1921, p. 112; West River Mutual Aid Telephone Corporation 1979, pp. 10-15.

production in 1963 (Beulah, North Dakota Jubilee Book Committee 1964, pp. 102-3). Employment from these operations was lower in the 1960s than earlier (table 12). Mercer County figures include employment at other mines, notably that of the North American Coal Company near Zap.

Coal became more important to Beulah in the second half of the 1970s; Two large lignite-fueled generating plants were under construction in 1979, Coyote Station two miles southwest and Antelope Valley Station eight miles north of Beulah. An additional plant is planned at each of these sites, and the first coal gasification plant in the United States will be built near the Antelope Valley station in the 1980s. An estimated 2,400 construction workers were employed at

TABLE 12

MINING EMPLOYMENT, BEULAH AND MERCER COUNTY, NORTH DAKOTA,
1930-1979

Year	Beulah	Beulah County
1930		221
1931-32	206	
1935	165	
1940		231
1942	108	
1950		189
1960		101
1964	58	
1970		115
1979		393

SOURCES: Beulah, North Dakota Jubilee Book Committee 1964, pp. 102-3; Energy Development Board of Mercer County 1979, p. 9; Heinemeyer 1932, p. 57; U.S. Bureau of the Census 1932a, N.D. table 20; 1943, N.D. table 23; 1952a, table 43; 1963, table 85; 1973, table 123.

these sites in October 1979. Of these, about 65% resided in Mercer County, most at Beulah or Hazen (Rogers 1979).

This recent growth at Beulah is immediately apparent to a visitor. Single-family housing has been built on several acres on the north side of town, and more is planned. Other development includes apartment buildings and a housing complex for unmarried construction workers. A 24-unit condominium is also planned (Rogers 1979).

Commercial activity has also increased rapidly. By 1979 there were a dozen construction firms in town, as well as numerous ancillary businesses specializing in surveying, concrete pouring, paving, plumbing and heating, electrical work, and interior decorating. There were

five real estate agencies and a development company. Along State Highway 49 just north of town is a new Best Western motel and restaurant. Beulah also has a radio station (West River Mutual Aid Telephone Corporation 1979, pp. 10-15).

Two miles north of Beulah, at the junction of highways 49 and 200, are two implement dealers and a lumberyard. This is a fairly common occurrence near North Dakota farm trade centers and illustrates the influence of modern highways in decentralizing farm-related businesses.

Summary

These studies of individual towns complement the statewide perspective provided by the analysis in chapter III. It is apparent that many factors, such as business activity, farm population change, and specialized economic activities such as mining, manufacturing, and transportation facilities have contributed to the growth or decline of towns in addition to those factors examined in the previous chapter. This helps account for the low degree of explanation provided by the independent variables.

Most North Dakota towns resemble more closely Maddock and Hunter than Beulah or Marmarth. They are almost solely farm trade centers and reflect this status in the business functions to be found there. They were founded with the arrival of the railroads and most grew rapidly for a short time. Many have, like Hunter, lost population in recent years, but have retained their status as trade centers. Few have ceased to perform central place functions.

The low residuals of towns such as Maddock and Hunter are indicative of the fact that they have been little influenced by activities

not related to their trade center status. In contrast, the population changes experienced by Marmarth and Beulah are a result of their unusual situations. Marmarth grew very rapidly as a railroad division point in an area of scant farm population. When railroad employment plummeted, the town, having no other major source of employment, experienced a drastic loss of population. Beulah has always been a combination of farm trade center and mining town, and would have a sizeable population even without the nearby deposits of coal, which provide the basis for its unusual growth.

It must be reiterated that towns such as Marmarth and Beulah are exceptional in North Dakota. Most small towns are dependent on agriculture and the businesses it supports.

CHAPTER V

SUMMARY

The review of literature showed that geographers have theorized about how towns should be distributed in a homogeneous landscape if they function as trade centers for the farm population surrounding them. While not distributed uniformly in an unchanging landscape, most North Dakota towns would seem to fit into the category of farm trade centers. Factors held constant in the idealized central place landscape suggested possible variables for inclusion in an analysis of population change. These factors, such as population size, distance from other centers, and trade functions, also figured in studies of actual central place systems. Previous studies of population change suggested that a profitable method of analysis would combine the use of these factors with a long time period. It was concluded that the best period for a study of North Dakota towns as a whole would extend from 1920 to 1970, while the entire history of individual towns could be considered in case studies.

Chapter III began with a definition of the size limits used in the study, justifying the exclusion of urban places and those with fewer than 250 inhabitants. The method of analysis was multiple correlation and regression, which not only tested the degree and significance of the relationship between the independent variables and population change, but computed the equation which would best account for

each town's population change in terms of the values of the independent variables and found the residual, or amount of deviation from the value predicted by the formula.

For the initial analysis, four independent variables were chosen. These included town population size at the beginning of a decade, distance to the nearest town of equal or larger size, distance to the nearest urban center, and percentage change during the decade in the value of farm land and buildings. The analysis was conducted for each of the five decades from 1920 to 1970, with all towns included that met the size limits.

Each of the four independent variables was significant at the 10% level or better for two or more of the five decades studied, but each showed a different trend of relationships to population change with time. Size of place was only important during the last two decades, when it showed a positive relationship to population change. This may indicate that smaller towns were at a competitive disadvantage with larger ones when the mobility of rural consumers permitted a greater range in the choice of trade centers.

Distance to the nearest place of similar or larger size was significant at the 5% level or better for the first four decades, showing a positive relationship to population change. Apparently, nearby places of similar size were competing with one another. The other distance variable, which involved urban places, was also significantly related to population change during four decades. In this case, however, the relationship was positive at first, indicating competition of urban centers with small towns, but became negative

during the 1950s and 1960s. This negative relationship points to a possible suburbanization of some small towns.

Change in farm value showed a strong positive relation to town population change during the 1920s and 1930s, when farm values dropped drastically. A slight negative relationship existed during the 1960s.

A discussion of residuals revealed the complexity of the factors that influence the population change of individual towns. Local and regional economic specializations, such as manufacturing, construction, and mineral extraction, contribute to anomalous changes, both positive and negative, in town populations.

The towns were next divided into three population size categories, and two additional distance variables were introduced. This modification did not add to the explanation of population change, although it was noted that distance to nearest urban place showed a changing relationship to the population change of towns in the smallest size group, 250-399.

Another variable, per-capita retail sales-tax receipts, was used as a substitute for the strength of towns as farm trade centers. This variable had a significant positive relationship to population change during the last two decades of the study, the only period for which data were available.

A final variable, county seat status, was compared with population gain or loss by means of a Chi-square test. It was found that county seats of 400 to 2,500 population were more likely to grow than non-county seats of similar size during the 1930s, 1940s, and 1950s.

Four towns of different ages and growth patterns were examined in chapter IV, with particular attention paid to their status as farm

trade centers and to other sources of employment for the residents. Each town was considered from its beginning to the present day.

Maddock, which exemplifies the North Dakota farm trade center, was examined in more detail than the other towns. From its almost explosive growth with the arrival of the railroad until the present it has been a market place for nearby farmers, and has retained numerous functions even as the rural population has declined sharply. Maddock's population since 1920 has been slowly rising, and its degree of change fits very closely the values predicted by the model equation. The presence of a county agricultural school added to Maddock's vitality until the late 1960s.

Hunter, a smaller and older town than Maddock, has also functioned almost exclusively as a trade center since its founding in 1880. Trade functions have decreased in number since 1900, but the town population level has been very stable until recently. Hunter probably suffers more than Maddock from the competition of nearby centers.

Marmarth is an exceptional town which owed its swift early growth to its status as a division point on the Milwaukee Road. By 1920 over 200 Marmarth residents were railroad employees. The town was situated in an area with a very small farm population, however, and Marmarth had few farm trade functions. When railroad employment declined beginning in the 1920s, the town had no other economic base, and the population had dropped to 200 by 1975.

The final town examined in chapter IV, Beulah, would also be exclusively a farm trade center, like Maddock and Hunter, were it not for the presence of lignite coal in the vicinity. Mining employment

contributed to Beulah's growth in the past, and today the development of lignite-fueled generating plants nearby has swelled the town's population to urban size.

The presence of places such as Marmarth and Beulah complicates the picture of town population change in North Dakota, and helps account for the low degree of explanation obtainable through the use of a few variables. Even trade centers such as Maddock may exhibit unexplainable changes in size, however.

It is hoped that this study will contribute to knowledge of North Dakota and of towns in general. Other researchers may desire to expand and refine the analysis begun here, perhaps through the discovery and testing of additional significant factors. Further analyses might include consideration of the age structure of town populations and more precise delimitation of trade areas, with attention being given to variations in rural population density and income in different parts of the state.

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