FACTORS AFFECTING THE SIZE AND LOCATION OF NUCLEATED SETTLEMENTS IN AN IRRIGATED AGRICULTURAL AREA
A Case Study of the South Saskatchewan River Project Area

by

JEAN CRAWFORD DOWNING

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Abstract

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IN AN IRRIGATED AGRICULTURAL AREA

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The purpose of this thesis is to examine the factors affecting the size and location of urban and rural nucleations in an irrigated agricultural area. The locale selected for study is an area in Central Saskatchewan which will become irrigable upon completion of the South Saskatchewan River Project - a multi-purpose project designed to provide irrigation for half a million acres of land, a source of hydro electric power, and a 150-mile long reservoir with an important recreation potential.

The approach is based on Christaller's theory of central places. This theoretical model assumes an "ideal" landscape, where the terrain is flat, there are no barriers to movement, land has equal fertility and population is distributed uniformly. The theory explains the settlement pattern as a hierarchy of central places, classified by functions, and arranged spatially in a regular pattern of interlocking hexagons. The applicability of the theory is examined in two agricultural areas - Southwest Wisconsin (based on a study by John E. Brush) and Saskatchewan (based on a study by the Royal Commission on Agriculture and Rural Life). These studies conclude that the central place theory provides a useful framework of analysis against which to measure deviations and to explain
Experience in planning for nucleated settlements in irrigated areas is not extensive. As a means of pointing up some of the problems of Saskatchewan development by comparison and by contrast, consideration is given to selected experience in regional planning in the Netherlands Polders and in Israel. Studies related to development of the Columbia River Basin in the State of Washington are also considered. The experience elsewhere shows, particularly, the essential relationship of settlement planning to a clearly formulated policy of comprehensive development, the necessity for planning location and size of urban and rural nucleations in relation to the employment base for the region, and the importance of development sequence to effective implementation of a plan.

With this theoretical and actual experience in planning for nucleated settlements elsewhere as a background, the present settlement pattern in the South Saskatchewan River Project area is then analyzed, using a functional classification of central places as the starting point, considering the size and shape of service areas, and the factors which distort the pattern from the theoretical model of Christaller. The effects of soil condition, hydrographic factors and transportation are discussed and illustrated by maps.

Use of the service center analysis for planning purposes is then considered. It is apparent that the theory provides a system of hierarchical classification that is valuable for analytical purposes to provide an understanding of service center relationships, and that the
delineation of trading areas is a further useful tool. The changes which may be brought about by the South Saskatchewan River Project can then be projected, not by a forced attempt at formal adherence to a theory, but by reasoned consideration of the impact of a more intensive agricultural use and recreational potential on particular parts of the region. The method is one of expanding and adjusting service center areas, based on such factors as the population to be served, road distances between service centers, and comparative drawing power of larger centers. This permits proposals to be made for general location of service centers of different levels in the hierarchy, reclassification of some existing centers, and desirable sequence of development.

The value of the study lies in the practical application of the theoretical concept - its use in planning the nucleated settlement pattern of the future. Such planning is advantageous to the region, in permitting more efficient development, with a minimum number of central places of appropriate rank to serve the population. It is also advantageous to the central places in clarifying the opportunities and limitations of their respective roles. Each center is then in a position to develop its functions with the conscious goal of full achievement of appropriate service center status.

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Department of Community and Regional Planning,
The University of British Columbia,
Vancouver 8, Canada.

Date May 12, 1957.
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Data essential to the study was obtained from Mr. B. Sufrin, economist in charge of research on proposed local government administrative boundaries, for the Local Government Continuing Committee, Regina, Saskatchewan. His willing cooperation was invaluable.

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INTRODUCTION
INTRODUCTION

The decision by the Government of Canada and the Government of Saskatchewan, in the fall of 1958, to undertake construction of the South Saskatchewan River Project suggested the subject of the present study. This multi-purpose project, which has been mooted for many years, will provide irrigation for about half a million acres of land in Central Saskatchewan, power generating facilities, and a reservoir with an important recreational potential. Such a Project may be expected to produce dramatic changes both in the areas to be irrigated and throughout the Province.

The South Saskatchewan River rises on the eastern slopes of the mountains in Alberta and flows through the southern part of Saskatchewan, turning north at the "elbow" of the river and proceeding through Saskatoon to its junction with the North Saskatchewan River east of Prince Albert, from whence the Saskatchewan River flows to Lake Winnipeg. The integrated development of the entire river basin has been advocated, as a means of realizing the maximum potentialities of the river and its tributaries.¹ Such a view is undoubtedly valid, but for purposes of the present study the Project is accepted as defined in the agreement between the Government of Canada and the Government of

Saskatchewan.

The present study is focused on the impact of the South Saskatchewan River Project on the pattern of nucleated settlements in the Project area. It is assumed that irrigation, power and recreation development in the Project area will create changes both in individual villages and towns and in their relative importance. By discussing the factors affecting the size and location of nucleations, an attempt is made to determine what some of these changes may be. The approach to the study is reviewed briefly in the Abstract.
Chapter 1
A THEORY OF LOCATION OF NUCLEATED SETTLEMENTS
AND ITS APPLICABILITY TO WISCONSIN AND SASKATCHEWAN

"The ideal hierarchy of community associations, centred in village, town, city or city sub-centre, is not to be thought of as something drawn out of the blue by the planner or the architect. It does really exist in the fabric of our society, and the geographical structure of this society must be thoroughly mastered if we are to discover and rectify its maladjustments and to elaborate principles of planning in accordance with its needs."

Robert E. Dickinson
Chapter I

A THEORY OF LOCATION OF NUCLEATED SETTLEMENTS AND ITS APPLICABILITY TO WISCONSIN AND SASKATCHEWAN

The analysis of settlement patterns has taken two major forms - the development of theoretical models, and the investigation of existing communities and their interrelationships. An early student of rural society described the community as "that territory with its people, which lies within the team haul of a given center".1 A few years later, Dr. C. J. Galpin introduced the technique of mapping to record the community relations of centers in Walworth County, Wisconsin. He concluded that the "trade zone about one of these rather complete agricultural civic centers forms the boundary of an actual, if not legal, community, within which the apparent entanglement of human life is resolved into a fairly unitary system of interrelatedness."2 Thus emerged the idea that a community could be defined both in spatial terms and in terms of functions.

The first comprehensive theoretical analysis of the settlement

2 The Social Anatomy of an Agricultural Community, Wisconsin Agricultural Experiment Station Research Bulletin 34, 1915.
pattern was developed by Walter Christaller, in 1933.\(^3\) He worked out a theoretical model, which he then tested by examining the actual settlement pattern in Southern Germany. Christaller's central-place theory is pertinent to the present study because it assumes an ideal landscape, that is, one which is flat, without impediments to movement, where the land has equal fertility, and where population is distributed uniformly. Such assumptions apply most closely to prairie regions with an agricultural base, such as the mid-western plains of North America.

Christaller's theoretical model has been used as the frame of reference for studies of nucleated settlements in many countries. The two studies which have particular interest and significance for the present analysis are the investigation of central places in southwestern Wisconsin and the study of service centers in Saskatchewan.\(^4\) This chapter will be devoted to a discussion of Christaller's theory and these two studies, as a basis for subsequent consideration of the settlement pattern of the South Saskatchewan River Project area, now and in the future.

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THE CENTRAL-PLACE THEORY

The theory of central places advanced by Walter Christaller is based on the idea that a hamlet, village, town or city develops for the purpose of providing services to a surrounding area of productive land. The services performed for the surrounding area are referred to as "central" functions, and the settlements as "central" places.

Christaller's theoretical model of the settlement pattern is based on assumptions which acknowledge only one variable - the number of functions in the central place. He assumes an "ideal" landscape, in which the topography is flat, land fertility is uniform, and the resources are equally distributed. Additional assumptions are that there are no physical or human impediments to mobility, that the rural population is evenly distributed, that all of the people have incomes adequate to be in the market for goods and services, that all goods and services in the area are offered by the central places, and that each central "good" has a uniform price.

Different types of goods and services require different levels of aggregate purchasing power, before they will be offered on the market. Each type of good will seek a market area sufficient in size to assure the requisite minimum demand. Given Christaller's assumptions of uniform population distribution and purchasing power, the size of the market area

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will vary from one good or service to another. This implies a hierarchy of centers, offering different ranges of central goods and services. The highest order centers offering highest order goods will have the largest market areas, while the lowest order centers offering a narrower range of goods will have the smallest market areas. Ideally, the tributary area of a hamlet would lie within the tributary area of a village, the tributary area of a village within that of a town, and the tributary area of a town within that of a city. Thus, the full range of goods would be available in all parts of the region.

The ideal spatial arrangement of central places is one which satisfies the maximum demand for all goods and minimizes the number of central places. For a central place in isolation, a circular tributary area with the central place in the middle is the most efficient shape. The introduction of additional centers would result, however, in either overlapping circles with duplicated services, or tangential circles with unserved interstitial areas. Christaller therefore advocated a hexagon as the most efficient shape for the tributary area of a central place, since it is the closest figure to a circle which will completely cover an area.

Towns offering a similar range of goods would be spaced at equal distances from each other, competing at the outer edges of their service area. At these border points, centers of a lower status would be able to offer local goods more efficiently. A center of a higher order would, therefore, have on the periphery of its service area six equally spaced centers of a lower order. Thus, in Christaller's
theory, central places of lower and higher orders would be arranged spatially in an interlocking series of hexagonal service areas.

Fig. 1. Theoretical Shape of Tributary Areas

Goods offered by the central places follow a gradation, varying with the size of the tributary area. As it is a stepped gradation, the settlements can be classified according to the goods they offer. The hierarchy of centers worked out by Christaller, based on South Germany, included seven classes of central place, ranging from a hamlet to a regional capital:

- Market Hamlet
- Township center
- County seat
- District city
- Small state capital
- Provincial head city
- Regional capital city

<table>
<thead>
<tr>
<th>Central Place</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Hamlet</td>
<td>M</td>
</tr>
<tr>
<td>Township center</td>
<td>A</td>
</tr>
<tr>
<td>County seat</td>
<td>K</td>
</tr>
<tr>
<td>District city</td>
<td>B</td>
</tr>
<tr>
<td>Small state capital</td>
<td>G</td>
</tr>
<tr>
<td>Provincial head city</td>
<td>P</td>
</tr>
<tr>
<td>Regional capital city</td>
<td>L</td>
</tr>
</tbody>
</table>

Marktort, Amtsort, Kreisstadt, Bezirksstadt, Gaustadt, Provinzhauptstadt, Landeshauptstadt
Fig. 2. Christaller's Theoretical Spatial Arrangement of a Hierarchy of Central Places

The corollaries of Christaller's theory involve several useful locational rules, based on the interlocking system of centers and the mathematical relationships of the hexagons:

1. The tributary area of any higher center invades the areas of the six nearby hamlets and supersedes the hamlet's services with services the hamlets do not provide.

2. Each center of a rank above the hamlet has a ring of six centers around it of the next lower rank. As the rank gets higher, a series of rings of all lower centers intervenes.

3. Each center of a lower rank is equidistant from three centers of a higher rank (but not necessarily of the same higher rank).
4. The number of centers in any given rank is twice the number of all higher ranking centers.

5. Each center of a higher rank has a service area three times as large as that of the next lower rank.

6. The distance between centers of each higher rank increased by $\sqrt{3}$.

Christaller proceeded from his theoretical model to an investigation of the distribution and characteristics of settlements in South Germany. It is unnecessary to detail herein his method or his findings, but his general conclusions are of interest. Where actual conditions most closely resembled the assumptions of the theory, the model provided a reasonable explanation of the settlement pattern. This occurred in thinly populated agricultural areas of flat terrain. The pattern broke down when the physical and human conditions diverged from the model. Industry, for example, seemed to be a more important factor than central service in some parts of Germany.

Subsequent studies of settlement patterns in various countries have shown some of the uniformities of Christaller's model and have revealed also deviations from it. The two major points on which the theory has been criticized are its failure to take into account the influence of industrial location or major transportation routes. In highly industrialized areas concentrations of industry often arise in response to availability of resources and transportation and, once established, attract further development. The central place pattern is thereby sometimes distorted beyond recognition.
Transportation routes, particularly railways, tend to create linear patterns in contrast to the areal pattern of central place services. Such a linear arrangement of centers changes the shape of tributary areas, elongating them with their long axes at right angles to the transport route. Where a second parallel transport route exists, the tributary areas may be squeezed back into roughly concentric form or into oval shapes with their long axes parallel to the railway line. In recent writings, Christaller acknowledges that transportation may exert an influence on the settlement pattern. He feels that this influence is limited to low-ranking centers, drawing them to the main route between higher ranking centers. In South Germany, Christaller argues that the settlements were established before transportation played a significant role and its effect is therefore negligible.

Other factors which distort the theoretical pattern include uneven distribution of resources, terrain differentiation, and hydrographic factors which may act either as a barrier to movement or as a cohesive factor. The effects of such factors were excluded from the theory by the original assumptions, so do not invalidate the theory, even though they account for divergence from the model. Also having a bearing on the location of settlements are political and economic considerations, chance selection of sites, and the historical persistence of centers over time.

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Despite the highly theoretical nature of Christaller's model, and the fact that local factors have been found to distort the theoretical expectations, the central-place concept remains a valuable analytical tool, providing a consistent framework of reference with which to investigate actual settlement and to measure deviations from a norm.

THE SETTLEMENT PATTERN IN SOUTHWESTERN WISCONSIN

The conditions assumed for the theoretical analysis of Christaller seemed to Dr. John E. Brush to be fulfilled as nearly as possible in the American Middle West. He felt that if the spatial arrangements worked out in theory were to apply to any actual pattern of settlement, it should be in agricultural areas removed from manufacturing and urbanizing influences. He therefore undertook an analysis of a portion of southwestern Wisconsin, selecting an area characterized by an even distribution of population and dependent on agriculture. In this dairy farming area the ratio of non-agricultural to agricultural employment was roughly 1 to 2, with most of the non-agricultural workers employed in trade and services in the agglomerated settlements.

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8 This section is based on John E. Brush, Ibid.
Fig. 3. Distribution of Agglomerated Settlements, Wisconsin

The 234 settlements included in the study area were assigned functional status by Brush on the basis of their particular sets of functions. The application of his functional criteria produced a threefold classification, including hamlets, villages and towns. The functional criteria for each of these three levels of center are outlined below.

**Hamlets** The hamlet was described by Brush as the smallest
agglomerated settlement. Using Trewartha's minimum requirements, he defined a hamlet in terms of three aspects—number of buildings in use, clustering, and number of retail or service units. The requirements were at least five residential structures or other buildings used for commercial or cultural purposes, clustered within ¼ mile linear distance, plus at least one but not more than nine retail and service units. The most typical functions in hamlets were found to be grocery stores and elementary schools. In addition, taverns, filling stations and churches were often present.

**Villages**

Villages were described as incomplete trade centers, lacking many features of an urban center, but playing a significant role in providing goods and services. Brush's criteria for villages, which were developed empirically, emphasized both the number and types of retail and service units. The village required at least ten retail and service units of all types, plus at least four retail businesses other than those found in hamlets, and three other essential services. Thus, in addition to grocery stores, taverns and filling stations, a village needed four other businesses, such as automobile, implements, appliances, lumber, hardware or livestock feed outlets, and three other essential services, such as auto repair, banking, telephone exchange or postal delivery.

**Towns**

Towns had a greater multiplicity of functions and were more specialized urban centers. The requisites for classification as a

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town in Brush's study were at least fifty retail units, thirty of which were in addition to the types found in hamlets. Further, towns were to have banks and weekly newspapers, high schools, and four other professions, such as physician, dentist, veterinarian or lawyer. Brush cited four main causes for development of the multiple functions which contributed to the importance of towns as trade centers.

1. The aggregation of people in the town provided a market large enough to permit some specialization.

2. The larger trade area permitted towns to add new types of trade and services, e.g. professional services.

3. The larger farm market enabled towns to offer goods and services solely for farmers, and attracted food-processing plants which used raw materials from the surrounding area.

4. The concentration of business and population permitted the town to develop as a distributing center, adding wholesaling to its other functions.

Spacing of Centers.

Brush continued from his functional classification of settlements to a study of their spatial relationships. He found that smaller centers showed an interlocking locational pattern and a linkage to larger centers. Closest to the towns were the hamlets, with villages located beyond. This aspect of spatial arrangement agreed with Christaller's theory.

The mean distance between centers in Wisconsin was 5.5 miles between hamlets and other centers, 9.7 miles between villages and other villages and towns, and 21.2 miles between towns. These figures
approximated Christaller's rule that the distance between centers of each successive class increased by $\sqrt{3}$.

Some other characteristics of the Wisconsin settlement pattern differed from Christaller's theoretical model. Brush observed a pronounced tendency for the centers to occur in rows or clusters. He found that low-ranking centers were grouped together in areas farthest from large centers. Hamlets were not equidistant from each other and from centers of other rank, but were 4.8 miles from other hamlets, 5.6 miles from the nearest villages and 6.9 miles from the nearest towns. Brush turned to the centrifugal concept of the American sociologist, J. H. Kolb, to explain this spatial arrangement.10

Kolb's classification scheme included five types of service centers:

<table>
<thead>
<tr>
<th>Single-service</th>
<th>Neighborhood or hamlet</th>
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</thead>
<tbody>
<tr>
<td>Limited and simple service</td>
<td>Small village</td>
</tr>
<tr>
<td>Semi-complete or intermediate</td>
<td>Village or small town</td>
</tr>
<tr>
<td>Complete and partially specialized</td>
<td>Town or small city</td>
</tr>
<tr>
<td>Urban and highly specialized</td>
<td>City</td>
</tr>
</tbody>
</table>

The service areas of the higher ranking centers, such as towns and cities, had three distinct parts, according to Kolb - the primary service area in which the town provided the bulk of the service; the secondary service area in which there was competition from other centers, and the specialized service area in which the town attracted only specialized trade.

Single-service centers (A) occurred near the periphery of the secondary service areas of semi-complete centers (C). The limited service centers (B) were located beyond, but were still within the specialized service area of C centers. Although A centers were closer to B than to C centers, they were outside the primary service area of the B centers. Kolb argued that because of the greater pull exerted by the larger trade centers than by the smaller ones, due to the larger aggregate of services offered, smaller centers were likely to develop closer to each other than to large centers.

In addition to the centrifugal clustering of smaller centers, Brush observed linear tendencies in the arrangement of settlements. These he was able to explain by the impetus to growth offered by the railway or to the effect of the terrain, e.g. where settlements occurred in valleys along the river.

Brush summed up his conclusions on settlement location in the following words:

The spatial pattern of agglomerated settlements is the result of site and transport influences during the nineteenth century. Inertia of the settlement pattern is so great that centers have not died out completely, though rural population has decreased. Railroads, once the life lines of trade, have lost nearly all their local traffic, having been replaced by trucks and passenger cars. Hamlets have regressed as trade centers but remain viable as residential settlements, retaining some of their central services. Villages are important, though incomplete, local centers; their functional attributes have changed and even increased in variety, while their

Fig. 4. Spatial Arrangements Kolb
population has generally remained stable or increased slightly during the past forty years. Towns are the only centers that continue to make large gains in population, making relatively and absolutely the greatest gains in new functional units. Thus the functional status of settlements is dynamic, influenced by economic and technological changes. But their locational pattern remains fixed. 11

Tributary Areas

Having classified the trading centers by applying associated functional criteria, and compared the locational pattern of settlements to theoretical models, Brush then delineated the tributary areas of the trade centers. His method was to use traffic data to identify points of traffic convergence. The traffic divides, where few vehicles travelled, he interpreted as the boundaries of the tributary areas of towns and villages. Such a method permitted delimitation of traffic areas for the towns and villages, but there was not sufficient traffic convergence at hamlets to enable identification of its tributary area.

Brush felt that traffic analysis was a satisfactory method of defining tributary areas, arguing that the poorly defined area of the traffic divide was a true reflection of the overlapping tributary areas for various commodities. Given universal automobile ownership, the movement of vehicles measured the combined influences attracting people to a trade center. Thus the area of traffic convergence represented the area of absolute dominance of trade near the center.

11 John E. Brush, ibid., page 395.
The analysis of traffic data corroborated the conclusions on spacing of trade centers. Clustering of centers was again observed. This clustering apparently affected the shape of the tributary areas. They tended to be elongated with their long axes at right angles to the axes of rows of centers. The villages were located in belts between towns. Hamlets occurred at the margins of town or village areas, in the traffic divides, and also within the town areas of dominance.

Fig. 5. Traffic Areas, Wisconsin
Christaller's hexagonal system called for village tributary areas to be three times as large as hamlet areas. Brush was unable to identify hamlet areas, but found village areas to be considerably smaller than the theoretical size. He attributed this to their linear spatial arrangement and to the encroachment of town areas.

![Traffic Relations of Villages to Towns or Cities](image)

**Fig. 6. Traffic Relations of Villages to Towns or Cities, Wisconsin**

The local tributary areas of towns, according to Christaller, were equal in size to those of villages. Brush found that average town areas were four times the theoretical size (129.1 square miles for towns...
compared to 32.2 square miles for villages). He felt that this supported Kolb's observations, reflecting the greater attraction exerted by the town's greater assemblage of central services.

The relationship of the towns to the villages shown on the map indicated that the average town had four or five villages within its range of influence, or hinterland. Brush found that some villages were linked to two towns and some were linked to the cities just outside the study area. He estimated that each town served an area of 128.8 square miles beyond the periphery of its local tributary area. On this basis, towns seemed to be disproportionately small in relation to the population of their hinterlands.

**SERVICE CENTERS IN SASKATCHEWAN**

Christaller's theory formed the framework of reference for the Royal Commission on Agriculture and Rural Life in Saskatchewan, in its report on Service Centers. Appointed by the Government of Saskatchewan "to investigate and make recommendations regarding the requirements for the maintenance of a sound farm economy and the improvement of social conditions and amenities in rural Saskatchewan", the Commission produced a series of fourteen reports dealing with farm and rural problems. The study of service centre structure and trading areas was undertaken with the primary aim of finding a sound basis for the coordination of government services. The Commission felt that the

12 This section is based on Service Centers, Royal Commission on Agriculture and Rural Life, Regina, Saskatchewan, 1957.
service center structure could provide a common denominator for
delineating administrative regions for agencies which had similar needs
in terms of regional size, focal centers and road access.

The Commission restricted its analysis of service centers to an
area in the southwest portion of Saskatchewan. The centers in this
area were classified according to the diversity of their functions, and
their locational pattern was compared to the theoretical model of
Christaller. The Commission's method and general conclusions are a
valuable contribution to an understanding of service center structure
in Saskatchewan. They will therefore form the substance of this section,
providing the necessary background for consideration of the South
Saskatchewan River Project area.

One of the recommendations of the Royal Commission on Agriculture
and Rural Life was that a comprehensive analysis of service centers be
undertaken for the entire province. This recommendation has been acted
upon and the study has been carried out by the Local Government
Continuing Committee. Data from the Committee forms the basis for
analysis of the settlement pattern of the South Saskatchewan River Project
Area in Chapter 3.

Classification of Service Centers

The Royal Commission on Agriculture and Rural Life relied on
diversity of services as the principal basis for classifying service
centers in Saskatchewan. Services were tabulated for each center in the
area studied, which was the southwest quarter of the settled portion of
the province. In order that the services used for classification purposes would reflect as closely as possible services related to the population of the tributary area of the center, some adjustments were made. Excluded from classification were, in general, domestic service, maintenance and operation, manufacturing, and administrative services. More precisely, the excluded group covered salesmen, labourers, mail carriers, caretakers, railway employees not concerned with railway users, manufacturing activity, and municipal, school, welfare and agricultural offices. The reason for omitting the latter administrative group was not that they lacked central significance, but that the major purpose of the Saskatchewan study was to measure the effectiveness of location of government services.

A wide variation was found in the degree of development of various centers. For this reason, considerable subjective judgment had to be exercised in the classification process. The method used was to select the city first, and then to decide the next lower class of center on the basis of size, location and distance. In this way, the Commission selected five types of centers, and proceeded to examine their service diversity. The entire range of services was then divided into the following class intervals:

<table>
<thead>
<tr>
<th>Rank of Center</th>
<th>Number of Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamlet</td>
<td>2 to 10</td>
</tr>
<tr>
<td>Village</td>
<td>11 to 25</td>
</tr>
<tr>
<td>Town</td>
<td>26 to 50</td>
</tr>
<tr>
<td>Greater Town</td>
<td>51 to 100</td>
</tr>
<tr>
<td>City</td>
<td>101 to 200</td>
</tr>
</tbody>
</table>
Services which were typically found in a center of a given rank but were not found in centers of lower rank, termed "characteristic incremental services", were identified from a frequency distribution of central services.

Hamlet

The Hamlet was ranked as the lowest functional unit. Its role was to serve the basic needs of the adjacent rural population. In addition, it provided auxiliary services in transportation and communication, assembling farm products, retail trade, commercial, and public service.

The significant services of the hamlet were the grain elevator and the general store. The general store seemed to be the most important establishment and was considered a minimum requirement for designation as a Hamlet. Other characteristic services were a postmaster, railway depot, telegraph service, garage, one-room school and church.

Central employment in a Hamlet averaged 7 to 10 persons. The typical population range was from 20 to 80 persons, and there were from 5 to 20 residential structures.

Village

The Village had closer ties than the Hamlet with the surrounding rural area, due to its more diversified services. Titled by the Commission the "farmer's town", the Village provided the farmer with his urgent needs for both living and working.
The lower ranking services which first appeared in the Hamlet were more strongly developed in the Village. Typically, there were two general stores and two garages. The school was usually a consolidated school, offering both elementary and high school education. The Village also had a post office and railway depot, 3 or 4 grain elevators with a capacity of about 200,000 bushels, and 2 or 3 churches. In addition to the general functions of the Hamlet, the Village sometimes offered services in the sphere of banking and finance, usually in the form of a credit union.

Village services which were oriented to the agricultural community were the lumber yard, hardware store, fuel dealer, blacksmith shop, municipal office and telephone office. Derived from these basic center functions were such other services as the grocery store, barber shop, beer parlour, cafe, credit union and church.

Employment in central services ranged from 20 to 40 persons. There were usually from 100 to 300 persons living in the Village, occupying about 25 to 75 dwelling units.

Town

The Town offered a wider diversity of services and a larger tributary area than the Hamlet and Village. Among the lower ranking services, Towns had a greater number of units and higher sales volumes per unit. There were, for example, usually 4 or 5 grain elevators, with a capacity of 300,000 to 400,000 bushels.

The Town was the lowest-ranking center in which public services were significant. These included a hospital, physician, dentist,
barrister, local newspaper, theatre, community club and bank. Retail trade showed an advance in differentiation over the Village. Two significant incremental retail trade services were clothing and household appliance stores, both providing services for which there was a widespread demand which was not met in lower ranking centers.

The population of the town centers ranged from 400 to 1,000 persons, and these centers contained from 100 to 250 residential structures.

Transitional centers between Villages and Towns had only one or two of the higher ranking services. Some of the reasons cited by the Commission for the occurrence of these services were the size of the population in the center, mistaken government decisions for location of services such as hospitals, and local initiative in such endeavors as local newspaper publication.

Greater Town

The Greater Town showed a change in functions from the Town, Village and Hamlet. Here the urban population (1,500 to 5,000) played an important role for the first time, in contrast to the lower ranking centers which were based solely on agricultural service. The two key characteristics of the Greater Town were its specialized services and its importance in the social and economic life of the province.

Lower ranking services occurred in the Greater Towns in larger numbers or with increased capacity. There were, for example, more farm implement dealers, garages and automotive services. Some services showed
an increase in capacity instead of in the number of units, such as newspaper circulation, number of hospital beds, and theatre seats.

Incremental services were numerous in the Greater Towns. Wholesale trade first appeared at this level, in a minor but significant role. Greater Towns provided services which were needed by rural residents, such as apparel and accessory stores, and furniture stores, but which were not provided by centers of lesser rank because of infrequent demand for them and the need for a larger population base for economic operation. Public administration and transportation were also important functions of the Greater Towns.

City

The City Center provided more adequately than the lower ranking centers all of the main types of central function. Greater diversity and specialization were evident in retailing, commercial services, transportation, banking and finance, and wholesale trade. It was also a logical center, according to the Commission, for regional administration services.

City population ranged from 4,000 to 20,000. Service establishments of types occurring in lower ranking centers were, in the City, both larger and more numerous. The City added many incremental services, particularly in retail trade, commercial and public services.

Provincial City

A sixth class of center, the Provincial City, was identified by the Commission although its services were not tabulated. Such a center was characterized by greater specialization and was the provincial
headquarters for various activities. Two significant province-wide functions usually associated with a Provincial City were the provincial government and university functions.

**Location of Service Centers**

Before analysing the distribution of centers, the Commission considered some of the influences which, in Saskatchewan, might be expected to cause deviations from the Christaller theoretical pattern. The most important factors were transportation and consumer mobility. Also influential were topography, unequal distribution of resources and population, historical accident and local leadership.

In the field of transportation, two significant agricultural factors historically affected the location of nucleated settlements. First was the distribution of land offering the best agricultural potential. Branch lines of the railway penetrated areas where land was of good quality, and generally tended to avoid sub-marginal lands. Second was the grain marketing need for shipment points located along the railway lines at close intervals. Thus the influence of agriculture was reflected in tendencies to both areal discrimination and lineal attraction of settlements. These tendencies were offset to some degree by the extensive acreage of good agricultural land, which resulted in a fairly dense network of railway lines. Development of a highway and road network added to the general coverage provided by transport facilities. Today the visible evidence of the transport influence is most apparent in linear location of Village and Hamlet centers.
The effect of transport was to encourage centers to cluster along the main communication lines, to lower the rank of centers located on secondary lines, and to reduce the number of centers in areas with inadequate transportation. The clustering of centers forced the tributary areas out of their concentric shape, into areas elongated at right angles to the transportation route.

Fig. 7. Distribution of Service Centers in Saskatchewan

The Commission differentiated between the pattern of settlement in densely populated and sparsely populated areas. In areas of sub-marginal land, which supported lower population density, centers were
farther apart, and gaps in the system of centers occurred.

Neighboring centers with split functions also distorted the pattern. These were due, said the Commission, to historical accident, settlement in stages, or competition of local leaders. Split functions could occur between centers of any given rank, but the distance separating the split-function centers of higher rank would be greater. Regina and Saskatoon were cited as examples of split-function centers at the Provincial City level. The effect of the split was to increase the number of satellite centers to eight, as indicated in Figure 8. This was roughly comparable to the locational pattern of the principal centers of Saskatchewan, as shown in Figure 9.

Fig. 8. Diagram of Split Centers

Two other anomalies noted by the Commission were isolated centers and extended centers. The isolated centers appeared at frontiers of settlement or in areas cut off by a topographical barrier. Extended centers were interconnected to the service center system only through
another center of similar rank.

The commission concluded that distribution of centers by function and size in southwest Saskatchewan met the general theoretical expectations. According to their functional classification, there were 2 Cities, 8 Greater Towns, 26 Towns, 65 Villages, and 155 Hamlets. In instances where the location of centers varied from the symmetrical pattern, the influence of transportation explained most of the distortion.

Note: Areas are proportional to population.

Fig. 9. Principal Centers of Saskatchewan
Within the Swift Current System of Greater Towns, the number of centers of each rank were compared with the minimum number required in the model. The comparative figures were:

<table>
<thead>
<tr>
<th></th>
<th>Theoretical</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cities</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Greater Towns</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Towns</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Villages</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td>Hamlets</td>
<td>54</td>
<td>60</td>
</tr>
</tbody>
</table>

The average distance between centers also showed reasonable agreement with the relative distances in the hexagonal structure. Actual distances were affected by discrepancies in the expected numbers of centers and by the linear location along transportation routes.

<table>
<thead>
<tr>
<th></th>
<th>Theoretical Distances</th>
<th>Actual Average Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case I</td>
<td>Case II</td>
<td></td>
</tr>
<tr>
<td>Hamlet to Village</td>
<td>10.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Village to Town</td>
<td>17.3</td>
<td>20.8</td>
</tr>
<tr>
<td>Town to Greater Town</td>
<td>30.0</td>
<td>36.0</td>
</tr>
<tr>
<td>Greater Town to City</td>
<td>52.0</td>
<td>62.3</td>
</tr>
</tbody>
</table>

Adaptation of location to the railway was evident among the lower ranking centers. In about two-thirds of the centers convenience of transportation seemed to be a more important factor than service convenience.

Many centers were related to only one higher ranking center, rather than to two or three, as the theoretical pattern called for. The frequency of these separated centers was attributed to topographical barriers, submarginal land, and the international border.
Assessing the value of the theory in the light of its findings, the Commission concluded that the theory of central places offered a satisfactory explanation of differences in the size and functions of centers. It also was a guide to distribution of the centers, both in terms of the number of centers of different ranks and their locations. Deviations from the model could be explained by the effects of such factors as transport routes, topography and soils.
Chapter 2

EXPERIENCE IN PLANNING THE LOCATION AND SIZE OF
RURAL AND URBAN NUCLEATIONS IN SELECTED IRRIGATED AREAS

"There is, of course, no possibility of applying ready-made formulae of existing or ideal regional structure to practical needs everywhere. The study of other countries' experience in the field of regional development has quite another purpose: it helps to throw into sharper relief the uniqueness of one's own planning and development problems."

Artur Glikson
Chapter 2

EXPERIENCE IN PLANNING THE LOCATION AND SIZE OF RURAL
AND URBAN NUCLEATIONS IN SELECTED IRRIGATED AREAS

Planning for the spacing and size of community nucleations is one aspect of regional planning. As a part of regional or national planning programs in other countries, some experience has been gained with respect to planned community location and desirable size. It is felt that some familiarity with the experience elsewhere can be valuable in planning for the South Saskatchewan River Project area. The areas selected for investigation for the purposes of this study are agricultural areas where large-scale irrigation projects have been carried out.

Three areas will be discussed: the Columbia River Basin in the State of Washington, U.S.A.; the polders in the Netherlands, particularly the North-East Polder; and three regions in the State of Israel. The Columbia River Basin development resembles most closely the situation in the South Saskatchewan area, where dry land wheat farming will be replaced with irrigated land, offering an opportunity for more diversity in crop types and promising significant changes in the size of farm holdings and in the role of community service centers. The Netherlands situation has a very different basis. Here the land is claimed from the sea, by means of diiking and drainage, to provide new
irrigated land for agricultural use. This is probably as close as a planner can get to a pure situation uncompromised by existing facilities which often exercise some influence over the planning of the area. Here the planner has an area of fertile land to transform into a dynamic community. With no existing hamlets or villages, no existing road network, the location of communities, theoretically, can be decided in terms of the best possible service to the population. The Israeli experience is affected significantly by the pressing factor of time. The influx of thousands of immigrants, many of them with an urban background, demands that homes be found for them. This tends to disrupt the logical sequence of rural-urban development. Indeed, the contrasts between planned development in Israel, in the Columbia Basin and in the Netherlands should point up the differences in the settlement pattern resulting from the different factors which mold planning policy.

THE COLUMBIA BASIN PROJECT

The Columbia Basin project, in the State of Washington, is a multi-purpose project designed to store and deliver stored water for land reclamation, to generate electric energy, to control floods, to improve navigation and to regulate stream flow. The lands to be irrigated with water impounded behind Grand Coulee Dam lie in the Big Bend of the Columbia River, beginning about 60 miles south of Grand Coulee. The Project area contains some 2½ million acres, of which about 1 million acres is suitable for irrigation.
The Project was started in 1933, with construction of the Dam. By 1942 the Dam was completed and some of the power generating units were put into operation. Work on the irrigation works started after World War II. The initial irrigation, in the Pasco area in 1948, used water pumped from the Columbia River. The large-scale program, using water from the reservoir behind the Dam, did not get under way until 1952. Since that time, from 34,000 to 66,000 acres have been added each year,
so that by 1958 over 380,000 acres were irrigated. About half of the 1,029,000 acres planned for irrigation ultimately should be served by 1963.

Columbia Basin population in 1950 was 30,232, with 12% on farms, 16% rural non-farm, and 72% in towns and villages. The detailed distribution of the population is shown in Table 1.

Table 1.

<table>
<thead>
<tr>
<th>POPULATION DISTRIBUTION IN THE COLUMBIA BASIN, 1950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban (2,500 and over)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Large Village (1,000 to 2,499)</td>
</tr>
<tr>
<td>Small Village (200 to 999)</td>
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<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Total - Urban and Village</strong></td>
</tr>
<tr>
<td>Open-Country settlement:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

* Estimated by Bureau of Reclamation

Source: Indications of Business and Industrial Development that will result from the Irrigation of the Columbia River Basin Project, Ephrata, Washington, Jan. 1953, using census of population 1950.

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In an irrigated area in Southwest Idaho, the population distribution in 1950 was 29% farm, 13% rural non-farm, and 58% town and village population. The Bureau of Reclamation suggested in 1953 that the future population of the Columbia Basin Project might be distributed in a manner roughly comparable to the Idaho breakdown, when the Project is more fully developed. 2

Fig. 11. Columbia Basin Town and Village Growth

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The series of reports dealing with problems of planning for development of the Columbia Basin Project, prepared by the Columbia Basin Joint Investigations for the United States Department of the Interior Bureau of Reclamation, included a study of "the optimum number of towns and their advantageous placement". This *Towns and Villages* report is in two parts – the first, the Middle Yakima Valley in Washington State, and the second, town development in other irrigated areas, in Idaho, Oregon, Montana and Wyoming. The findings of the report which are pertinent to the present study form the subject matter of this section.

**The Middle Yakima Valley**

The Yakima Valley investigations were originally carried out in 1941. The purposes of the study were twofold: (1) to establish the character of towns which seemed to serve best the needs of farm families in an area of irrigation agriculture similar to that expected in the Columbia River Basin Project; and (2) to determine the support required for the establishment and maintenance of the more effective types of towns. The conclusions on these two points were expected to suggest criteria for planning the number and location of towns which would best serve the settlers in the Columbia River Basin.

The area investigated is approximately 150 miles southeast of Seattle, 160 miles southwest of Spokane and 140 miles northeast of

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Portland. Yakima, the chief commercial center in the immediate vicinity, is a few miles northwest of the area. The Yakima River is a physical feature of major importance, providing water for irrigation but also acting as a barrier to transportation, thus impairing easy access to towns from certain directions. The study concerned itself principally with the rural service functions of six towns in the Middle Valley of the Yakima River.

**Towns**

Placed in their regional setting and ranked according to the number of functions performed and the area served, the six towns covered by the study were considered to be centers of the third and fourth order. Such a classification, by function, is based on Christaller's theory and, as we have seen in the previous chapter, has been applied in many areas, including Wisconsin and Saskatchewan. Towns in the Middle Yakima Valley had fewer functions and only local service importance compared to such regional centers of the first order as Seattle, Spokane, Tacoma and Portland, or a center of the second order, such as Yakima. Centers of the first order served the agricultural area through wholesalers and distributors, daily newspapers, radio programs, and mail order goods shipped from warehouses in the metropolitan areas. These centers were also important markets for agricultural products collected in the towns from the surrounding farming area.

Yakima, of second rank, provided services related to agricultural communities. It was a secondary wholesale center, had a daily newspaper, a radio station, and was the primary shopping center of
the valley, with a wide variety of shopping and specialty goods.

Towns of the third order were referred to as local shopping centers. They offered shopping goods and services which were adequate for most requirements. None of the three local shopping centers in the Yakima Valley had as wide a diversity of services as Yakima, and none had the added functions of the larger center.

The three towns of the fourth order had few significant retail establishments of shopping and specialty classes, no professional offices and few commercial amusements. The commercial establishments, which had largely "convenience" goods, served a function comparable to that of the rural service centers.

The primary function of towns of both the third and fourth order was as a local marketing center for the products of irrigation agriculture and as local distribution centers for commodities needed by farmers on irrigated land. They served also as social centers for people both in the town and in the nearby rural community. The significant difference between the third and fourth order towns was the extent to which their functions were performed.

Rural Service Centers

The twenty-five rural service centers in the area studied provided limited services. They were classified into three groups, according to the complexity of the service structure and the number of establishments. The typical rural service center of the least complex type consisted of a single commercial establishment offering not more
Fig. 12. Rural Service Centers, Middle Yakima Valley
than two types of service. Centers of intermediate complexity generally had two or three establishments, with a like number of different types of service. The most complex group were centers with more than three types of service.

Three significant facts concerning distribution of the rural service centers were apparent: (1) The rural service centers were, in general, not found within four miles by road from the local shopping centers; (2) Many centers were located close to the fourth order towns; and (3) Transportation facilities differed for the three groups, e.g. centers of maximum complexity tended to have rail facilities while the least complex centers did not. Also, all centers of least and intermediate complexity were on paved highways, while only four out of seven of the most complex centers were on paved highways. This was interpreted as an indication of the need for a means of handling bulky commodities at larger rural service centers. The possibility of providing satisfactory service by truck was raised in the report as a matter which would require special investigation.

Trade Areas

The trade area of a town was defined as the "area within which most of the residents go more frequently to that town than to any other". By assuming that frequency of travel to a center was a fair measure of the frequency with which the services there were patronized, the study was also able to describe the trade area for each town as that "within which residents patronize the town's services more frequently than the services of any other town".
The study did not attempt to delimit service areas for individual commodities. The object was to define a single-boundary trade area. This was done by using basic data obtained from a travel-destination survey made by the Washington State Department of Highways in cooperation with the United States Bureau of Public Roads in 1936 and 1937. This survey obtained through high school students detailed information on automobile travel of the students' families during the preceding twelve-month period. Data included the number and destination of trips for both pleasure and business purposes, mileage per trip and the routes used. The preliminary boundaries of trade areas were drawn by plotting data for 280 families, showing location of each family and the percentage of their automobile trips to various destinations. This permitted delimitation for each of the six towns of the area within which most families made the greatest percentage of trips to that town. Tentative boundaries were then checked by 209 field interviews, along roads crossing the tentative boundaries. The family in one out of every two dwellings was interviewed to determine the town to which trips were made more frequently than to any other. The tentative boundaries were then adjusted as required by the new information.

The outer boundaries of the trading areas coincide with the limits of the irrigable land. Beyond is dry land which in the Middle Yakima Valley is largely uninhabited. In the case of one town, located at the outer boundary, there was some support from the sparse population of the land not irrigated. Support from beyond the irrigated area was considered to be insignificant for the other towns studied. It is apparent that the degree to which the dry land farming area should be
taken into account in studying other irrigation projects will depend upon the soil conditions and density of settlement. In the South Saskatchewan Project, for example, some blocks of irrigable land are contiguous to productive land containing a farm population whose support could not be ignored without unjustified distortion of the findings.

**Support Needed for parts of the Trade Area Structure**

The population within the entire trade area was used as a rough measure of the aggregate support required for maintenance of the services at the center. This was considered to be an adequate measure because all of the towns were of local service importance. It would not have been considered adequate if Yakima, for example, had been included, since it depended on the patronage of residents of the entire Yakima Valley. The validity of the measurement was confirmed by the comparatively constant relationships found between population of the trade areas and numbers of services in the trade centers.

The general conclusions regarding the different types of centers in the Yakima Valley indicated that there were three towns serving as local shopping centers. The other three incorporated towns had been important prior to the widespread use of the automobile but had failed to retain their importance. Many of the rural service centers had survived and seemed to have an important role, but the need for others was questionable. Expressed in terms of road distances, the conclusions were as follows:

1. at road distances of 7 or more miles from local shopping centers, relatively complex rural service centers are needed,
(ii) at road distances of 5 to 7 miles from such towns, rural service centers of moderate complexity are likely to succeed, and

(iii) within 5 miles by road of such towns, rural service centers are not needed and, except under special conditions, are not apt to prove successful.

Desirable Rural Area Structure

The study of the Yakima Valley data led to the conclusions that there were two essential types of service center - the local shopping center and the rural service center. The local shopping center would be ideally represented by a town of at least 2,000 population, and should provide all the basic services required by farm families. The rural service center might consist of no more than the building, or a few buildings, at which the convenience types of service would be provided. There appeared to be little justification for villages of intermediate sizes to provide economic services.

The relationship between the two essential types of centers, and conditions under which the desirable structure could be expected to develop is indicated diagrammatically in Figure 13.

The basic requirement for a satisfactory local shopping center was considered to be the presence within reasonably close distance of a relatively large farm population. With 1,000 farm families in the trade area having purchasing power like that of families in the Middle Yakima Valley, and like that anticipated in the Columbia Basin Project, patronage would be adequate to support a local shopping center of the desired quality. A patronage base of about 600 farm families apparently would be
This trade area ideally includes at least 1000 farm families; the minimum requirement for a satisfactory local shopping center is about 600 farm families.

With 1000 families, approximate, minimum population obtained at mature development is as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm</td>
<td>4000</td>
</tr>
<tr>
<td>Rural non-farm</td>
<td>1000</td>
</tr>
<tr>
<td>Town and suburbs</td>
<td>3000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8000</strong></td>
</tr>
</tbody>
</table>

Desirable maximum extent of trade area, provided ideal conditions noted above are met.

- **RURAL SERVICE CENTER** (Tributary area indicated by hexagonal figure.)
sufficient and could be expected to support a reasonably satisfactory local shopping center where distance, or other considerations, limited the trade area.

Distance was cited as a secondary but important element in the development of local shopping centers. People would not regularly travel farther than necessary to obtain the services desired. But adequate patronage, rather than arbitrary distance, was considered the important factor in the location and spacing of towns for the Columbia Basin Project. It was pointed out that undue increases in the spacing between towns from those indicated by adequate patronage bases would stimulate the development of centers at intermediate locations which had no sound prospect for growth as satisfactory shopping centers, or would place farm families in the intermediate zone at a disadvantage with respect to easy access to the requisite services.

The Yakima Valley data provided a working guide to the distance people might reasonably be expected to travel to a local shopping center. Ten miles by road did not appear to be an unreasonable distance, in view of the distances regularly travelled in the Yakima Valley. In areas where the patronage base within a ten-mile radius was inadequate, the distance from the outer limits of the trade area to the center should be greater. However, where population density and other conditions permitted, distances shorter than ten miles were considered desirable.

In view of the location and character of rural service centers in relation to local shopping centers in the Yakima Valley, six miles was
indicated as the closest distance to a local shopping center at which the utility and the prospects for success of a rural service center seemed to be assured. About 100 farm families with purchasing power comparable to that of families in the study area apparently would provide an adequate patronage base for such minimum services as a combination grocery store and automobile filling station. With a density of farm population such as that in the Yakima Valley, and that anticipated in most parts of the Columbia Basin Project, the minimum adequate patronage would be found within a tributary area of two-mile radius. At least in areas closer to the local shopping centers, two miles appeared to be also about the maximum "attraction" radius of the average rural service center.

Population distribution data for the Yakima Valley indicated that for each farm person in the trade area of a local shopping center there was at least one non-farm person. The report suggested that this ratio, applied to prospective farm population, would provide a means of estimating the probable minimum population within prospective trade areas of the Columbia Basin. The results would be minimum estimates, because the number of non-farm residents in some trade areas undoubtedly would be increased appreciably by the growth of towns into metropolitan centers serving a wide area, and by the possible development in some towns of industries in addition to those reflected in the Yakima Valley data. On the minimum basis, it was estimated that about 75% of the non-farm population would probably reside in the towns, and about 25% in the rural areas. Thus, the distribution of total population of the trade area (minimum) might be expected to be about 50% farm, 37.5% town, and
12.5% rural non-farm.

Town Development in Other Irrigated Areas

The second part of the Towns and Villages report undertook to check the conclusions based on the Yakima Valley data, by considering aspects of town development in other irrigated areas. The three areas considered were a large area in southwestern Idaho and adjacent Oregon; a similar area in south central Idaho; and small irrigation projects in Montana and Wyoming. The aspects checked were: (i) requisite patronage support for local shopping centers, (ii) spacing of local shopping centers, and (iii) distribution of population between farm and non-farm groups within the trade areas of centers.

Methods of study differed from those used in the Yakima Valley. Some of these differences may be noted. This part of the report was based on available map and census materials, rather than on field investigation. The towns were classified according to population, with a population of 1,500 or more being used as the criterion of a local shopping center. (This figure was derived from the Yakima Valley data, where the smallest place with the characteristics of a local shopping center had a population of 1,449.) Trade area boundaries were estimated on the basis of Yakima Valley findings, with adjustments being made to census data boundaries. Thus, the trade area data provided a rough approximation only, for general checking purposes. Purchasing power of farm families was compared with the Yakima Valley, using level of living indices. These were obtained by county for 1940, from a study by the
Bureau of Agricultural Economics of the United States Department of Agriculture.

It is unnecessary for purposes of the present study to go into the findings regarding the irrigated areas in Idaho, Oregon, Montana and Wyoming. It is sufficient to note that, in general, the data supported the findings in the Yakima Valley. The few exceptions were explained by special circumstances.

The Columbia Basin - Planning For Towns and Villages

The Community Development Section of the Bureau of Reclamation was responsible for planning new communities in the Columbia Basin Project area. In addition to the development of existing communities, six new towns were recommended, based upon the following general criteria:

A. For the most effective community integration, social and commercial services for rural people should be located in the same center.

B. The economic services offered at a center must be extensive and varied enough to meet most of the needs of the rural people or they will not support them.

C. Studies indicated that it requires a town of at least 1,000 population to provide adequately the economic services demanded by rural people.

D. As towns exceed 3,500 to 4,000 population they tend to become unsatisfactory as social centers for rural people.

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E. A trade area containing 700 productive family size farms yielding average annual farm incomes of not less than $1,500 is approximately the minimum size necessary to support the type of center satisfactory for the location of services for rural people.

F. A high school serving the community should be located in each service center to integrate the community and provide a nucleus for the development of recreational and social facilities.

No data is available concerning the planning, if any, of satellite relationships among the various service centers, but Moses Lake, Pasco, Ephrata and Othello were apparently expected to be the four major centers of population.

The planned development of communities has not been followed through in the Columbia Basin Project. In June 1953 the Community Development Section was "deactivated". Only one town has been established at a site recommended by the Bureau. This is the Town of George, in the Burke Junction vicinity, which was planned by the Bureau for its personnel during the dam construction period. Two other towns have been established. One is the Town of Royal, located in the Lower Crab Creek Valley, which was developed by a private corporation, after a feasibility study. The study included estimates of population potential, financial capacity of the population, and possible locations of other towns. The need for storage facilities for crops was considered, as well as the effect of recreational attractions.


The purpose of the studies for the new town of Royal was to determine whether a particular town development was economically feasible. Similar studies undertaken by a public instead of a private agency should take a broader view, aiming towards a pattern of settlement that would be most efficient for the whole region. The results of planning for individual towns and planning for a region as a unit, with an interrelated settlement pattern, are likely to be vastly different. It is therefore most unfortunate that the operation of the Community Development Section was terminated.

REGIONAL PLANNING IN THE POLDERS, HOLLAND

Extensive areas of fertile land are found along the coast of Holland, at a level of two to five meters below sea-level. The goal of the Zuiderzee Reclamation Plan was to develop 220,000 hectares of this land by dike building and drainage. The first step in the plan was to erect the Zuiderzee Dike, cutting off the Wadden and the North Sea from the Isselmeer. This project, made possible by modern engineering, was completed in 1932. The Zuiderzee Dike, by excluding the sea, enabled creation of a fresh water lake which could be used as a reservoir to supply water for agriculture, towns and industry; it permitted drainage of the neighboring land and regulation of the water level; it eliminated the sea tides and prevented floods; and it provided a communications

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7 This section is based on Artur Glikson, Regional Planning and Development, Leiden, Holland, 1955.
link between Northern Holland and Friesland. Construction and maintenance of this 30-kilometer sea wall made it possible to use lighter construction for some 320 kilometers of dikes protecting the polders around the Zuiderzee. (See Figure 14).

Fig. 14. The Partial Reclamation of the Zuyderzee

Before the Zuiderzee Dike was completed, a small experimental polder of about 100 acres was developed near the village of Andijk, in the Province of North Holland. Here experimental plots were seeded with crops which would be cultivated later in the larger polders. 8

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The first polder to be developed was the Wieringermeer, in the Province of North Holland. The villages in this polder contain shops, churches, schools, and other services and institutions. These villages have been criticized as being located too close together in the central part of the polder, where their spheres of influence overlap, and being too far from the outer boundaries of the polder. The latter results in lack of integration with the portions of the country adjacent to the polder, as well as inadequate service to the farmers who have too far to travel to the nearest village.  

The experience gained in the Wieringermeer development was used in planning the North-East Polder, which was started in 1937 and drained by 1942. The plan was to settle 40,000 people on the 48,000 hectares (120,000 acres) of land in the polder. Farm size varies, with holdings of 30, 60, 90 and 120 acres. Types of crops also vary. At the end of 1955, there were 1,213 farms ready for operation, including 1,142 agricultural farms, 33 horticultural farms, and 38 fruit-growing farms.

Small farm units are located near the villages and larger farms are farther away, as the farmers with more extensive acreage are better able to provide their own transportation. The maximum distance from a farm to the nearest village is 5 kilometers, or about 3 miles. This was considered a reasonable distance to travel at the time that the North-East Polder was planned, before World War II, when bicycles were

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Fig. 15. Plan of the North-East Polder in the Netherlands
the typical means of transportation.

The ten villages in the polder are located in a ring around the central town of Emmeloord. All the main roads lead to the town, and the villages are also linked to each other by a circular route. These regional roads, which provide efficient connections, are more closely related to the canal system for irrigation than to the landscape plan of the polder. Glikson suggests that the number of rectilinear, monotonous lines might have been reduced by developing an overall landscape plan for the region and conforming to it.

The development policy for the polder is based on agriculture exclusively. The goals do not include the easing of population pressure in Holland, nor industrial development unrelated to agriculture. The population density of the polder is low, representing about one-third of the density for the country as a whole. The agricultural orientation is reflected in the geographic pattern for the region, with its town and several villages, and their respective spheres of primary and secondary influence. This pattern may be compared to two levels in the hierarchy of settlements described by Christaller's theoretical model of central places which has been discussed in Chapter 2. It is based on efficient marketing of goods from a minimum number of central places, and service to the population supported by the surrounding productive land with a minimum of aggregate travel.

The North-East Polder's 40,000 residents will be distributed on farms (25%), in the ten villages (50%), and in the central town (25%).
The role of the village is to provide such services as commerce, education and religion, and to provide a dwelling place for some of the agricultural laborers. Population in a village will range from 1,000 to 2,500. The minimum of 1,000 persons is based on the smallest number desirable for social contacts, a school and a small nucleus of shops. One criticism of the planned village size is that it is influenced too much by the traditional size of villages in Holland. 10

Planning of the occupational distribution of the ultimate population in the Polder was based on experience and on research into the socio-economic structure of regions. It takes into account the stages of development, assuming settlement at a rate of 260 farmers a year. In the early years of development, the proportion of temporary laborers is higher, for example, and the proportion of service occupations is lower than in the later stages. The proposed geographic and occupational distribution of the ultimate population is shown in Table 2.

No less important than the planning principles applied to polder development, are the policies of implementation. After drainage of the polder was completed, State farms were established to plough the land, grow the first crops and prepare the soil for farming. This period of State-farming enabled research and experiment, preceding distribution of the land to tenants. Workers' camps were established

near the sites of future villages, and such development work as erecting farm buildings, constructing roads, digging canals, and installing electricity, was started. When the first permanent farms were rented, six years after drainage was completed, they were completely developed. Such a procedure was used in order to assure organic development of the Polder.

Table 2

PROPOSED GEOGRAPHICAL AND OCCUPATIONAL DISTRIBUTION OF POPULATION

NORTH EAST POLDER

<table>
<thead>
<tr>
<th>Occupations (including families)</th>
<th>On farms No.</th>
<th>In villages No.</th>
<th>In central town No.</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenant farmers</td>
<td>6,500</td>
<td>-</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>Agric. laborers</td>
<td>3,500</td>
<td>9,000</td>
<td>1,000</td>
<td>34</td>
</tr>
<tr>
<td>Industry</td>
<td>-</td>
<td>-</td>
<td>4,000</td>
<td>10</td>
</tr>
<tr>
<td>Commerce &amp; communications</td>
<td>-</td>
<td>4,950</td>
<td>2,250</td>
<td>22.5</td>
</tr>
<tr>
<td>Crafts</td>
<td>-</td>
<td>4,670</td>
<td>2,125</td>
<td>21.5</td>
</tr>
<tr>
<td>Education</td>
<td>-</td>
<td>550</td>
<td>250</td>
<td>2.5</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>-</td>
<td>830</td>
<td>375</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,000</strong></td>
<td><strong>20,000</strong></td>
<td><strong>10,000</strong></td>
<td>100%</td>
</tr>
</tbody>
</table>

Percentage

25% 50% 25% 100%


Preparation of the farms and farm settlement is fully integrated with construction of the town and villages and settlement of the non-farm
population. Both farmers and workers in other occupations are carefully selected from numerous applicants. According to Glikson, "Holland uses the highest quality population and the most advanced technological means at its disposal for the creation of the Zuiderzee Polder regions, and the synchronization of the Polder developmental operations has achieved true perfection." 11

The policy regarding sequence of development of the villages and town is an important aspect of effective implementation of the plan. In the earlier polder development, the Wieringermeer, a similar arrangement of service centers was planned, with a central town and subordinate villages surrounding it. The first farms settled were located near one of the village sites, so this village was developed first. The result was that it attracted central regional services and developed as a small town, while the planned regional center did not grow and was unable to assume its planned town status. Taking advantage of this earlier experience, the importance of the time factor is acknowledged in the development in the North-East Polder and development of the villages is deferred until Emmeloord, the central town, becomes established. The Polder management encourages the establishment in Emmeloord of more stores and services than are perhaps justified by the population now living in the vicinity. By so doing, the settlers experience some temporary difficulties, as they are a considerable

11 Glikson, op. cit.
distance from a service center. But such an "artificial" stimulus during the early years is considered both justifiable and necessary to ensure appropriate long-range development of the central town.

The Eastern Flevoland polder, an area of 133,000 acres, is currently being developed, and changing conditions are taken into account in planning this polder. The change in the mode of transportation from bicycles to small motor-bicycles, for example, has permitted an increase in the "reasonable" distance from farm to village. The result is that in the Eastern Flevoland polder six villages will serve 133,000 acres, compared to ten villages in the North-East Polder to serve 120,000 acres. Because it can serve a larger trading area, containing more families, the minimum village population in the Eastern Flevoland will be 2,000, compared to 1,000 in the North-East Polder. 12

RURAL PLANNING AND DEVELOPMENT IN ISRAEL

In the ten years immediately following establishment of the State of Israel in 1948, about 1 million immigrants arrived in Israel. 13 Combined with the natural increase, this influx brought the population to approximately 2 million in 1958, compared to 850,000 in 1948.

12 Letter dated January 12, 1959, from Van Rynvan Alkomade, Secretary, "The Netherlands Abroad", Amsterdam, Holland.

Israel is a small country, with an area of about 8,000 square miles. More than half of the total area is desert (the Negev) or is unfit for cultivation, and much of the remainder is suitable only for pasture. It was, therefore, necessary to develop the country at a high population density.

Land, people and time were the three chief factors cited by Arieh Sharon as determinants of planning objectives in Israel. He noted that the land varies widely in such natural characteristics as climate, soil and topography. The population has a diverse cultural background, making social composition a vital consideration in planning, in order to achieve integration of the old and the new population without undue difficulty. The time factor is more urgent in Israel than in most countries because of the vast numbers of immigrants. To take care of them, a quick tempo of development is required, with high priority on immediate needs. The pressure of time called for compromise which, as Sharon pointed out, might prove detrimental to planning.

The Israeli population is expected to be about 80% urban. In order to guide the stream of immigrants in the direction most desirable from the national and economic standpoint, plans were prepared for a balanced distribution of population. To achieve decentralization, twenty-four planning regions were proposed, each delimited by geographical and economic factors, such as soils, mineral resources and communications.

14 This introductory section is based on Arieh Sharon, *Physical Planning in Israel*, Tel Aviv, 1951.
Each planning region would have an urban center to serve as a communication and trade center, as well as the cultural and social focus of the region. The proposed regions are shown in Figure 16.

The proposed distribution of population, so important to the nation, could not be accomplished without a consistent planning and development policy. A National Master Plan for Israel was therefore prepared, which would coordinate development of the agricultural potentialities, the location of industry, a system of communications, a nation-wide plan for parks and forests, and planning for new towns.

In 1948 Israel had only two types of nucleated settlement - the small agricultural village and the large town with regional and national functions. The National plan proposed to introduce three new forms of settlement to act as cultural and economic centers, providing a graded continuity of settlements. The five types proposed were developed from a survey of existing settlements and consideration of future needs.

1. Village (population about 500) - a basic agricultural cell
2. Rural Center (population about 2,000) - several agricultural units linked to a common service center
3. Rural-Urban Center (population 6,000 to 12,000) - economic, cultural, commercial and industrial services for numerous nearby villages
4. Medium Town (population 40,000 to 60,000) - the center of a region
5. Large Town (population over 100,000) - regional and national focal point

The Village would contain up to 100 families, each farming an irrigated area of some 2,000 to 3,000 dunams, or larger areas of
### Planning Regions in Israel

<table>
<thead>
<tr>
<th>Region</th>
<th>June 15 1948</th>
<th>First Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huleh</td>
<td>4,450</td>
<td>50,000</td>
</tr>
<tr>
<td>Safed</td>
<td>3,750</td>
<td>59,000</td>
</tr>
<tr>
<td>Kinneret</td>
<td>14,000</td>
<td>95,500</td>
</tr>
<tr>
<td>Asher</td>
<td>4,450</td>
<td>122,000</td>
</tr>
<tr>
<td>Nazareth</td>
<td>200</td>
<td>81,500</td>
</tr>
<tr>
<td>Bet Shean</td>
<td>9,650</td>
<td>55,000</td>
</tr>
<tr>
<td>Afula</td>
<td>5,400</td>
<td>86,000</td>
</tr>
<tr>
<td>Western Valley</td>
<td>19,450</td>
<td>95,000</td>
</tr>
<tr>
<td>Haifa *</td>
<td>95,000</td>
<td>260,000</td>
</tr>
<tr>
<td>Carmel</td>
<td>4,350</td>
<td>63,000</td>
</tr>
<tr>
<td>Northern Sharon</td>
<td>16,600</td>
<td>92,000</td>
</tr>
<tr>
<td>Central Sharon</td>
<td>24,100</td>
<td>117,000</td>
</tr>
<tr>
<td>Southern Sharon</td>
<td>24,100</td>
<td>92,000</td>
</tr>
<tr>
<td>Dan</td>
<td>26,900</td>
<td>85,500</td>
</tr>
<tr>
<td>Tel Aviv *</td>
<td>287,380</td>
<td>450,000</td>
</tr>
<tr>
<td>Rishon Lezion</td>
<td>16,120</td>
<td>70,000</td>
</tr>
<tr>
<td>Yavneh</td>
<td>16,900</td>
<td>70,000</td>
</tr>
<tr>
<td>Ludd</td>
<td>1,000</td>
<td>78,000</td>
</tr>
<tr>
<td>Yehuda</td>
<td>1,350</td>
<td>55,500</td>
</tr>
<tr>
<td>Jerusalem *</td>
<td>76,800</td>
<td>220,000</td>
</tr>
<tr>
<td>Darom</td>
<td>3,100</td>
<td>165,000</td>
</tr>
<tr>
<td>Beersheba</td>
<td>750</td>
<td>120,000</td>
</tr>
<tr>
<td>Sdom</td>
<td>40,000</td>
<td></td>
</tr>
<tr>
<td>Elath</td>
<td>22,000</td>
<td></td>
</tr>
</tbody>
</table>

* Town Regions

Source: Arieh Sharon, *Physical Planning in Israel*, Tel Aviv, 1951.
extensive agriculture.\textsuperscript{15} It would contain a school, community hall, and such economic services as a garage, store-houses and smithy.

The Rural Center would be linked to 3 to 5 Moshavim (cooperative villages), resembling parts of a large village with 400 to 500 families. Its services would include cooperative consumer stores, bakery and restaurant, store-houses and refrigeration plants, packing houses and garages, areas for handicrafts and light industries, schools with sports grounds, a community hall and synagogue. There would also be secretariat, dispensary, police station, and residential quarters for institutional employees. The rural center would be located between the villages, with cultivated lands surrounding it.

The Rural-Urban Center would serve an agricultural area of about 100,000 dunams, with about 30 villages and a rural population of about 15,000. It would be a large center containing regional services and handicrafts, industry using the agricultural produce of the vicinity, a building materials industry, and special industries based on local resources or local initiative. Such regional services as agricultural and vocational schools, administrative, commercial, cultural and health institutions, would also appear in these centers.

The Medium Town would serve as the central city for a planning region. Consideration of the topographical and physical data and the economic possibilities of a region with a population of 75,000 to

\textsuperscript{15} Four dunam equals one acre.
120,000 at the end of the first stage of development suggested a town population of 40,000 to 60,000. This size presumably would permit healthy economic development, provision of municipal services at reasonable unit cost, and promotion of cultural and social activities. Regional services would include banking, administrative and medical institutions, agricultural crafts and industries, and education and communal buildings. The chief purpose of the Medium Towns would be to absorb national industries, thereby preventing undue growth of the largest conurbations.

The Large Town would have special functions related to national and international trade and communication. The three large towns in Israel are Jerusalem, Tel Aviv and Haifa.

An indication of the progress made in rural settlement in Israel is the fact that by 1958 about 200,000 immigrants had settled in villages, and nearly 400,000 in small and medium towns in rural regions. This amount of rural settlement was costly but Glikson considers it a sound investment. The reasons for this are several - it enhanced prospects of economic independence, provided favorable conditions for absorbing new immigrants, directed growth away from large cities, and helped to achieve homogeneous settlement of the whole country.

Glikson also notes the excellent results from industrial development in rural towns. The combination of agricultural and industrial development was undertaken as a means of achieving intensive

\[16\] Artur Glikson, Ibid.
settlement in rural regions. Wherever a comprehensive regional concept formed the basis for planned rural-urban development, the pace of development and the ease of transition were spectacular.

The factors of land, people and time, which operated so forcefully in molding national planning policy in Israel, do not, of course, have the same urgency in Canada. Nevertheless, Israel's progress in rural planning and development suggests methods which are worth examining. In the remainder of this section, consideration will be given to three regions - the Afula region, the Huleh region and the Lakhish region. The Valley of Jezreel, in the Afula region, is an agricultural area which also serves an important role in national and international communications. The Huleh region is an agricultural area of intensive cultivation, where swamp drainage followed by irrigation brought significant changes in agricultural production. In the Lakhish region, dry farming has been replaced by field crops on irrigated land.

The Valley of Jezreel

The Valley of Jezreel is bounded by hills and highlands and, on the east, by the Jordan River. Communications routes through the area are of national and international importance. In addition, the Valley has historic significance and such natural attractions as scenic beauty and an excellent climate.

17 This section is based on Artur Glikson, Regional Planning and Development, Leiden, 1955.
There are four sub-regions in the Valley of Jezreel, each with an urban center. These are the Beisan Valley (Beisan), the Northeastern sub-region (Mujdil), the Western sub-region (Yokn'am), and the Central sub-region (Afula). Afula is centrally located between the two main parts of the Valley and is a communication center of importance, being on the east-west rail route from Haifa to the Jordan Valley, and having a rail connection to the south. National as well as regional roads converge at Afula. These reasons made it a logical choice for development as the most important center of the region, with a sphere of influence extending over the entire Valley of Jezreel.

Glikson draws some interesting comparisons between development in the Valley of Jezreel in Israel and development of the North-East Polder in the Netherlands, which was discussed earlier. The area of agricultural land in the Jezreel Valley (67,000 Hectares) is about 1½ times the agricultural area in the North-East Polder. The communications system resembles in general outline that in the Polder, with a national route traversing the Valley and a regional network linking towns and villages to the regional center of Afula.

The Valley of Jezreel was developed during the period from 1948 to 1952. In 1948 the population was about 34,300, including 30,600 agriculturists and 3,500 urban dwellers. By 1952, total population had increased to 60,000, with 37,900 agriculturists and 22,100 urban dwellers. In the same period the population of Afula had quadrupled.

Population density in the Valley was 51 persons per square kilometer of arable land in 1948. By 1952, the density was 90 persons
Fig. 17. Regional Plan for the Valley of Jezreel, Israel
per square kilometer, similar to that for the North-East Polder. The preliminary plan for the Valley of Jezreel suggested a still more intensive development – a density of 240 persons per square kilometer. A comparison of the Polder and the Valley, in terms of area, population, and population density, appears in Table 3.

Table 3

<table>
<thead>
<tr>
<th>Area (hectares)</th>
<th>Population</th>
<th>Pop. Density Per Sq. Km.</th>
</tr>
</thead>
<tbody>
<tr>
<td>North-East Polder Plan</td>
<td>48,000 Agric. 40,000</td>
<td>Total Rural Urban</td>
</tr>
<tr>
<td>1948</td>
<td>40,000 75 25</td>
<td>83 100</td>
</tr>
<tr>
<td>Jezreel Valley</td>
<td>1952</td>
<td>92,000 67,000</td>
</tr>
<tr>
<td>Plan</td>
<td>34,300 90 10</td>
<td>37 51</td>
</tr>
<tr>
<td></td>
<td>60,000 63 37</td>
<td>65 90</td>
</tr>
<tr>
<td></td>
<td>160,000 44 56</td>
<td>174 240</td>
</tr>
</tbody>
</table>


The agricultural area in both the North-East Polder and the Valley of Jezreel was sufficiently extensive to justify a town. The Polder had the advantage, says Glikson, of a tradition of town development related to an agricultural region. In Israel, farmers lived in the villages instead of on separate farms and there was little, if any, relationship between agriculture and regional towns. Apart from agriculture, the strategic geographical location of the Valley with respect to national transportation provided a more favorable urban development potential than in the Polder.
Opportunities for regional industry related to agriculture were similar in Emmeloord, the regional center of the Polder, and in Afula. But actual development in these central towns reflected the different emphasis on industry in the two regions and the decisions regarding relative importance of urban centers in providing employment opportunities.

The difference in planning goals for the Polder and for Israel affected the rural-urban population ratio. The aim in the Polder was optimum growth of an agricultural region. The aim in Israel was intensive and rapid settlement at locations with a development potential. The pace of development of services and industry in Emmeloord was synchronized with the needs of regional agriculture. The urban population was, therefore, relatively low in number in relation to the area of the Polder. Urban population was expected to comprise only about 25% of the total population. In Israel, by contrast, the rate of urban development exceeded the rate of agricultural development and the pace at which urban facilities were installed. The technological operations necessary in the Jezreel Valley for irrigation and power development were comparable in extent, to the drainage operations in the Netherlands Polder. Even though these projects were just beginning in Israel, 10,000 people had been settled in Afula. The policy was to settle immigrants in the vicinity of their future sources of livelihood despite the fact that this required artificial economic support temporarily. The State employed immigrants in development of communications and irrigation until such time as regional services and
industrial needs could absorb the workers.

The plan for the Valley of Jeareel provided for a hierarchy of settlements, with Afula as the major center. The logical sequence of development, argues Glikson, would have been to develop Afula first and to postpone development of lesser centers. Actually, development of three of the four planned centers in the Valley started at the same time. Each center was near some development project, such as irrigation, afforestation, road building or drainage, so the opportunity was taken to combine the establishment of the permanent settlements with provision of a labor force for development operations. Workers' camps, instead of being dismantled after completion of the work, as in the Polder, formed the basis for stable urban settlement. Thus the chronological order of settlement was determined by resource development needs for the region, rather than the consolidation of regional development. This transitional stage in regional development in Israel, Glikson points out, was an obstacle to regional integration, but was a practical necessity in order to absorb the immigrants.

The Huleh Region

The Huleh region lies in the northern corner of Israel.\(^{18}\) It has fertile soils, an abundant water supply, and a variety of land conditions in the valley and on the slopes and ridges of the Galilee and

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\(^{18}\) This section is based on Artur Glikson, *Rural Planning and Development in Israel - Two Case Studies*, United Nations Economic and Social Council, Working Paper No. 46, 1958.
Lebanon mountains. This permits varied land uses, ranging from irrigated farming to sheep raising and forestry.

Although the new urban center of this region, Kiryath Shmoneh, is only 20 kilometers from Haifa, the Huleh Valley is an isolated area. Road connections must traverse terrain where mountains rise to 900 m. above sea level and the sea of Genassareth falls to 200 m. below sea level.

In 1948, the Jewish population of the Huleh region was 4,500 persons, living in 18 villages, most of which were collective farms. By 1958, the population had grown to more than 21,000, a figure well below the capacity of the region. Much of the rapid population growth occurred in Kiryath Shmoneh (Khalse), which was established in 1949 as the economic, administrative, and social center of the region.

Mixed farming, which used to be typical of the Huleh region, has been replaced to a great extent by irrigated cultivation of crops suited to the soil, water and climate of local areas. The size of the farming unit per family was fixed by the Government Agricultural Planning Center at 3 hectares. Crops include fruit orchards and irrigated cash crops such as potatoes, cotton and peanuts. Dairy farming is fairly well developed, and cattle and sheep breeding are increasing as natural
pastures are brought into use. In the fertile marsh areas, reclaimed under the Huleh Reclamation Project, new crops were introduced, such as rice, sugar cane, asparagus, medical herbs, and bulbs.

The changes in agricultural practice in the Huleh region had several effects: produce became more varied, improving Israel's prospects of economic independence; progress was made in consolidating agricultural settlement; employment was created for new immigrants; the processing of agricultural produce in Kiryath Shmoneh was started; and several service industries were established in the new town.

The preferred location for new industry was Kiryath Shmoneh. Typical new industries were an automobile service station, bakery, packing plant, cold storage plant, and a stone and gravel quarry. Plans had been made by 1958 for a cotton gin, textile factory, rice grinding plant, and a canning factory. A few new industries were based on resources other than local agriculture. Mats and baskets were produced in Kiryath Shmoneh from the reeds of the Huleh marshes. Peat was processed and sold as fertilizer. Recently discovered iron ore near Kiryath Shmoneh could be enriched and processed economically if a local plant were started. Other enterprises which were established after the basic industries were building materials factories, a small radio factory, a motorcycle assembly plant, and a diamond cutting plant.

The major communication route in the Huleh region connects Israel with Lebanon, following the dividing line between the mountain slope and the valley. Kiryath Shmoneh was located on this main road and
rural settlements were connected to the town by lateral roads branching from the main road. Most of the 27 villages in the region were from 7 to 12 kilometers from the town, and the maximum distance was 18 kilometers. A regional ring road system was planned to improve communication between the villages and Kiryath Shmoneh.

No final assumptions were made initially regarding the future economic development of the regional town, which might change drastically with the development of heavy industry. The first master plan prepared for Kiryath Shmoneh provided for a population of 15,000. In 1958, with a population of 13,000, the regional center had become an important market for local agricultural produce. It was becoming a country town, attracting villagers to such regional services as the two banks, the post office, offices of the Regional Council of Upper Galilee, various cooperative commercial firms, and the new health center. The modern shopping center, completed in 1958, was expected to add shopping to the villagers' reasons for visiting the regional town.

The economy of the Huleh region was still in a transitional stage in 1958. Over 40% of Kiryath Shmoneh's workers were engaged either in resource development, such as soil conservation, drainage, irrigation and afforestation, or the provision of services, such as construction of roads and houses, electrification and telephone installations. Activities were still financed largely by public funds, invested in types of development which were designed to strengthen the region's economy.

The occupational structures of the established villages and the new town were in sharp contrast. The kibutziym had a high percentage of
specialists, such as artisans, managers and educators, while the population of Kiryath Shmoneh consisted largely of unskilled workers. The absence of artisans, specialists and professional people handicapped development of the new town. The Government improved the situation to some degree by successfully encouraging 150 specialists to settle at Kiryath Shmoneh. Progress of a new immigrant town, according to Glikson, requires settlement of teachers, doctors, administrators, and engineers, at the same time as the rest of the population.

Many residents of Kiryath Shmoneh worked in the villages as laborers and farm hands, while the village population supplied managers for industries, banks and shops, nurses, health officers and social workers in Kiryath Shmoneh. While this exchange of labor and service promoted social contact in the region, Glikson feels that the arrangement should be temporary. The village population should be increased, and farm work should revert to the villagers. The occupational structure of Kiryath Shmoneh should be balanced, with the urban functions being carried out by town residents. This would require instruction, professional training, education and community development.

The village population of the Huleh region doubled from 1948 to 1958. Part of the growth occurred in new villages and part resulted from the gradual population increase in the older settlements. About \( \frac{3}{4} \) of the village population lived in collective villages. There were also four cooperative villages and three villages with private holdings.

Little was done directly, at least until 1958, to promote social contacts between the urban and rural population. Contacts were largely
incidental to the distribution of the economic, administrative and cultural focal points in the region. For example, when a villager visited the new offices of the Regional Council in Kiryath Shmoneh, he would probably also visit the modern shopping center and cinema. As the two amphitheaters and museums of the region were located in collective villages, town residents had to go to the rural area to attend theatre performances or concerts. The new football field in the town was expected to become an important meeting place for the region. The regional secondary school to be built in Kiryath Shmoneh would bring town and country children together, and was expected to play a significant role in helping to develop regional understanding and cooperation.

The Lakhish Region

The Lakhish Region, in the south of Israel, was underdeveloped until recently, due to scarcity of water resources. At the end of 1954 its development began in accordance with a regional settlement plan prepared by the Jewish Agency's Settlement Department. The lack of an adequate water supply in the region was remedied by piping water some 60 kilometers from the sources of the Yarkon River to the south of Israel. The objectives of the plan were to increase agricultural production, to integrate new immigrants into the rural community, and to settle the region intensively.

19 This section is based on Artur Glikson, Ibid.
Prior to completion of the water pipeline and irrigation, extensive dry farming prevailed in the Lakhish area. There were only a few, widely dispersed villages. With provision of irrigation, cultivation changed to field crops. The area of land per farm family was reduced in size to 4 hectares, with 2.5 hectares for field crops, 0.5 hectares for orchards and the rest for fodder.

The population target planned for the Lakhish region was 36,000, with 50% rural and 50% urban population. Most of the urban workers would be engaged in services and industries in the new regional town, Kiryath Gat.

The site selected for the regional town was at the intersection of the main roads crossing the region; on the dividing line between the western coastal plain, with potentially fertile agricultural land, and the eastern part of the region with eroded hills best suited for pasture; and in the geographical center of its area of influence. Kiryath Gat was about 60 kilometers from Tel Aviv to the north, Jerusalem to the east, and Beer-Sheva to the south. Within the region, to the west there was a semi-circle around the town of four sub-regional clusters, each with 4 to 6 villages linked to a Rural Community Center. These Centers were, on the average, about 10 kilometers from Kiryath Gat. To the east, the settlement pattern was very different. Here, there were more collective villages, Kibutzim, located 10 to 15 kilometers apart.
The planned population for Kiryath Gat was 14,000. In 1958, the 31 villages in the Lakhish region had a population of approximately 10,000 and the regional town, Kiryath Gat, about 7,000. Some 12,000 of these were newcomers who settled in 23 new villages and the new town.

New villages in the Lakhish region were mainly cooperative villages, moshavim, in which land, houses and production were individually owned and marketing and cultivation were organized cooperatively. As the villages were concerned exclusively with agricultural production, a town was needed for services and marketing. The basic functions of Kiryath Gat, therefore, were the processing of agricultural produce, the storage, marketing and transportation of raw materials and finished products, and the provision of services to the surrounding agricultural area.

Kiryath Gat was established in 1956 and its development proceeded quickly, complementing the intensification of agriculture in the region. By June 1958, industries related to agriculture included two cotton gins, a cotton spinning plant, and a peanut sorting plant. Other industries planned were a dye-house for cotton, a paper factory which would use cotton stalks, and a sugar factory to process sugar beets.

Occupations in Kiryath Gat included about 33% of the wage earners employed in industry, 38% in building, 13% in trades, commerce and small workshops, and 10% in public services. Glikson attributed this favorable occupational structure, just 2½ years after the town was established, to the planned integration of the town in the regional framework.
By 1958, Kiryath Gat was beginning to attract the villagers. Some came to town by small mule-cart, from distances of 10 to 12 kilometers. Completion of the regional ring road was expected to enhance the drawing power of the regional center.

More than 90% of the rural population settled in the moshavim villages. Here the social aim of planning was to provide a decent standard of living, to develop a village community, and to ease the adjustment of immigrants to their new environment. Village size was limited to 80 to 100 families, in order to minimize distances within the village and to achieve a cohesive rural community. In areas of intensive cultivation, villages were placed close together, in clusters of 5 to 6 villages around a service village, a Rural Community Center. This created small sub-regions, in which services in the individual moshav were minimized, while the Rural Community Center combined most of the services needed for the 5 to 6 villages. The population of such a center was about 2,000, a figure considered necessary for desirable development of village life and services. The distance from the Rural Community Center to the villages averaged 2 to 3 kilometers.

The Rural Community Center had disadvantages as well as advantages. Glikson referred to the danger of the Center becoming a settlement of managers, officials and specialists largely of European origin, while the villages contained farmers from under-developed countries. Suggestions for overcoming the problems which this situation creates were being considered in Israel in 1958. One suggestion was to place more teachers in the villages. Another was to introduce small
industries into the Rural Service Center, thereby diversifying the population and strengthening the link between the service center and the villages.

The planning and development of these three regions shows a consistent approach to high density settlement in rural regions. The emphasis is on the coordination of agriculture with industry based on agriculture, plus other types of industrial growth appropriate to the region. Glikson stresses the fact that a region is an interrelated environmental unit and must be conceived as such, if the design for development is to be successful. Towns and villages can and do develop balanced relationships by processes of trial and error over periods of years. But where delay means human suffering and high "social costs" of readjustment, as in Israel, some method must be found to speed up the process of achieving a balance. Thus, the pressing need for decisive action in Israel has served to bring into sharper focus the critical role of regional development authorities - a role designed "to shorten and alleviate such processes of balancing by the comprehensive planning and efficient timing of regional operations". 20

CONCLUSIONS

The selected experience of three "case studies" in planning for rural and urban nucleated settlements shows both similarities and

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20 Glikson, Ibid.
contrasts. It will be useful to recapitulate and explore some of the highlights, as a summation of the discussion in this chapter. No attempt is made to produce all-inclusive conclusions, but rather to focus attention on key differences in planning objectives, factors entering into the planning process, and effective policies of implementation, which emerge from the study of these regions.

The primary objectives of the Columbia Basin development were to irrigate an extensive area of semi-arid land and to provide power for the Pacific North-West. The development policy in the Dutch Polders was oriented exclusively towards agriculture, an orientation which Glikson criticizes as a weakness in Polder planning. He feels that as a first step in settlement of the Polders it was sound, but that industrial expansion to ease the population pressure in Holland could be superimposed on the basic agricultural structure at a later date. Israeli policy was molded from the problems created by pressures of new immigrant population, which required rapid, high density settlement. How have these policies emerged in practice?

The study of service centers in a developed irrigated area in the Middle Yakima Valley, which was undertaken to assist in planning for the Columbia Basin, concluded that there were only two essential types of service center - the rural service center and the local shopping center. The intermediate settlement type, the village, seemed to have

21 Glikson, op. cit., p. 108.
little economic justification. The rural service center role would be to provide convenience goods, through such minimum service outlets as a combined grocery store and automobile filling station. The local shopping center would be a town, with a minimum population of 2,000, providing all the basic services needed by farm families.

Support for the two types of centers was measured in terms of the number of farm families in the trading area, their purchasing power, and the size of the trading area. For successful operation, the rural service center would need about 100 farm families with purchasing power comparable to that of Middle Yakima Valley families. The minimum patronage necessary would be found within a two-mile radius, where population density was comparable to the Middle Yakima. A further requirement was that the rural service center should be at least six miles from the local shopping center.

The desirable support for the local shopping center was 1,000 farm families, with purchasing power similar to that of Middle Yakima families. In areas where the trading area was limited by topography or other controlling factors, 600 families was the basic minimum. The distance from farms to the local shopping center was ten miles or less in the Yakima Valley. Unless the patronage base within such a distance was inadequate to support a center, this was felt to be the desirable maximum distance.

Distribution of population in the Middle Yakima Valley was one farm person to at least one non-farm person in the local shopping center. Application of the ratio of 1:1 to farm population for the Columbia Basin
would suggest a minimum population, which would be increased if industry developed to a greater extent than in the Yakima Valley. The non-farm population was distributed with 75% in towns and 25% in rural areas, giving a population in the trade area of 50% farm, 37.5% town, and 12.5% rural non-farm. A 1953 report by the Bureau of Reclamation suggested that future population in the Columbia Basin might approximate 29% farm, 13% rural non-farm and 58% town and village, based on the pattern in a Southwest Idaho irrigated area in 1950. This shows a sharp divergence from the Yakima data, which was gathered in 1941. While the relative importance of rural service centers is practically unchanged, the towns and villages have assumed a much more significant role in comparison to farms.

General criteria used by the Community Development Section of the Bureau of Reclamation in planning for towns in the Columbia Basin involved town population, trading area population, and purchasing power. Desirable town population ranged from a low of 1,000 to a high of 3,500 to 4,000 persons. The minimum figure was based on the number necessary to provide satisfactory services and the maximum figure was based on the social needs of the rural people. The trading area should have at least 700 family size farms producing an annual income of $1,500. The latter criterion falls within the range recorded in the Middle Yakima study for number of farm families.

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22 Indications of Business and Industrial Development that will result from the Irrigation of the Columbia River Basin Project, Bureau of Reclamation, January 1953.
A comparison may be drawn between the Columbia Basin studies and the Dutch Polders. In the North-East Polder, there are two types of service center - the town and the villages. The "village" of the Polder would correspond roughly, in terms of population size, to the "local shopping center" of the Middle Yakima, or the "towns" planned for the Columbia Basin. The village had a population range from 1,000 to 2,500 in the North-East Polder and later, in the Eastern Flevoland Polder, a minimum population of 2,000. The types of centers required in the two countries seem to differ, with the Polder eliminating from its hierarchy of settlements the smallest center, which in the United States provides convenience goods.

Maximum distance from the farm to the village was three miles in the North-East Polder and somewhat more in the Eastern Flevoland, due to the change from bicycles to motor-bicycles. This was much less than the ten miles by road in the Yakima, as would be expected when comparing travel by bicycle to travel by automobile. The comparison indicates the need to consider time-distance rather than distance alone.

The North-East Polder population distribution was 25% on farms, 50% in villages, and 25% in the central town. The difference between this distribution and that in the Yakima Valley or Southwest Idaho probably reflects the effects of numerous factors, including agricultural laborers living in the Polder villages, a different emphasis on local processing of agricultural produce, and different forms of settlement nucleations.
The Polders are an outstanding example of successful plan implementation. Much can be learned from the staging of farm development, the synchronization of farm and non-farm settlement, and the scheduled sequence of town and village growth, to assure that the interrelationships planned for the Polders are not distorted by uncontrolled development.

The key planning problem in Israel in the past ten years has been to achieve a balanced distribution of the thousands of immigrants who were pouring into the State. The volume of population in relation to land resources made intensive settlement necessary. This fitted in well with the backgrounds of the immigrants, who were largely from urban environments, and it suggested emphasis on industrial development in addition to development of land resources by irrigation of the desert or by drainage of the swamps. But the need for rapid settlement of the immigrants injected unusual pressure into both the planning and action process. The resulting policy was one of intensive, rapid settlement, at locations with a development potential, so that a later move would not be necessary. New settlements were supported for a temporary period by development works undertaken by the State, and the location of these development works was an important determinant in the sequence of settlement in nucleations.

Historically, there were only two types of agglomerated settlement in Israel, the small agricultural village and the large city of regional and national importance, such as Tel Aviv and Haifa. The National Plan introduced three new types to fill out a hierarchy which would permit decentralization of industry and balanced regional growth.
The new types were a Rural Center of about 2,000 population, a Rural-Urban Center of 6,000 to 12,000, and a Medium Town of 40,000 to 60,000, which would act as a regional center. The considerably greater population of the regional center compared to the Polder center or the towns in the Columbia Basin reflects the urban emphasis in Israeli development.

Urban emphasis is also evident in the rural-urban population distribution. In the North-East Polder the rural-urban ratio is 75:25; by contrast, in the Afula region (Valley of Jezreel) it is 44:56 and in the Lakhish region, 50:50. Planned population density in the Polder is 100 persons per square kilometer of arable land; in the Jezreel Valley, on the other hand, it is 240 persons per square kilometer. An indication of the rapidity of industrial growth is evident in the development of Kiryath Gat, the center of the Lakhish region. Within 2½ years after its establishment, the occupational structure was 33% industry, 38% construction, 13% trades, commerce and small workshops, and 10% public services. Thus it becomes apparent that with positive objectives, comprehensive planning, and clearly defined development priorities, dramatic results may be achieved.
Chapter 3

THE PRESENT SETTLEMENT PATTERN IN

THE SOUTH SASKATCHEWAN RIVER PROJECT AREA

"If the nature of the service center and its tributary area is understood and applied to shifting rural relationships, it may provide an effective guide in establishing an orderly and stable pattern of rural service and rural life in the future."

Royal Commission on Agriculture and Rural Life, Saskatchewan
Chapter 3

THE PRESENT SETTLEMENT PATTERN IN THE
SOUTH SASKATCHEWAN RIVER PROJECT AREA

The area referred to in this study as the South Saskatchewan River Project area comprises most of the land which will become irrigable upon completion of the Project. It includes some 431,000 acres located in compact blocks, extending roughly from Saskatoon to Elbow, and from Colonsay to Asquith. (See Map 7). An additional 24,000 acres, comprising small parcels in the Qu'Appelle Valley, has been excluded from the maps since its importance for this study was not commensurate with the technical difficulties of mapping the larger, scattered area of irrigable land.

SOURCE OF DATA - THE LOCAL GOVERNMENT CONTINUING COMMITTEE, SASKATCHEWAN

The analysis of the settlement pattern in the Project area is based on unpublished data obtained from the Local Government Continuing Committee, Province of Saskatchewan. As noted in Chapter 1, one of the recommendations of the Royal Commission on Agriculture and Rural Life was that a comprehensive analysis of service centers be undertaken for the entire province. This recommendation was acted upon, and the study was made by the Local Government Continuing Committee, which used the service center concept as a first approach to the problem of
reorganizing local government boundaries. Preliminary administrative areas were derived on the basis of geographic arrangement of urban centers, reflecting the system of service relationships which had evolved between the urban centers and their rural hinterlands. The natural hierarchy of service centers offered possibilities for varying the number of local government areas by choosing an appropriate level in the hierarchy — village, town or greater town — as the basis for boundary delineation.

The Committee added some refinements and introduced more corroborative material to confirm the classification of service centers based on the concept developed in the Service Centers report, which is discussed in Chapter 1. It will be useful to outline briefly the steps taken by the Committee to develop the ranking of service centers recorded in Table 4 and shown graphically on Map 1.  

The functional analysis was derived by cataloguing all the services provided in each center, and then classifying all centers into a limited number of categories. The rank based on functional diversity was then confirmed or adjusted by data on population growth and volume of retail sales. The sales figures were obtained by totalling the sales recorded by individual establishments on their Education and Hospitalization Tax returns to the Taxation Branch. As the entry on the tax records for total sales, as opposed to taxable sales, is not enforced,

1 Based on letters from B. Sufrin, who is responsible for this research for the Local Government Continuing Committee, Regina, Saskatchewan, March 1959.
these data are not too reliable. For the South Saskatchewan River Project area, sales figures for centers of town rank or higher were used, after the functional classification, as a corroboration of status.

The primary trade areas were delineated by first indicating the village level of service, regardless of higher rank. Factors used were population density by township, location, direction of traffic movement, and topography. The areas served by rural telephone exchanges were checked later against the primary trade areas and were found to correspond fairly closely. Satellite status of centers was based chiefly on the school superintendents' knowledge of the relationships of villages to towns, and of towns to cities.

No attempt was made to delineate the service areas precisely, because school administration became the key consideration in the Committee's work. Centers and their satellites were grouped into areas of appropriate size for proposed county administration, in an effort to develop more efficient local government units than the present small rural municipalities. The resulting areas were then checked against the larger school unit areas proposed by the school superintendents.

Some of the implications of this emphasis on school administration deserve comment. The boundaries of larger school units as proposed by the school superintendents were based on the following factors:

(1) Existing centralization points which would continue to be used, plus planned as well as probable conveyance, were combined to produce larger attendance areas which should be left intact. The criteria for
larger attendance areas related to the number of grades per room, conveyance time, and enrolment. The goal was not more than three grades per room for elementary school and one grade per room for high school; not more than one hour conveyance time for elementary school children and 1½ hours for high school students; and an enrolment of 150 to 200 pupils. These conditions are not mutually consistent, and they varied widely with differences in population density and road conditions. On the average, it was found that high school centralization with a 15-mile service radius met the grade and enrolment standards.

(2) The boundaries of larger school units were related also to optimum administrative scale. Rough criteria adopted by the Department of education were 80 to 100 rooms (and teachers) and a pupil enrolment of 1,800 to 2,000 for each larger school unit.

(3) Some subsidiary factors used to adjust boundaries to achieve the best overall arrangement included satellite relationships between urban centers, ethnic homogeneity, topography, and communications.

The establishment of local government boundaries which are coterminous with larger school unit boundaries will unite the two most important roles of local government, and will have an important bearing on the future of some urban communities. A nodal point selected as the center of both new county government and larger school unit operations will be substantially strengthened in its role as a service center. Similarly, the removal of the local administrative function from a center will reduce its importance. Where the same factors are components of the centripetal force exerted by a specific center - such factors as topography, population density, distance, road conditions, railway
facilities - selection of a community for centralized administration and for a key service center role should coincide. Where different factors come into play, such as optimum administrative size of school facilities, the decisions may differ. The final decision on location of local government boundaries and centers of administration will effect the future functional diversity of service centers and their satellite relationships.

Having outlined the method used by the Local Government Continuing Committee to classify the service centers and to delineate primary trading areas for Saskatchewan, we will now proceed to analyze, on the basis of the Committee's data, the service center structure of the South Saskatchewan River Project Area.

FUNCTIONAL CLASSIFICATION OF SERVICE CENTERS

It was noted in Chapter 1 that the Service Centers report, by the Royal Commission on Agriculture and Rural Life, classified centers in Southwest Saskatchewan into five levels in a hierarchy of settlements, ranging from the hamlet, through the village, town and greater town, to the city. The Local Government Continuing Committee, in classifying centers for the entire province of Saskatchewan, has introduced additional ranks. These are illustrated by the two new designations of Village-Town and Town-Greater Town, interjected into the Village, Town, Greater Town Sequence.

Based on this new analysis the South Saskatchewan River Project area includes four types of service center, exclusive of Hamlets with a population under 1,000, and the Provincial City of Saskatoon, at the

2 See above, p.20.
northern fringe of the area. The four classes are Village, Village-Town, Town, and Town-Greater Town. The population of these centers ranges roughly from 100 to 1,000, and the types of function range from 1 to 32. Details of rank, population change from 1951 to 1956, and types of function in each center, are recorded in Table 4.

Examination of Table 4 indicates a grouping of functional types. Group I includes functions which occur at the lowest level in the hierarchy, such as lumber yard, hardware, implements, grocery, hotel, and are found also in larger centers, usually in greater number or with a higher volume of sales. Group II includes commercial functions requiring a larger patronage base, such as appliance stores and drug store, financial services, and health services. Banks and physicians are important incremental services, appearing in all Village-Towns but in only a few Villages. Newspaper publication, also in Group II, is an important incremental service distinguishing the Town from centers of lower rank. Group III functions reflect greater diversity and specialization. Few Group III functions are found in the centers of the South Saskatchewan River Project area. Insurance and real estate offices are in most of the centers of Town and higher rank, but also appear in a number of the Villages. Plumbing and heating is an incremental function at the Town level, and furniture stores appear in two Towns and the Town-Greater Town.

The Villages in the Project area offer from 1 to 20 types of service. The three Villages offering 20 services may be considered in detail, in order to determine what distinguishes them from a Village-Town.
SOUTH SASKATCHEWAN RIVER PROJECT AREA

LEGEND

O Village
(©) Village-Town
© Town
© Town-Greater Town
© City

SOURCE: Local Government Continuing Committee, Regina.

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SERVICE CENTERS
JEAN C. DOWNING
U.B.C. APRIL 1959
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<td>168</td>
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<tr>
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<td>V</td>
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<td>123</td>
<td>-6.8</td>
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<td>V</td>
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<td>167</td>
<td>25.6</td>
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<td>VANSCOY</td>
<td>V</td>
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<td>-1.8</td>
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<td>V/T</td>
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<td>YOUNG</td>
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<td>431</td>
<td>363</td>
<td>-16.7</td>
<td>577</td>
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<td>906</td>
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<tr>
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<td>482</td>
<td>431</td>
<td>-10.9</td>
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<td></td>
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<tr>
<td>DUMMORE</td>
<td>T</td>
<td>300</td>
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<td>0.3</td>
<td>460</td>
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<td>1,602</td>
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<tr>
<td>PREEDIE</td>
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<td>670</td>
<td>27.0</td>
<td>2,303</td>
<td></td>
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</tr>
</tbody>
</table>

Source: Local Government Continuing Committee, Regina, Saskatchewan.

*V* - Village
*V/T* - Village-Town
*T* - Town
*T/G.T.* - Town-Greater Town
Allan has 20 functions and a population of 337, which is above the general population range of 100 to 300 for Villages. It showed no increase in population from 1951 to 1956, and it lacks such important Group II functions as a bank and a physician. Asquith's 20 functions also reflect good coverage of Group I functions and Group II commercial functions, but lack Group II public services. Conquest's 20 types of service are well distributed in the three Groups. It has a bank and a dentist in Group II and a furniture store and custom tailor in Group III. Its population in 1956 was similar to that of Asquith, 295 compared to 288, and both centers showed a 12% population increase from 1951 to 1956. These three Villages with 20 functions are the most fully developed in the Village classification, but their functions need to be supplemented with additional key services before they will qualify as Village-Towns in the service center hierarchy.

In addition to the three Villages which exceed the general range of functional diversity for their particular classification, there are Villages which exceed the general population range. One of these, Allan, has already been mentioned and described. The other two are Kenaston, with a population of 385, and Dundurn, with a population of 421. Kenaston seems to be a center where population outruns functional growth - it offers only 6 types of function - draying, implements, hotel, pool room, restaurant, and meat market. This unusual cross section of functions may be partly due to its location in relation to highway routes. Kenaston is on the main highway from Regina to Saskatoon, the two Provincial Cities, and it is at the junction of the Regina-Saskatoon
highway and the east-west highway to Outlook and across the South Saskatchewan River to the west. This route also branches to the south and another river crossing at Elbow. (Map 4). Kenaston recorded a population jump of almost 40% from 1951 to 1956. Dundurn had a population of 421 in 1956, an increase of 41% over 1951. This Village has 14 functions, including two particularly significant ones for a center at this level - physician and vulcanizing. The imbalance between population and functions in Dundurn probably results from its proximity to the army camp, which attracts population not wholly related to the Village's service center functions. The vulcanizing service may also arise from the army camp effect - in this case its effect on traffic generation. The size of population is not a sufficient reason to change the status of either Dundurn or Kenaston, since they do not qualify as Village-Towns on the basis of functional structure.

The Village of Elbow has 18 functions; 7 in Group I, 7 in Group II, and 4 in Group III. With a population of 281 in 1956 and a population increase of 14% from 1951 to 1956, Elbow is one of the most fully developed villages in the South Saskatchewan River Project area.

The Village-Towns, with about 400 persons each, have a larger population than the Villages. The number of functions varies from 16 to 19, which is in the top segment of the range for Villages. The functions differ, however, with the Village-Towns offering many more in Group II. Each center has an appliance store, drug store, automobile dealer, restaurant, and meat market. Also, each has a bank and a physician. Incremental functions appearing at this level are barristers in two of
the centers, and a hospital in the third center.

Towns in the Project area show a wide variation in population, from roughly 400 to 900, and a functional diversity ranging from 19 to 32. Functions are concentrated more heavily in Group II than they are for centers of lower rank. All the centers of Town status have banks, all have physicians, and four centers have hospitals. Important incremental functions also appear. These include newspapers published in all Towns, clothing stores in three centers, a library in one center, and plumbing and heating in one center. The Town of Outlook has the greatest functional diversity (32 functions), the largest population (885), and the largest volume of retail sales ($1,602,000). It has seven Group III functions, including an automobile body shop, vulcanizing, and plumbing and heating services, which are not found in the other Towns. Some idea of the physical appearance of a Town with these characteristics can be seen in the air photograph of Outlook on the following page.

The only Town-Greater Town included in the South Saskatchewan River Project area is Davidson, located on the Regina-Saskatoon highway route. This center had a population of 851 in 1956, and has 32 functions. In both population and functional diversity it is obviously similar to the Town of Outlook. What factors merit assigning Davidson a higher rank than Outlook? The two centers offer the same types of functions in Group I. In Group II, Davidson has a dentist and Outlook does not. But Outlook has a liquor store and Davidson does not. The only incremental function in Davidson is a photographer. So the difference
Town of Outlook, Saskatchewan, looking north-east. P.F.R.A.
Pre-development farms can be seen immediately south of the town.

P.F.R.A. Photograph.
in functions is not sufficient to explain the difference in classification. Comparing retail sales volumes, Davidson shows sales of about $2.3 million and Outlook $1.6 million. This suggests that Davidson has either a greater number of establishments than Outlook or a higher volume of trade per store. This is apparently the significant factor on which Davidson's Town-Greater Town status rests.

The South Saskatchewan River Project area does not contain the full hierarchy of nucleated settlement types. In addition to the lower ranking centers which have been considered, the city of Saskatoon is located just inside the northern boundary of the area. This city has a population of about 80,000 and contains the University of Saskatchewan, which serves the entire province. The Royal Commission report on Service Centers classified Saskatoon as a Provincial City, sharing with Regina the top rank in the hierarchy for Saskatchewan.

**SPATIAL ARRANGEMENT OF SERVICE CENTERS**

Christaller's theoretical model of central places, which was discussed in Chapter 1, resulted in a number of locational rules which should apply to the settlement pattern provided that the assumptions basic to the theory hold true. These locational rules pertain to the number of central places in a full hierarchy of centers, the distance between centers, and the size of the service areas of centers of different rank. Therefore, we will have to examine Christaller's assumptions to determine whether the location of centers in the South Saskatchewan River Project area can be usefully discussed in terms of his theoretical relationships.
One of the basic assumptions of Christaller's theory is an "ideal" landscape, with flat terrain, uniform land fertility, equal distribution of resources, and unimpeded mobility. Such conditions suggest the possibility that rural population would be distributed evenly on the landscape, which was a further explicit assumption. It is apparent that the South Saskatchewan River Project area does not conform to these requirements. Although the area lies in a "prairie province", the local topography includes hills and sand dunes, and soils vary in type and productivity. (Map 2). Other resources in addition to productive land occur, such as potash. The South Saskatchewan River winds through the area, creating a natural barrier to movement. Since the rural population depends upon soils for a livelihood, the density of population varies with changes in soil productivity. (See Map 3 in relation to Map 2). Thus, since the given conditions are not in accord with the assumptions, it would be of little value to attempt to apply the theoretical relationships to explain the settlement pattern in the Project area. Moreover, since the Project area is limited in size, it does not embrace a full hierarchy of service centers within its boundaries. In view of these variations from Christaller's basic assumptions, the discussion of spatial relationships among service centers in the South Saskatchewan River Project Area will be approached in a less formalized way.

Since the role of the central place is to serve areas of surrounding productive land, the service center naturally tends to avoid areas of poor soil. Reference to Maps 1 and 2 shows the location of the
Towns of Delisle, Dinsmore and Craik in pockets of good soil. The larger area of good soil east of the South Saskatchewan River, extending to the eroded land along a creek, is served by both Outlook and Davidson.

The tendency for settlements to establish and develop in good soil areas is also related to the transportation factor. The relationship of railway routes to soils is evident when Maps 4 and 2 are viewed together. When the railways were built, opening up the west, the lines were routed through good soil zones in order to be most accessible to grain deliveries from good crop land. The settlements followed the railway, resulting in a linear tendency in their spatial arrangement, in contrast to the theoretical areal pattern of location based on serving the entire, uniform landscape with a minimum number of centers. Reference to Maps 4 and 1 indicates the linear pattern along the rail routes channelling towards Saskatoon. In particular these maps show how service centers of all levels in the hierarchy are strung along the railway and highway route through Craik, Davidson, Saskatoon, leaving broad expanses on either side where no centers occur. Similarly, the east-west rail routes through Saskatoon have attracted all the nucleations in the vicinity. Even at the Village level, the dependence on the railway is apparent along the line from Elbow through Outlook to Milden. It is worth noting that highways separate from rail routes do not attract settlement, as evidenced by the highway directly east of Saskatoon, and the east-west route through Milden, Outlook and Kenaston.

Smaller centers seem to cluster more closely to each other than to the larger centers. Villages between Saskatoon and Young, for example,
are closer to each other than to the Village-Town of Young, and closer to Young than to the Provincial City of Saskatoon. (See Map 1). A close grouping in a linear pattern occurs between Outlook and Davidson. Again, these villages are closer to each other than to centers of higher rank. This pattern appears to be similar to what Brush found in South-west Wisconsin. He suggested that it upheld the principle of Reilly's Law of Retail Gravitation which states, in part, that the attraction of a center varies directly with the population. If population growth roughly parallels functional diversity, then the centers of higher rank should have a greater attractive force.

Some Villages are interspersed between centers of higher rank at roughly equal distances. Thus there are two patterns which emerge in the South Saskatchewan River Project area, raising a question as to which can more logically be attributed to historical persistence.

Hamlets occur most often within the boundaries of trading areas of Towns and centers of higher rank. (See Map 5). They also appear occasionally in areas between the primary trading areas. The Hamlets are invariably located on the railway, but not necessarily on the highway.

**TRADING AREAS**

The primary trading areas of service centers in the South Saskatchewan River Project area vary considerably in size. (Map 5). In general, the size varies directly with the functional classification
of the center, with the Villages having the smallest trading areas, and the provincial City the largest. This conflicts with Christaller's theory, which indicated that the primary trading area of each center was of equal size, and that the hinterland, or satellite range, varied with centers of different rank.

The primary trading area of Saskatoon is the largest in the Project area, containing within it numerous hamlets. Just beyond the trade area boundary is a ring of Villages, each with small trade areas. Beyond the Villages are Towns and Village-Towns. This pattern is roughly in accordance with Kolb's theory of centrifugal clustering of smaller centers, discussed in Chapter 1. According to Kolb, a center of town rank or greater has a trading area consisting of three parts - primary, secondary and specialized. In the Saskatoon situation, the Villages are beyond the primary trade area, in the secondary service area. Here there is competition from other centers, such as the Towns of Perdue and Delisle. In the case of Vanscoy, for example, the link is to Delisle rather than to Saskatoon. The Towns are still within the Saskatoon sphere of influence, but only for specialized trade. The broken lines on the map, indicating the general area where Saskatoon's influence terminates, seem to confirm this explanation.

The shape of the trading areas also varies widely. On some of the transport routes, the lineal arrangement of centers close together has pushed the trading areas into roughly elliptical shapes. This is particularly apparent on the Regina-Saskatoon route from Craik to Hanley, and between Elbow and Hawarden. A similar pattern was found in Wisconsin
Another effect of the transport route is to draw the trade area boundary farther out along the major route. This is clearly evident along the highway east of Saskatoon, and is probably a phenomenon more likely to occur along a highway than along a railway, due to the general preference for using a car for shopping trips.

A similar eccentric stretching of a portion of the trading area boundary occurs in the Delisle and Outlook trading areas, for different reasons than that noted above. At Delisle a branch of the rail line veers to the south, drawing the trading area along its route to serve three Hamlets. The Outlook trading area also stretches farther south to take in four Hamlets located on the railway.

A rough guide to the patronage base for service centers is the rural population density, shown by township on Map 3. Relatively high density of rural population in the northern part of the area falls within Saskatoon's service range. Dinsmore serves typical densities for the Project area of 81 - 120 persons per township. The primary trading area of Outlook includes one township in the 121 - 150 persons per township range. Davidson has low densities in its primary trading area but its Village satellites' trading areas contain some higher density lands.

The effect of the South Saskatchewan River on the settlement pattern can best be considered in terms of trading area boundaries. Immediately south of Saskatoon's trading area, extensive tracts of poor
soil on both sides of the river discourage development, so that the barrier created by the river creates no problem. At Outlook, a river crossing overcomes the natural barrier and Outlook's primary trading area and satellite ties both extend across the river. Farther south, at Elbow, the primary trading areas break at the river, despite the fact that there is a river crossing. But here again, the influence of soils is apparent, as the bend in the river contains eroded land and sand. Thus, in the South Saskatchewan River Project area, there is no evidence that the river alone creates a barrier which cannot be fairly readily surmounted, except where it is in association with poor soils.

The linkage of service centers is, in general, from smaller centers to larger ones. Villages are linked to Towns, the Town-Greater Town and the City. Some Villages are within the sphere of two centers of higher rank. Loreburn, for example, is related to Outlook and to Davidson, with the stronger link to Outlook. This is probably due to the more direct highway route to Outlook.

Davidson, a Town-Greater Town, has only Villages as its satellites, thereby skipping both Towns and Village-Towns which would be expected to appear within its sphere of influence. Perhaps the classification used for purposes of defining administrative boundaries is insufficiently differentiated to permit identification of satellite relationships with centers of the next lower rank.

The discussion of the present settlement pattern has been, in fact, just that. It has not attempted to discuss, except insofar as the
recent population trend is concerned, changes in the service centers over time. Obviously, service centers are not static artifacts. The dynamic process of change will be introduced not in terms of forces bringing about past trends, but as determinants of the future. The following chapter will discuss some pertinent factors which must be considered in attempting to answer the question, "How will irrigation and new development in the South Saskatchewan River Project Area affect the existing nucleations and their interrelationships?"
Chapter 4

THE IMPACT OF THE SOUTH SASKATCHEWAN RIVER PROJECT
ON NUCLEATED SETTLEMENTS IN THE PROJECT AREA

"The project is to provide facilities for the irrigation of approximately 500,000 acres of land in Central Saskatchewan and in the Qu'Appelle Valley and to provide other benefits to the area including a source of hydro electric power, a source of rural and urban water supply, flood control, and recreation facilities."

Agreement between Canada and Saskatchewan, September 1958
The population of each settlement is indicated according to the following examples:

- under 500
- 500 - 2,000
- 2,000 - 25,000
- 25,000 - 100,000
- WINNIPEG Provincial Capital (regardless of size)

The names of incorporated cities, towns and villages are shown in red. Unincorporated places are shown in black.
Site of South Saskatchewan
River Dam, looking south-east.

P.F.R.A. Photograph.
Chapter 4

THE IMPACT OF THE SOUTH SASKATCHEWAN RIVER PROJECT ON NUCLEATED SETTLEMENTS IN THE PROJECT AREA

The purpose of this study is to apply the theoretical principles of a hierarchy of central places differentiated by functional diversity, each with its related service area, to an evaluation of the impact of the South Saskatchewan River Project on the pattern of nucleated settlements in the Project area. The impact represents a totality of numerous factors, each factor acting and interacting to produce changes both in the functional structure of individual nucleations and in the satellite relationships among them. Discussion of these pertinent factors forms the core of this chapter.

The approach used is to consider each factor in relation to the theoretical implications, experience elsewhere, and the South Saskatchewan River Project. The Project is described briefly and specific stages of its development are defined in terms of the extent of irrigated acreage, with the emphasis in this study on long-range development. The factors are then considered in relation to some actual towns and villages in the Project area, to indicate possible changes in the role and status of these centers as the Project progresses.

This study makes no attempt to embrace within its scope conclusive evidence regarding the factors discussed. Limitations are imposed by
both lack of basic data regarding farm settlement and therefore probable future population, and the proportions of the present study, which constitutes a "project in lieu of a thesis". The intention is (1) to raise points which are vital to the process of evaluating the impact of the Project on settlement nucleations in the Project area and to the process of planning the future settlement pattern; (2) to show some of the complex interrelationships and interactions of the various factors discussed; (3) to consider the implications of development priority decisions on the status of nucleated settlements; and (4) to note some specific areas which require research to supplement present knowledge. This initial study of the impact of the South Saskatchewan River Project on nucleated settlements in the Project area should suggest an orientation for future, more detailed investigation.

THE SOUTH SASKATCHEWAN RIVER PROJECT

Aspects of the South Saskatchewan River Project which are pertinent to the present study are outlined briefly in this section, as a basis for subsequent discussion of the factors affecting the size and location of nucleated settlements in the Project area.

After many years of discussion regarding the feasibility and desirability of constructing a dam on the South Saskatchewan River, an agreement between the Government of Canada and the Government of Saskatchewan was signed in September 1958, providing for construction of a dam and reservoir, power generating facilities, and irrigation
works. In addition to the major purposes of irrigation and hydroelectric power generation, the project will provide a water supply for rural and urban use, will assist in flood control, and will offer recreational opportunities related to the reservoir.

The earth dam will be located about 30 miles upstream from the City of Saskatoon, at the point where Coteau Creek flows into the South Saskatchewan River. It will create a reservoir about 150 miles long, extending from Saskatchewan Landing to the Coteau Dam (Main Dam) site, and about 30 miles down the Qu'Appelle Valley where a secondary dam will be erected. When the reservoir is filled to full supply level, it will inundate 116,000 acres of land. Nearly 90% of this acreage is immediately adjacent to the river and is not suitable for cultivation, due to erosion. The filling of the reservoir will also necessitate relocation of portions of both the highway system and the railway lines.

Irrigation is the major purpose of the Project. Some 431,000 acres of irrigable land are located in compact blocks in an area extending roughly from Saskatoon to Elbow, and from Colonsay to Asquith. (See Map 7). A further 24,000 acres occurs in small parcels in the Qu'Appelle Valley. Gravity flow will serve about 180,000 acres, while

1 Agreement between the Government of Canada and the Government of Saskatchewan regarding the South Saskatchewan River Project, September 1958, Appendix A.

the remainder requires pumping to the various levels indicated below.

<table>
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<th>Gravity</th>
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<tr>
<td>30' lift</td>
<td>70,400</td>
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<tr>
<td>60' lift</td>
<td>80,400</td>
</tr>
<tr>
<td>120' lift</td>
<td>78,600</td>
</tr>
<tr>
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<td>455,000 acres</td>
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</table>

Power for irrigation pumping purposes will be available from the generating station to be built at the Coteau Dam site. Initial installed capacity of 150,000 kilowatts is scheduled to be completed at the same time as the dam and reservoir. The power generated at this plant will be tied in with the provincial power grid to serve domestic, farm and industrial needs in the project area and throughout the Province. The initial capacity is expected to be increased in later years.

Responsibility for construction of the South Saskatchewan River Project is shared by the Government of Canada and the Province of Saskatchewan. The dam and reservoir will be built by Canada, through the Prairie Farm Rehabilitation Administration, and then will be turned over to the Province for operation and maintenance. Irrigation is the responsibility of the Province and the construction of irrigation facilities will be undertaken by the Provincial Department of Agriculture. Power is also a Provincial responsibility, with the generating works to be constructed by the Saskatchewan Power Corporation, a Crown Corporation.

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4 Agreement, op. cit.
Thus, by 1965 or 1966, upon completion of the dam and reservoir, irrigation of 50,000 acres of land, and power generating capacity of 150,000 kilowatts, the Province will have sole responsibility for operation and maintenance of all aspects of the Project, as well as for subsequent expansion of power and irrigation facilities.

The change from dry land farming to irrigation farming of half a million acres of land is a change which cannot be accomplished quickly. It will require provision of the physical facilities for irrigation—the canals, ditches and pumps; the formulation of land policy; land preparation on individual farms; and a desire on the part of the farmers to make the change. Any realistic discussion must therefore recognize that stage development of an irrigation project of this magnitude is both desirable and inevitable.

The impact of the multi-purpose Project will be discussed in this chapter at two separate stages, defined by the extent of irrigation. The full irrigation of 50,000 acres of land, scheduled to synchronize with the filling of the reservoir in 1965 or 1966, is considered to be the "initial stage" of Project development. The "later stage" is farther in the future, perhaps as far as 1980, when the entire irrigable area of 455,000 acres is under irrigation.

It is at once apparent that the more immediate construction phase has been omitted. This is not intended as a denial of the fact that the construction phase will bring change. During the next six to eight years, while the main reservoir and dam are being built, many
decisions will need to be made concerning development. Already plans are being made to provide accommodation for construction workers; sites have been selected for the P.F.R.A. construction headquarters and for several contractors' camps; and school needs for the P.F.R.A. employees' children are under study. Changes of this sort are not considered here because the purpose of this study is to use the analysis of the settlement pattern based on a theoretical framework to measure the impact of the Project on the region as a whole, over a long-term period. It can be argued that decisions during the construction phase can best be made within the framework of a longer-range, planned pattern of settlement. The two-stage approach therefore seems valid, as it will provide benchmarks against which to consider the implications of more immediate decisions.

GENERAL DISCUSSION OF FACTORS AFFECTING THE PATTERN OF NUCLEATED SETTLEMENTS IN THE PROJECT AREA

The impact of the multi-purpose South Saskatchewan River Project stems from its various development aspects, but the major change during the "initial stage" may be expected to result from irrigation of 50,000 acres of farm land. The farm size objective is a unit of 320 acres, containing a minimum of 200 irrigable acres. Such a size will permit use of the latest techniques in irrigation, which make it possible for a

farmer to irrigate relatively large acreages. The early stages of development will probably be based largely on livestock, forage and cereal crops. Later, when more specialty crops are introduced in the area, farm units of a smaller size may be desired.

The size of farm unit is a key determinant of the number of farms in a given acreage. A block of 50,000 acres, for example, in 320-acre farms, would contain about 150 farms. If land around the perimeter of the irrigable block was integrated with the irrigable acreage to provide a minimum of 200 irrigated acres on each farm unit, a greater number of farm units could be developed from irrigation of 50,000 acres. At present, in Census subdivisions partially within the irrigable blocks in the vicinity of Outlook-Elbow, the typical farm size ranges from 400 to 1,120 acres. In Census subdivisions 253 and 254, near Outlook, the total farm land comprises 381,017 acres and total farm operators 543. The average farm size is, therefore, 700 acres.

The effect of such a change in farm size on population supported by agriculture is immediately apparent, and may be illustrated by further reference to Census subdivisions 253 and 254. Here the total farm population in 1956 was 1,617. Relating this figure to the number of farms, 543, the average population per farm is approximately 3 persons. The comparable figure for the Province of Saskatchewan was 3.5 in 1956. The United States Bureau of Reclamation, in 1953, used 3.0 persons as the average population per farm in their studies.

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average population per farm in forecasting population for the Columbia Basin Project. It should be noted that in the Columbia Basin the farm size was smaller, ranging from 10 to 160 acres, depending on land classification, with the maximum of 160 acres set by federal law. The difference in farm size is probably not a significant factor in population per farm because the increase has been made possible by new developments in the technology of irrigation farming. In 1952, for example, the Saskatchewan Department of Agriculture recommended a farm unit size of 160 acres for the South Saskatchewan River Project but in 1958, based on experience in Alberta irrigation projects, the Department recommended 320 acres. Assuming that the average population per farm in the South Saskatchewan River Project area might increase from 3.0 persons to about 3.5 persons with more intensive crops and livestock production made possible by irrigation, a rough comparison may be made of the farm population density now and at the initial stage of development.

<table>
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<th>Present</th>
<th>Initial Stage</th>
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<tbody>
<tr>
<td>Average farm size</td>
<td>700 acres</td>
<td>320 acres</td>
</tr>
<tr>
<td>Size of area</td>
<td>50,000 acres</td>
<td>50,000 acres</td>
</tr>
<tr>
<td>Population per farm</td>
<td>3.0</td>
<td>3.5</td>
</tr>
<tr>
<td>Total farm population</td>
<td>214</td>
<td>515</td>
</tr>
</tbody>
</table>

It is apparent that the Project will make it possible to more than double


8 Compare Submissions of the Province of Saskatchewan to the Royal Commission on the South Saskatchewan River Project, 1952, p. 19, and Preliminary Statement on Irrigation Development Policy for the South Saskatchewan River Irrigation Project, 1958, p. 3.
the farm population of the irrigated area. A higher density, more uniform distribution of farm population should serve to strengthen some of the smaller centers which are in key locations and to provide sufficient support to enable them to improve their relative status in the hierarchy of settlement nucleations.

According to Christaller's theory, the function of the central places is to provide services for the surrounding area of productive land. An increase in farm population would increase the services required from the central places and, in turn, require more persons engaged in providing these services. The rural-urban population ratio varies from one region to another depending upon the development policy. In Israel, it will be recalled, the emphasis was on urban development, in contrast to the rural emphasis in the Polders. The South Saskatchewan River Project is probably most comparable, in its initial stage, to the Columbia River Basin. Here, in the Quincy trade area, the ratios of non-farm to farm population used in the estimates of population were 1.3, 1.4 and 1.5. These were based on ratios observed in other similar areas. Application of selected ratios to the farm population of the South Saskatchewan River Project area would suggest a figure for non-farm population.

Once an estimate of non-farm population has been developed, the next factor to consider is distribution of the non-farm population among the nucleated settlements in the Project area. This involves such

factors as time-distance relationships, distribution of purchasing power, shopping habits and social needs of the rural population. In the Polders it was noted that convenience goods centers were not used, and that there were only two types of center: the villages and the central town. In Saskatchewan, however, the needs of grain marketing still require small hamlets located on the railway to serve as shipment points and to provide convenience goods. Comparing the Middle Yakima, for example, the rural service center seemed to be needed and it was the intermediate village center which was found to be expendable. The Saskatchewan Royal Commission on Agriculture and Rural Life indicated that present trends pointed to roles of growing importance for the Town, Greater Town and City. Although the smaller centers showed limited growth, they still played an important part in rural life and seemed unlikely to disappear. The Commission also noted the inherent stability of centers, due to individual investment and social capital expenditures on schools, hospitals, roads and other public needs. This points up the need for planning the future pattern of nucleated settlement location to achieve optimum location of any new centers to serve the area efficiently and also to permit designation of strategically located existing smaller centers for more important service roles.

Farm family purchasing power is an important factor affecting the size of trading area required to support a center and, therefore, the location of centers in relation to each other. In the Quincy study it was pointed out, for example, that an increase in maximum allowable farm size from 160 acres to 320 acres would change the distribution of income. This would be likely to place a greater emphasis on shopping
goods and detract from the relative importance of convenience goods. The resultant effect on nucleated settlements would be to enhance the role of the larger centers above town rank and to detract from the role of smaller centers. This is in contrast to the South Saskatchewan River Project area, where a major effect would be the stabilization of purchasing power through control of the water supply. While the area can produce good dry-land crops in normal years, the major problem is still crop failures during periods of drought. Greater stability of farm purchasing power strengthens the prospects of service centers in the region.

In addition to its stabilizing influence, the South Saskatchewan River Project may be expected to increase the total value of production in the Project area. Based on long-term prices and yields, it is estimated that the average value of farm produce in the irrigable area could be increased from $4 million to $10 million annually.10 Average net income of Saskatchewan farms from 1948 to 1957 was about $3,470. It is estimated that the net income from a 320-acre farm in the irrigated area might be from $5,000 to $10,000 annually. Such an increase in average income per farm, coupled with an increase in the number of farms in the area, would increase the total volume of trade and service in the nucleated settlements. The added patronage base would tend to either increase the volume of business in existing centers or to encourage

establishment of new centers. The result will probably be determined to a large degree by the time-distance factor.

We have noted the effect of a change in mode of transportation on the planned location of the new Polder villages in relation to the farms. In Saskatchewan, the variable in the time-distance relationship is not the vehicle but the presence or absence of all-weather roads. The construction of the municipal road grid will change the relationships between some of the towns and villages in the Project area by providing new connections which shorten the time needed to move from one point to another.

Location of new highway links across the river and the reservoir may affect the hierarchy of settlement nucleations. Roads and highways will be needed in the South Saskatchewan Project area for marketing produce and for recreational use. In some cases these two separate needs may be served by a single route, while in other cases it may be desirable to separate the two uses in planning highways. Functional highway planning and its relationship to the pattern of nucleated settlements requires study by agencies concerned with highway, recreation and community development.

Inundation of land may bring about drastic changes in the size and shape of trading areas. A substantial reduction in the patronage base through loss of cultivated land could change the future status of a center in the hierarchy of settlement nucleations. In the Tennessee Valley, for example, the rural village of Sale Creek served a trading
area including a Valley which would be inundated. The reservoir would remove 7% of the trade area, which represented 16% of the land used for agriculture and 52% of its best agricultural land. Some 7% of the population of the trade area lived on the land to be flooded but as this land was the most productive the average annual expenditure per family was greater for families in this area. Losses of land, population and purchasing power should be taken into account in a detailed evaluation of the impact of the South Saskatchewan River Project on settlement nucleations in the Project area.

Shopping habits reflect both consumer mobility and technology. Universal automobile ownership and improved roads permit travelling a greater distance to shop within a given time. Coupled with this factor is the influence of rural electrification, which increases the use of refrigeration, thereby enabling preservation of foodstuffs and less frequent shopping trips. A reduction in the number of necessary trips tends to reinforce consumer willingness to drive farther to shop. Thus, the larger centers in the Project area are likely to show greater gains in functional diversity than the smaller centers.

The size of a center which satisfies economic needs of rural people may differ from the size which satisfies social needs. We have noted that social need was the criterion for maximum size of planned new towns in the Columbia Basin Project. Optimum community size is a

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subject on which there is limited definitive data. Such an area of study might be undertaken by the recently established Center for Community Studies at the University of Saskatchewan, Saskatoon, to determine the social needs of rural people and to describe these needs in terms of maximum size of nucleated settlements in Central Saskatchewan. Greater insight into size needs might affect the desirable distance between centers of a similar functional rank.

The provision of abundant supplies of water and power by the South Saskatchewan River Project will prove attractive to industry. The choice of industrial location will depend on the type of industry and its relative need for railway connections, labor supply and access to financial services. Undoubtedly industries needing a well developed city center as their headquarters will favor Saskatoon. Towns in the Project area should be able to compete successfully for industries related to agricultural processing and for other industries if adequate transportation routes are provided. The effect of industrial expansion can be expected to have its greatest impact on nucleated settlements in the Project area after the reservoir has been filled, the power generating plant has been completed, and irrigated lands have started to produce more specialty crops. The general effect of industry seems likely to be to encourage growth of the larger centers in the Project area and those most accessible to water, power and transport. Detailed study should be made of the potentialities of the Project area for industrial development and the characteristics of centers most attractive for industrial location.
The recreational potential of the reservoir, with its 450-mile shoreline, may be expected to stimulate functional diversification in some of the nucleated settlements nearby. The particular centers which will be affected cannot be determined until surveys of the shoreline have been made to select desirable sites for recreational development. Recreational areas should be clearly designated so that development will not be scattered haphazardly along the shoreline, disfiguring the landscape and providing inadequate service.

The factors which have been considered suggest some of the many influences brought into play by a project of many facets, such as the South Saskatchewan River Project. The list of factors is not exhaustive and a more detailed study would undoubtedly reveal other matters requiring consideration in attempting to evaluate the impact of the Project on nucleated settlement relationships. The factors raised are sufficient, however, to permit proceeding to examine some examples of the impact on particular centers, as an illustration of a possible method of evaluation which could be applied to the entire Project area.

EXAMPLES OF THE IMPACT OF THE SOUTH SASKATCHEWAN RIVER PROJECT ON NUCLEATED SETTLEMENTS IN THE PROJECT AREA

The provincial government's commitment for irrigation in the South Saskatchewan River Project area is to construct the works necessary to provide water to 50,000 acres of land within a year after the reservoir is filled. However, the location of the initial development of 50,000 acres has not yet been decided. The approach used in this study is to
select alternative areas as "initial stage" development areas, as a basis for consideration of some of the factors in relation to specific nucleated settlements.

Selection of the initial development areas is based on such factors as soils, drainage, topography, climate, pumping requirements for irrigation, accessibility to the source of water, present land use, and timing of development. A study of soils in the irrigable area, based on a consideration of soil texture, topography, alkali salt content, stoniness, and wind and water erosion, indicates that the need for irrigation and the probable success of it is greater in the southern portion of the area near Elbow and Outlook than in the northern portion near Saskatoon. 12

The largest gravity flow area occurs near Outlook in the area designated "A" on Map 7. It also has the advantage of proximity to the main dam. Block A is therefore selected as one of the alternative areas. Farther south are the blocks of irrigable land designated "B", which comprise some 35,000 acres. These blocks could be developed along with some of the acreage in the Qu'Appelle Valley to the east, to make up the 50,000 acres. By developing these southernmost blocks first, there would be an opportunity to consider the technical aspects of irrigation in the more northerly areas in more detail, prior to development. Blocks

B are therefore used as the second alternative for discussion purposes.

Which existing service centers may be expected to benefit from development of Block A? Outlook is at present the only Town in the area. With a population of 885 in 1956, it was almost double the size of Hanley, a Village-Town with a 1956 population of 425. Outlook's trading area extends at present more to the south and east than to the north, (Map 5). Hanley's trading area extends farther to the east than to the west. The distance by road from Outlook to the eastern extremity of Block A is about 30 miles. As Hanley is much closer, it is likely that it will attract trade from the eastern part of the area. The effect on the boundaries of the primary trading areas will be to pull the boundaries of the Hanley trading area to the west, and those of the Outlook trading area to the north and east. Development of Block A, therefore, may be expected to add greatest impetus to Outlook's growth and to make some demands on Hanley's services. The distance between the two centers, about 35 miles, is not sufficient to suggest any need for a new community.

Blocks B are located on each side of the Village of Elbow, which had a population of 281 in 1956 and has 18 functions. The only other Village nearby is Loreburn, with a population of 197 and 1 function. We have noted in Chapter 3 that Elbow is well developed for a center of Village status. Its primary trading area breaks at the River, a break which is reinforced by poor soils in the bend of the river. The development of Blocks B may be expected to enlarge the trading area of Elbow, stretching it along the reservoir to the north-west and expanding it to the east to almost double its present size. Whether the trading area
will then expand across the reservoir will depend on the location of crossings and on Elbow's competitive position in relation to centers to the south, beyond the boundaries of the Project area, as defined for the present study.

The functional rank of Elbow cannot be wholly predicted in relation to irrigation development. Its strategic location adjacent to the reservoir extending along the South Saskatchewan River and down the Qu'Appelle River Valley, gives the Village an enormous recreation potential. If good, direct road links were provided southward to the Trans-Canada Highway and eastward to the major north-south highway in the Province, Elbow could increase its functional diversity in response to recreational needs as well as irrigation. The steep valley sides of the reservoir will consist mainly of clay and silt which will be difficult to handle under fluctuating water conditions. A detailed survey is therefore necessary to determine the best sites for development of beaches and boat launching areas. Depending upon the results of such a survey, the recreation function might be concentrated in more than one existing community, or it might conceivably lead to establishment of a new community. In any case, the repercussions of recreational development may be expected to concentrate at the main dam and upstream from it.

What would be the effect on the future roles of Outlook and Elbow of developing Block A prior to Blocks B? The Polder experience, discussed in Chapter 2, brought to our attention the importance of timing in implementing the planned functions of nucleated settlements. In the Wieringermeer Polder the village which was started first attracted central
services intended for the central town. While this experience related to new development, the same principle applies to regions already settled, where new development is taking place. Applying this principle to the South Saskatchewan River Project "initial stage" of development, the decision as it relates to nucleated settlements should be made on the basis of whether a center of higher than Village rank will be needed in the area roughly bounded by the South Saskatchewan River, Outlook, Davidson and Craik. If so, and if the present Village of Elbow is a logical existing center in which to encourage development, some conscious direction is needed.

To what degree would the future role of Elbow be impaired by prior development of Block A, which would give initial impetus to Outlook and enlarge its already substantial sphere of influence? It seems probable that Elbow's development could best be assured by developing Blocks B before Block A. Outlook, the largest Town in the Project area, is located near the main Dam site and will develop during the period of construction of the Dam, reservoir and power generating plant. Prior development of Blocks B to encourage Elbow's growth would, therefore, in no way detract from Outlook's importance. Based on these considerations, initial development of Blocks B would seem to be preferable. The effect on the nucleated settlement pattern is one of several aspects to be weighed in selecting the initial development area, but in cases where other aspects are equal, it could become the significant factor.

The "later stage" of development has been defined as full development of irrigable acreage. This could include all the northern
blocks on the west side of the South Saskatchewan River, extending from Outlook to north of Saskatoon. The Town in the heart of this area is Delisle, which had a population of 482 in 1956 and has 19 functions. Most of its present trading area contains irrigable acreage, so that more farm units, an increase in population and greater farm purchasing power will produce greater functional diversity in Delisle, even if the primary trading area boundaries remain unchanged. Since the blocks of irrigable acreage extend across trading area boundaries, to the north and to the south, the possibility of expansion of Delisle's primary trading area into the interstitial areas between primary trading areas of various other centers seems likely. A factor which may influence the primary trading area is the market for produce. Saskatoon, a major urban market, may tend more and more in the future to broaden its primary trading area. In the case of Delisle, however, the intervening Village of Vanscoy may act as an effective buffer, minimizing the effect on Delisle's trading area of Saskatoon's enlarging sphere of influence.

Industry may be expected to have a greater impact during the "later stage" of development. If it tends to concentrate in locations close to the source of power and to productive irrigated acreage, Outlook seems to be the most appropriate center. Where industry seeks reasonable accessibility to power and produce, plus close association with the main line of a railway, financial services and a labor supply, Saskatoon seems likely to increase its dominance. The effect of industry in the southern part of the Project area is likely to be relatively limited.
The discussion of the impact of the South Saskatchewan River Project on nucleated settlements in the Project area has been general and suggestive rather than detailed and definitive. Such an approach was necessitated to keep within the imposed limits of the study.

The purpose has been to indicate the possibility of using a theoretical concept of settlement, applied to a particular region, to analyze the impact of a Project such as the South Saskatchewan River Project on the pattern of nucleated settlements. The value of the study lies in this practical application of Christaller's theory of central places, insofar as it relates to functional classification of centers and delineation of their trading areas, to the process of analysis and planning of the nucleated settlement pattern. Such planning is advantageous to the region, in permitting more efficient development, with a minimum number of central places of appropriate rank to serve the population. It is also advantageous to the central places in clarifying the opportunities and limitations of their respective roles. Each center is then in a position to develop its functions with the conscious goal of full achievement of appropriate service center status.
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Figure


SOUTH SASKATCHEWAN RIVER PROJECT AREA

LEGEND

- 0 - 15
- 16 - 50
- 51 - 80
- 81 - 120
- 121 - 150
- 151 - 200
- 201 - 300
- 301 +

Population per township, 1956 Census.

TITLE
RURAL POPULATION DENSITY

JEAN C. DOWNING
U.B.C. APRIL 1959
SOUTH SASKATCHEWAN RIVER PROJECT AREA

LEGEND

Trading Center
Primary Trading Area
Satellite ties

TITLE
TRADING AREAS

Source: Local Government Continuing Committee
Regina, Saskatchewan

JEAN C. DOWNING
U.B.C. APRIL 1959