PAKISTAN GEOGRAPHICAL REVIEW

Volume 37 .. Number 1 & 2

1982

PAKISTAN GEOGRAPHICAL REVIEW

Volume 37 1982 No. 1 & 2

CONTENTS

SOME GEOHYDROLOGICAL PROPERTIES OF ISLAMABAD LOESS

ANIS A. ABBAS1*

Introduction

Soil moisture is important for the growth of plants. The dissolved soil constituents and their availability to the plants has a great significance. In this article some important liquid phaze characteristics of loessic soils of Islamabad have been discussed.

In most parts of the Federal Capital area loess is of common occurance. The term loess is of German origin, meaning "loose". It was first used in 1821 by Scheidiq and by Lyell in 1834. Loess is defined as a massive well sorted silt with some clay and very fine sand commonly buff in colour generally accepted as eolian deposit laid down in pro glacial arid climatic regions during pleistocene p~riod. Tn Tshm'J,bad it: is best exposed in the terrace scarps which appear brownish-yellow in ~.:olour having silty texture. Its fine constituents which make it friable so that i(can be rubbed to an impulpable powder with fingers, its richness in *kankerno.dule,* occurance of innumerable root like tubes 0.2 mm to o:ver 4 mm in diameter, are its area typical characteristics. Absence of stratification and occurance of mollusc gastroped shells is also common.

Location of Study

The study of permeability of loessic deposits has been carried out in the Federal Capital area of Islamabad lying between Margalla Hills ang Chaklala along the Islamabad highway. The area constitutes the northern most part of the Potwar plateau and lies between latitude 33°-29 and 33°-49 and longitude 72°-25 and 73°-24 east. (Fig. I Photo of site)

Surface Configuration

From Margalla hills, the land slopes towards Rawalpindi in which alternating steeply dipping almost vertical beds of sandstone and shales

·Professor Anis A. Abbasi is Associate Professor Department of Geography, University of the Punjab.

LOCATION OF STUDY AREA

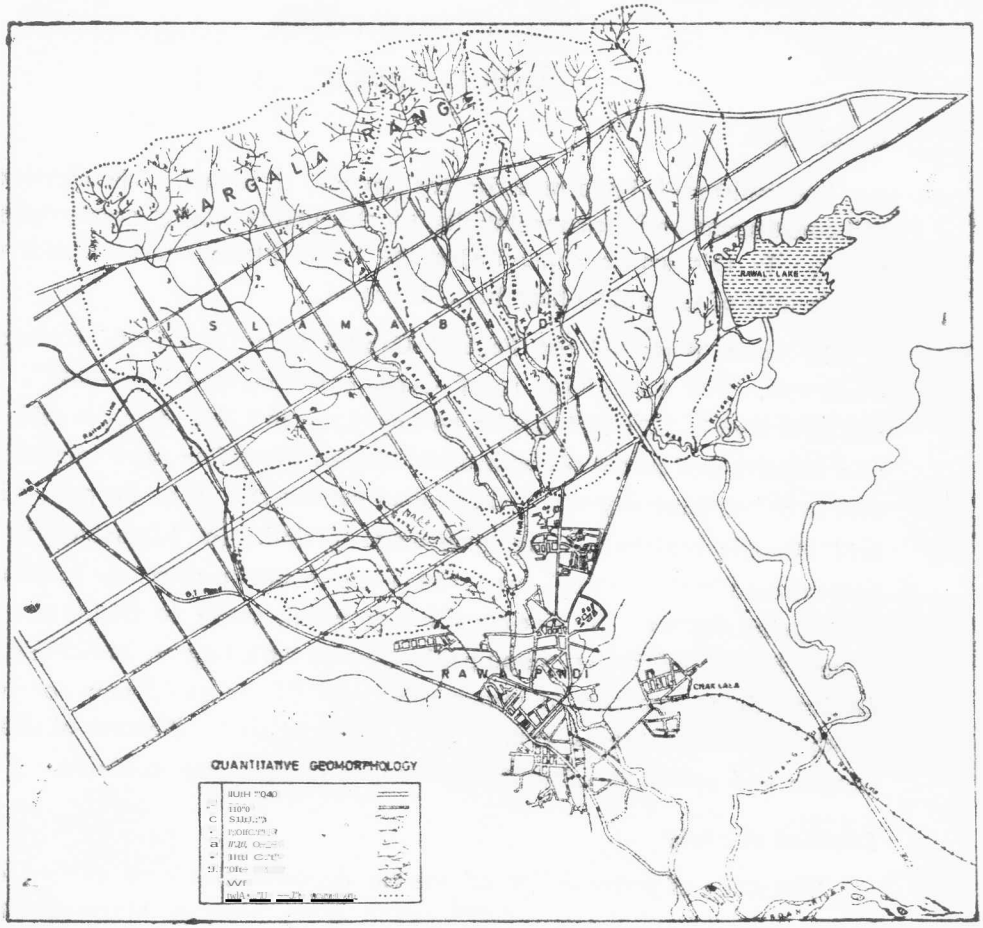
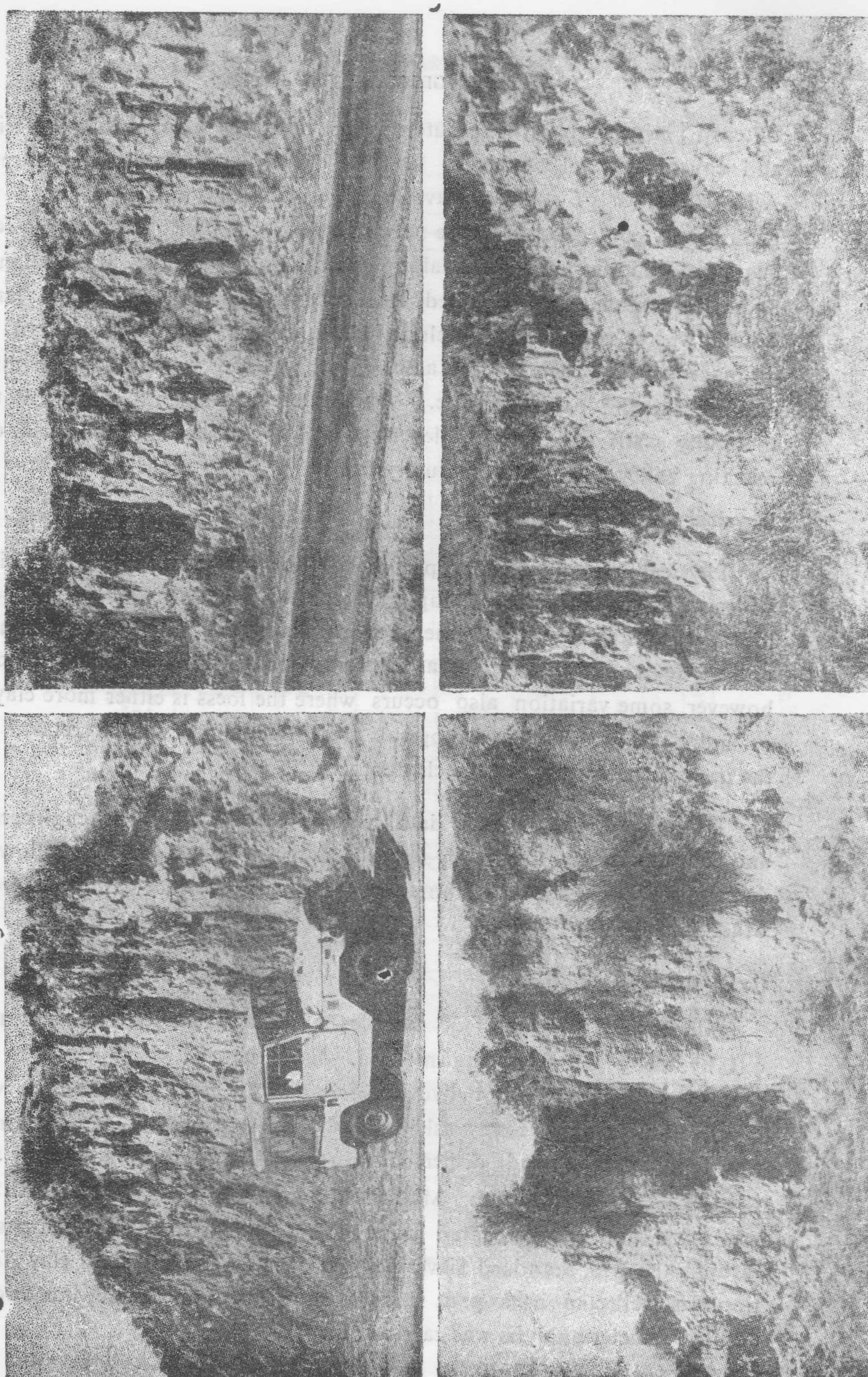


Figure 1



Areas of Sample Collection

outcrop ; large p;trts of ~hese outcrops are covered with loessic material and constitute level to nearly level or gently undulating plain area. A large number of streams traverse the area from north to south in geologically controHed drainage network. In large parts stream erqsion has produced terraced land along with deeply eroded gullied land. Some flat remnants ofJ.meroded land can also be seen. Gullied land occurs where runoff has developed an !ntricate dendriatic pattern of drainage in which each g1,ll1yis actively engaged in widening, deepening and lengthening of its profile. Mass wasting frequently occurs along tbe gully walls and ~mall valley slopes. The mass wasting material on reacbing valley bottol1l~ is gradually transported by streams.

Physical properties

Pbysica1 hydrological properties of loess were studied from sites widespread in the Federal Capita.} area. A large number of tests on loess areas indicate that the general properties of the material are common and the loess over entire area has silty properties. In some places, however, s.ome variation also occurs where the loess is either more clayey or more s.andy. The hydrological properties appear to be related to the increase or decrease in the clay contents in loess.

Duriing the inyestigl;ltion data was also collected from engineering and foundation reports already completed or in progress. The following description is based on the laboratory tests and the data collecteq from other SOUrces.

Grain Size Dis~dbution

Mechanical analysis of 30 samples of Islamabad loess was c~rried out by usin& the following method. Each sample weighing 40 to 50 grams was placed in hot hydrochloric acid. Once the carbonates were dissolved th~ samples were washed 5 to 6 times and dried. Each sample was then weighed and dispersed using sodium oxalate solution and wet sieving was carried o'ut. Material retained on sieve No. 200 U,S.S. was dried al}d disaggregated using soft plastic sticks and then passed through the U.S. Standard Sieves for gradation. The silt and clay frae· tion was collected in a pan, a solution of sodium oxalate was added, ,and hydrometer analysis was carried out.

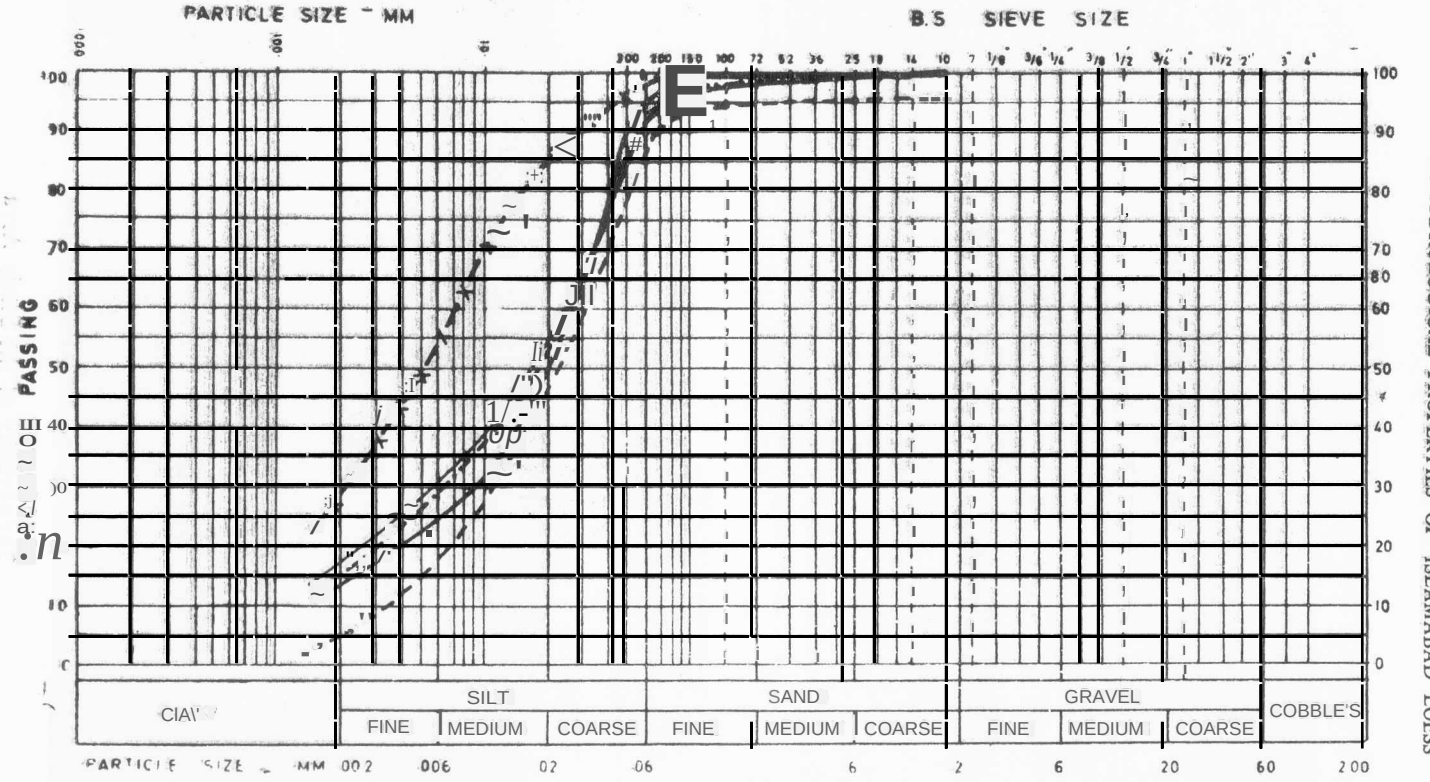
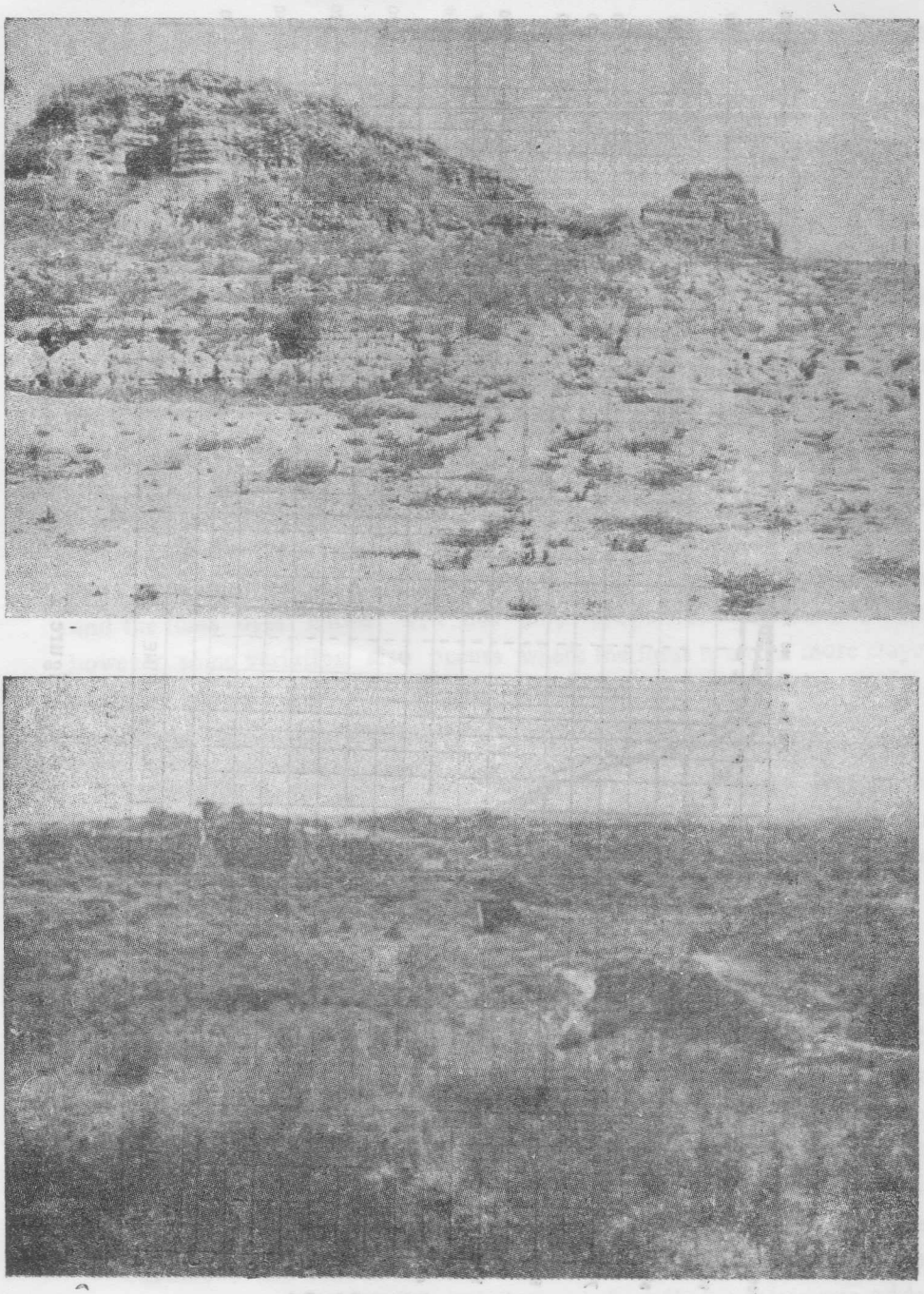

PARTICLE SIZE - MM
B.S SIEVE SIZE
PASSING
CLAY
SILT
FINE
MEDIUM
COARSE
SAND
FINE
MEDIUM
COARSE
GRAVEL
FINE
MEDIUM
COARSE
COBBLE'S
PARTICLE SIZE - MM 002 006 02 06 6 2 6 20 60 200

Figure 2



Tapography of the Study Area

The result of grain size analysis is shown in Figure 2. In most of the samples sand particles above 0.25 millimeter on the average rang~ frGm 6-10 percent, clay size fraction (below 0.005 millimeter) range between 5.10 percent and constitute the most abundant fraction in all the samples. It has also been noted that in the reworked and transported loess either the sand fraction or clay fraction shows some increase at the cost of silt or loess fraction.

Dry Unit Weight.

Dry unit weight of loess Le. the weight of a unit volume of loess is rather its easily determined property and is expressed in grams per cubic centimeter or in pounds per cubic feet.

Dry unit weight of loessic samples was determined by using the following formula:

$$Va = \frac{Ws}{V}$$

Where

Va = Dry unit weight in grams.

Ws=Weight of oven dry sample in grams.

V = Total volume of mass sample in cubic centimeters

The following values of dry unit weight of 6 lamples was obtained:

Sample No.	Location	Dry unit weight g per cc	Dry unit in pound/c/ft
1.	Islamabad Highway	1.15	71.76
2.	Faizabad Chauk	1.21	89.28
3.	Islamabad Highway	1,29	80,49
4~	Islamabad Highway	1,38	82.36
!.	Islamabad Highway	1,35	84.24
6.	Islamabad Highway	1,60	99.84
T.	Average 30 samples different locations in Islamabad.	1,36	

Specific Gravity

Volumetric flask method wAS used in determining th~ specific gravity of many 10essic samples collected from different areas of Islanlltbad", samples were oven dried and a portion Of tlie dtied s!Irtple was dis pets~d in water in calibrated volumetdc flask. Unit weight ot the solid pattieles was obtained by divining the dry weight of f1le sample 1>1'the v6Jtiftie of the sample, The results were expressed as the ratio between the unit weight or particle density and weight of distilled water of equal voluMe at 4°C. The results show very little variation and remain within narrow limits of 2.54 to 2.88 with an average of 26.66.

The plasticity characteristic of loessic sam-pIes was determined in order to understand how its properties are effected by water content, While wet loess becomes a viscous liquid and drying it acq,uires the properties of solid, in between the two states it is capable of being moulded. For plasticity characteristics Atterberg Limits Tests were carried olit on many samples from 15 sites; American Society for Testing Materials' procedures were adopted to determine liquid limits and plasticity index.

Liquid limit and plasticity index data were plotted on standatd plasticity chart. The study of the plotted data shows tne liquid limit samples of loess fall between 25-35 percent and plasticity indke'S range from 6-13. The plasticity data was also compared with the gradation curves, and found to fit well with the silty loess. In some samples however, higher plasticity indices and liquid limits. sbow slightl1 bigMr clay contents in the gradation curves. The samples having slightly higher contents of fine sand showed decreased values or Plasticity Index and Liquid Limits.

Petrology

Several loess sections were taken out from. undisturbed loessic material by impregnating them w!th a thermal plastio resia whi<;h was allowed to cool for several hours on slides; grinding of the- thiD' sections was then carried out with extreme care.

Sections were studied under petrographic at1d bioculat microsscopel using 12x & 30x magnifications. Fig;:: reo 3.

The sections under microscope exhibited abundance of clay coated angular quartz, feldspar plus calcite:, micas and other rock fragments seen were not abundant while some of the heavy minerals could also be indentified and ranged in size between 20-44 microns.

The study of photomicrograph with 12x magnification shows that the silt particles are loosly arranged and have numerous voids and root-like vertical channels.

Permeability

Variable head permeater was used to determine the co-efficient of permeability of 6 loess samples in the laboratory. Coefficient of permeability may be defined as the rate of flow of water in gallons per day, through a cross sectional area of 1 sq. f1, under a hydraulic gradient of 1 foot per foot at a temp. of 60°P.

The following basic formula for determining the permeability usina variable head permeater was used:

$$K=2.3 \frac{aL}{At} \text{LogTCf} \frac{ho}{h}$$

where

K = coefficient of permeability,

ho=head in monometer at zero time.

h=head at any elapsed time,

t = elapsed time.

A = area of sample cyclinder.

a=area of monometer.

L=length of sample.

Cr = temperature correction.

In order to obtain the results of P in gallons per day per square foot 'A' and 'a' were measured in square centimetres, 'L' length in centimeters; 't' was measured in seconds, 'ho' and 'h' were measured in centimeters, for which the formula used was;

$$P = .48815 \frac{aL}{At} 101 \frac{ho}{h} Ct$$

The results are as follows ;

Sample No.	Location	Vertical permeability g. pd per sq. ft.	Mean
1. IHW/l	Islamabad Highway	0,40	
2. IHW/2	"	0.350	
3, lHW/3	"	2.65	1.210
-4. IHW/4	,.	0.17	
.5. IHW/5	"	2.39	
6. S-/-6	Kashmir Rd.	3.26	

The data obtained gives a mean value of vertical permeability 1.21 gallons per day per square foot..

Conclusion

Geohydrological characteristics of the loessic material can be related to its density, gradational characteristics, and grain shape. The loess shows quite uniform gradations put slight variations may occur in percentage of clay or fine sand may influence the values towards higher and/or lower values. Its density is also fairly related to its plasticity. Under microscope the grains of sand and silt size show strongly developed faces with sharp corners and reenterents. The loess samples also show well developed tubelike voids resembling roots of plants.

Gradation study of samples when related to permeabilty values shows that higher values occur when sandy material is slightly high, and lower values occur in the clayey loess. True loessic values lie between the two. The data for recompacted loess within a density range of 100 to 110 per cubic feet show a rather low permeability range of 0.01 to 0.45 feet per year. This data it may be pointed out, also resembles well with reWOrked and fluvially deposited loessic material.

I. A.S.T.M.—Designation D 423—54T.

Sample Collection and Examination of surface by the Author

POPULATION PRESSURE AND AGRICULTURAL CHANGE IN THE PUNJAB, PAKISTAN

MASAUD A. MIAN*

Theoretical Considerations

The relationship between population aftd agriculture-whether agriculture can feed the growing population and provide it the means of livelihood- has been at the same time an old and a new topic of discussion in academic circles. In the remote past, Confucius (551-478 BC) and Plato 427-3·H BC), for instance, paid attention in their respective areas and times to the vital question of population growth vis-a-vis the then prevalent economic climate. However, this question received rather scanty attention which resulted in a few scrappy accounts of the relationship between the two variables.

With the publication of ~althus' *'Es.1ay'* almost two centuries ago. the question of the relationship between population and development once again caught the limelight.. After the *E~say* spelled out the nature of this relationship in a scientific perspective, the common attitude has been that population growth affects development adversely. This was, however, challenged by some economists and population scientists, most notably Clark and Boserup who have preiented historical evidence that population growth stimulates economic development.

According to Clark, population growth provides a stimulus to economic development; in agriculture it usually leads to changes both in methods of cultivation and in social and economic relationships, which are capable of greatly raising the return per unit of labour input.

> "Population growth has taken place, and will continue, because of improvements in medical knowledge and practice. It brings economic hardship to communities living by traditional methods

*Dr. Masaud A. Mian is Assistant Professor, Department of Geography, University of the Punjab, Lahore.

> of agriculture: but it is the only force powerful enough to mates such communities change their methods, and in the long run transformc; them into much more advanced and productive societies. "1

Several other authors have also emphasized the stimulative role of population growth in economic development and particularly in intensification of agriculture ;2 but the theory of agricultural growth which has won the greatest academic attention since the late 1960's is that of Boserup.3

Looking at the problem of agricultural change along the historical time scale in an entirely new perspective, and discarding the dichotomy of cultivated and uncultivated, Boc;erup (1965) attacks the Malthusian concept of the inelasticity of food 01lt01lt. According to her, growing population prec;sure nrovides a stimulus for technclogical change in agriculture, which not only naves the wav for a steady intenc;ification of agriculture but also snurs the whole ran!!e of socioeconomic forces and result<; in chan1~<; in the lan1 nc;~ n'ltt~rn, agricultural technology, land tenure systems, cropping patterns, labour input-output relationship and settlement form .

> ".....it is unrealistic to regard agricultural cultivation systems as adaptations to different natural conditions .....cultivation systems can be more plausibly explained as the result of differences in population density: As long as the population of a given area is very sparse, food can be produced with little input of labour per unit of output and with virtually no capital investment .....As the density of population in the area increases .....it becomes necessary to introduce other systems which require a much larger agricultural labour force."4

Tn a nutshell, Boserup's schema warrants a positive relationship between population pressure and agricultural intensity. Population pressure, once generated, will not only cause agricultural intensification hut will also bring about technical changes since subsistence farmers are labour-efficient and will select the intensity of cultivation and agricultural techniques which will fulfil their agricultural requirements with the minimum amount of work. Thus, not only will an increase in population pressure cause an increase in agricultural intensity but also the latter will be interdependent with the new farming implements.

The Case of The Punjab

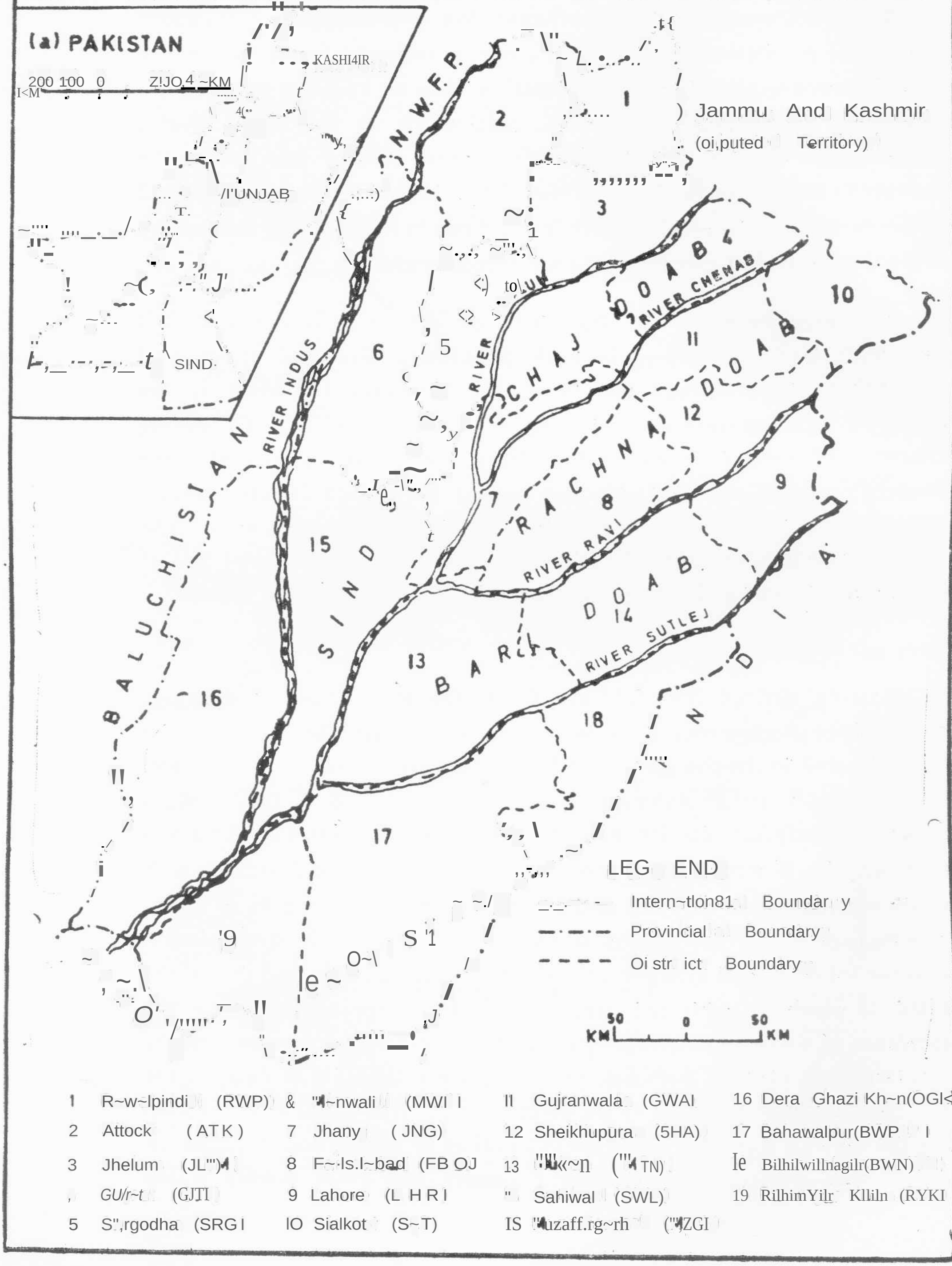
This article examines the ngro-population interrelations. particularly in terms of population density and cropping intensity, in the Punjab. A dose interconnection between population density and the productivity of land is a universal 'Phenomenon, particularly, in the Third World. However, the Punjab (Flg. 1) presents a most striking case where the changeg in population and agriculture have been intimately interlinked particularly ~;nce the revolutionary innovations in its irrigation technology beginning in the last quarter of the nineteenth century.

The experience of the Punjab is of great significance since it is Pakistan's leading province in both population size and agricultural production. Economical1y the heart, the land-locked Punjab is the country's most prosperous and most influential province. Occupying almost one fourth of the national territory, it contains 56 per cent of the country's population. and with the highest population density amongst the provinces, it has almost 70 per cent of Pakistan's net sown area. The Punjab alone produces three fourths of the country's wheat, almost half of its rice. nearly half of its maize and two thirds of its total food grains.

Data and Methodology

Boserup derived her findings from the experiences of primitive communities in numerous Third World countries along the historical time scale reflected in the changes of land use and agricultural techniques etc. But the present article examines the spatial variations of such changes vis-a-vis population density among the Punjab's districts during a given time period. Boserup defines agricultural intensity as the frequency with which a given area is cropped, and uses the crop-fallow cycle as its index. The measure used in the present study is, however, much more simple. It is the total cropped area per unit of total cultivated area and shows the extent to which the cultivated area is used fO,r cropping, reflecting the incidence of single or double cropping. Level of mechanization can be measured in numerous ways but, limited by the availability of data, in the present study it is indicated by the percentage of farm households reporting the use of a tractor. There are two indices of population pressure in she present investigation: arithmetic density and rural density which

FIG. 1 (b) ADMINISTRATIVE DISTRICTS OF THE PUNJAB BEFORE 1977



characterize the distribution per unit area of total and rural population respectively.

An analysis based on the Pearson product-moment correlation coefficient (r) was conducted between various population and agricultural variables. The values of variables pertain to 1972 in the case of population and to the average of 1970-1/1974-5 for agriculture; the changes are for the periods 1961-72 and 1958-9{1962-3 to 1970-1/1974-5 ~espectivelY. In order to be significant, the coefficient of correlation in the present analysis has to b;:: 0.46 at 5 perc~nt level and 0.58 at one percent level, with 17 degrees of freedom. To have a graphic view of the amount of correlations and their regional variations, scatter diagrams are plotted for various pairs of variables. In all such cases population variables are taken along independent (horizontal) axes.

Marked regional contrasts are characteristic of population density and agricultural (or cropping) intensity. In 1972, the Punjab as a whole had an arithmetic density of 183 persons per sq km ; and out of its 19 districts nine had densities welJ above the provincial average. Tn terms of rural density, however, ten districts outclassed the Provincial average of 138. And, whereas the arithmetic densities varied between 43 (Bahawalpur) and 654 (Lahore), the rural densities ranged from the minimum 34 in Baha walpur to Jhe maximum 366 per sq km in Sialkot. .

During the period 1970-1/1974-5, cropping intensity was 106.3 percent in the Punjab compared with 60.4 in Sind, 33.3 in Baluchistan, 106.2 in NWF and 89.1 in Pakistan as a whole. Among the Punjab districts, those in Rachna and Bari doabs, with a greater quantity of irrigation water and higher population pressure, generally had a higher cropping intensity. Thus, Lahore (133.2 percent), Gujranwala (128.4), Sheikhupura (126.4) and Sialkot (121.6) stood in sharp contrast to Dera Ghazi Khan (68.9), Mianwali (90.8) and Jhang (91.3). During the decade preceding 1970-1/1974-5, the Punjab increased its cropping intensity by 7.7 percentage points-from 98.6 to 106.3-when the most significant increases at district level were registered by Lahore (29.3), Sheikhupura ([7.7) and Multan (11.0).

Findings and Discussion

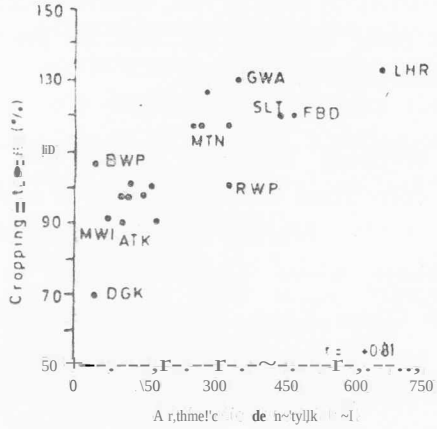
(a) *Population and Cropping Intensity*

Cropping intensity is a useful index of a region's effort to respond to and combat its mounting population pressure by making the maximum use of a parcel of land. It is argued that, as per capita cultivated area declines with the growth of population, the farming class increases the intensity of cropping in order to compensate for that decrease particularly when horizontal addition to the agricultural area is not possible This is why the relationship between population pressure and cropping intensity occupies a focal position in a study of the inter-relationship between population and agricultural change. A positive correlation between population pressure and cropping intensity is fundamental to Boserup's scheme and this has been amply testified by various other studies. The present analysis revealed that cropping intensity is fairly strongly or strongly correlated with total population (r = +0.67), rural population (+0.52), arithmetic density (+0'81), rural density (+0.79) and net in-migration (+0.71).

Figure 2 presents a graphic view of the association b~tween cropping intensity and arithmetic density in the Punjab's 19 districts. In general, there is a tendency for the high values of cropping intensity to be associated with the high values of arithmetic density and vice versa. Lahore with the highest arithmetic density in the Province (654 per sq km) has the highest cropping intensity (133.2) and, at the other end of the scale, Dera Ghazi Khan demonstrates an association between the lowest value of cropping intensity (68.9) with the second lowest of arithmetic density (47). A clearer picture of the association between population pressure and agricultural change is provided by Figure 3 which depicts the relationship between cropping intensity and rural density. A few revealing patterns of association are discernible from the scatter. 1) A group of three districts-Lahore, Gujranwala and Sheikhupura-where the highest cropping intensities (126.4-133.2) are associated with high rural densities (234-245 per sq km^2). 2) A set of two districts-Sialkot and Faisalabad-with the highest rural densities in the Province (366 and 350 per sq km) and high cropping intensities (121.6 and 121.2). 3) A set of two districts-Sahiwal and Multan-with high rural densities (224 and 214 per sq km)

SCATTER DIAGRAMS

Fig.2



A r,thmet!c de n~tyl]k ~I

Fig .3

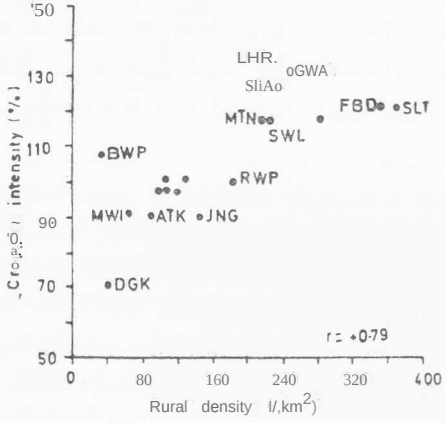
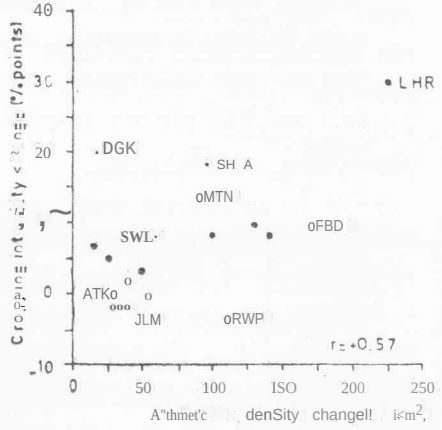


Fig.'



and high cropping intensities (117.7 and 117.1). 4) A group of five districts-Jhelum, Sargodha, Muzaffargarh, Bahawalnagar and Rahimyar Khan-with low rural densities (99-130 per sq km) and low cropping intendi.::s (95.2-100.4).5) Aset of two districts-Mianwali and Attock-with the lowest rural densities (61 and 88 per sq km2) and the lowest cropping intensities (90.8 and 91.6).

Change in cropping intensity during the period 1961-72 has a moderately high correlation with the change in arithmetic density during that period (r = +0.57). Marked variations from the general pattern are exhibited by Lahore, where highest changes in the two values are associated; Dera Ghazi Khan, where the second highest change in cropping intensity is associated with the smallest change in arithmetic density; and Rawalpindi, where one of the highest density changes is linked with a decline in cropping intensity (Fig. 4). Besides Rawalpindi, in four districts-Attock, Jhelum, Bahawalnagar and Rahimyar Khan-the density changes were among the smallest in the Province and these were linked with declines in cropping intensities. Two of these districts-Attock and Jhelum-are unirrigated, while in Bahaw;llnagar and Rahimyar Khan 91.5 and 97.2 per cent respectively of the total cropped area is irrigated.

To summarize, cropping intensity is strongly correlated with population density (or population pressure) in the region. Thus, there is a tendency for high density areas to have a generally higher level of cropping intensity. However, the changes in the values of the two variables do not exhibit sim ilar strength in their correlation. This is explicable in terms of the variation in other influences on agriculture such as physical inputs particularly water. Thus, whereas the mounting population pressure has prompted change in agricultural methods and performance the actual change has been influenced by the availability of water. In fact there have been varied responses to population pressure. As a first step, the districts with growing population pressure have usually expanded their agriculture into hitherto uncultivated areas, given the availability of inputs such as water. Secondly, the districts have increased their net SOwn areas and, as a third step, intensification has taken place.

(b) *Population and Modern Agricultural Technology*

Although the application of chemical fertlizer in Pakistan started in 1952, it increased sharply in the mid-1960's together with the introduction of high yielding fertilizer-responsive seeds in the wake of increased water supply via tubewell development. This was the period when tractor use also demonstrated a sharp increase, thus marking the beginning of any significant mechanization in Pakistan's agriculture. An investigation into farm mechanization and agricultural development in the Punjab revealed that 93 percent of the tractors in 1908-9 were on farms with irrigation; and as the installation of a tubewell on a canal irrigated farm provided a more reliable water supply system, 63 percent of all tractors were on farms with both tubewell and canal water, 20 percent on the perennial canal irrigated farms and 10 percent on the farms with only tubewell water.[5] The present investigation confirmed these findings; moreover, there is a markedly high correlation between the modern inputs indicating that the use of chemical fertilizer and tractors is common only where the constraint of water has been removed. Thus, whereas population pressure provided a necessary inducement for the region's better agricultural performance during the 1960's, water provided the important physical infrastructure for the overall change and for a more efficient utilization of other inputs.

It follows from the above that tractor use can be taken as an index not only of mechanization but also of the use of all modern inputs. Although data on a distrtct basis regarding the number of tractors is available since the late 1960's, it is only through the 1972 Census of Agriculture that the number of households reporting the use of a tractor is known. According to this source, 20.4 per cent of the Punjab's farm households reported use of tractors. At the district level, the figure varied betwecn 3.4 in Dera Ghazi Khan and 38.2 in Gujranwala. In all, in seven districtsGu-jranwala, Faisa!abad, Sahiwal, Lahore, Sialkot, Sheikhupura and Multan - the level of tractor use was higher than that of the Punjab as a whole.

Figures 5 and 6 present a graphic view of the association between the level of tractor use and rural density, and change in rural density in the districts of the Punjab. Generally the highest level of tractor use is

SCAtTER 01 AGRAMS

Fig .5

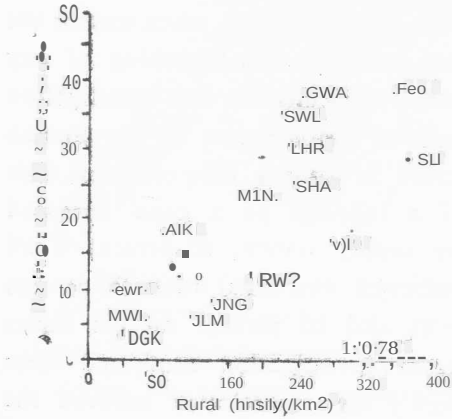
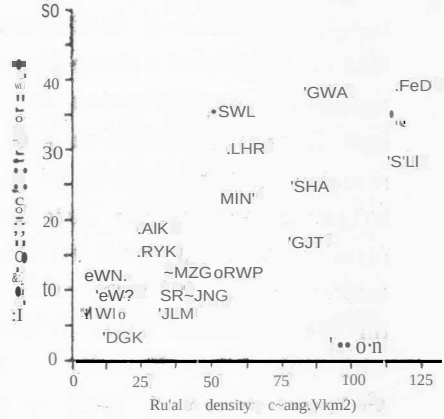


Fig.6



associated with the highest values of population variables with the seven above mentioned districts standing out.. Six out of these districts-except Sheikhupura-have the highest ranks in total population and five-except Sheikhupura and Lahore~also lead in rural population. Together they occupy 28 percent of the Province's area and contain 55.6 percent of its total and 52.6 percent of its rural population. In addition, with 85 of the Province's 202 urban places, they contain almost two thirds of its urban population. Four of these districts have the highest level of urbanization, five the highest arithmetic density and six the highest rural density in the Province. Situated in a contiguous block in the central doabs-Rachna and Bari-all of them, except Sialkot, occupy the old canal irrigated tracts where major tube well installations during the 1960's have also taken place, linked, in five of them, with the highest rates of population increase between 1961 and 1972. The large number of their almost uniformly spread urban: places not only acts as a catalyst for agricultural expansion but also provides ample opportunities for machine purchase. and repair. Thus, benefitting from a better overall social climate and provided with adequate physical infrastructure, such as water, these districts have_adopted modern technology at a faster rate than others.

Conclusion

This article has focussed on the interrelations between population pressure and agricultural change in the Punjab, in the light of Boserup's theory of agricultural change. Taking arithmetic and rura I densities as the indices of population pressure and cropping intensity and level of mechanization as those of agricultural change, the investigation has come to the conclusion that there exists a significant association betw~en the two families of variables in the Province. The districts with high population densities have not only high cropping intensities but also make a greater use of modern agricultural technology particularly machinery and other modern inputs.

However, interesting regional variatiOns in the association between these selected variables have come to the surfac~. The three Potwar districts-Rawalpindi, Attock and Jhelum, with their rain-fed agriculture form a distinct category of agricultural performance. But, not all the other districts form a uniform pattern. The old canal colony districts particularly Faisalabad, Multan and Sahiwal-with high population densities, high levels of urbanization and abundant water supplies through canals and tube wells-stand in sharp contrast to the districts (such as Mianwali, Muzaffargarh and Dera Ghazi Khan) where canal water was introduced relatively tate.

Refrences and Notes

1. Clark, C., 1967), *Population Growth* and *Land Use* London, p.253.

2. For instance, Brookfield, H.C., (1962) "Local Study and Comparative Method: An Example from Central New Guinea", *Ann. Assoc. Amer. Geog.* 52, 3, and Dumond, D.E., (1961)" Swidden agriculture and the rise of Maya civilization", *Southwestern Journal of Anthropology*, 17, 4.

3. Boserup, E., (1965) *The Conditions of Agricultural Growth*, London

~. *Ibid.,p.117.*

5. Ahmad, B., (1972) *Farm Mechanization and Agricultural Development: A Case Study of the Pakistan Punjab*, Ph. D. Thesis, Michigan State University, p. 47.

AN ANALYSIS OF THE DETERMINATES OF GEOGRAPHIC POPULATION MOBILITY IN THE PUNJAB

ANWAR-UL·HAQ AND UMAR FAROOQ*

Introduction

Movement of human beings from one place to another entails a number of significant implications from a development perspective. An understanding of the forces by which human migration is determined is usually considered a subject of real inter-est and importance for development planners and decision makers who wish to utilize the knowledge about human mobility to achieve balanced development.. The social scientists, therefore, have not neglected the subject.. The characteristics of migrants, their reasons for moving, and consequences both at the place of origin and destination have beeliamply described in the demographic literature of developing countries and migration relearch has been oriented to the needs of development planning.

Pakistan also belongs to the club of developing countries. Migration phenomenon is gradually reshaping its poplllation from a nati_on of farmers and villages to a nation of urban dwellers. Yet this phenomenon so critical to the quality of life in Pakistan's future, is not well understood. The subject has been liberally sprinkled with artiCles and newspapers reports, but the phenomenon and its determining factors affecting domestic migration in Pakistan has as yet received li.ttle attention,

The present study was undertaken to identify the underlying factors and interpret the phenomenon of migration in the Punjab. Specifically, this article will provide to the reader some background informati0n on domestic migration flow in the Punjab, as well as examining differ.ential growth among the ni~eteen distncts of this province and the relationship of growth to origins and flows of migration.

* Dr.. Anwar-ul-Haq is Associate Professor and Mr.. Umar Farooq is Lecturer, Departn:ent of Rural Socielogy, University of Agriculture, fai~alabad.

Table 1. population and Population Growth of the Punjab

District	Population (in thousand)				Percentage growth		
	1951	1961	1972	1981	1951-61	1961-72	1972-81
Campbelpur	689	766	982	1140	11,2	28,20	16.09
Rawa1pindi	907	1137	1747	2123	25.3	53.65	21,52
Jhe1um	678	749	1052	1162	10,4	40,45	10,46
Gujrat	1157	1316	1899	2247	14.5	43.21	18.32
Sargodha	1161	1468	2101	2557	26,4	42.12	21,70
Mianwali	549	747	1095	1376	35.9	46.59	25.66
Faisalabad (Lyallpur)	2152	2684	4242	4656	24.7	58.35	9.76
Jhang	875	1079	1561	1962	23.2	44.67	25.69
LahQre	1895	2480	2588	3512	30.8	4.35	35.70
Gujranwa1a	1046	1292	2060	2659	23,4	59,44	29.08
Sheikhupura	923	1080	1657	2011	17.1	53,43	26.79
Sia1kot	1474	1596	2344	2706	8.3	46.87	15,44
D.G. Khan	627	777	1143	1581	23.8	47,10	38.32
Muzaffargarh	751	990	1565	2151	31,1	58.08	37,40
Mu1tan	2107	2702	3133	4068	28.2	15.95	29.84
Sahiwal	1815	2134	2684	3613	17.5	25.77	34.61
Bahawa1pur	527	735	1071	1447	39.3	45.71	35.11
Bahawa1nagar	630	823	1074	1371	30.5	30.50	27.65
Rahimyar Khan	664	1016	1399	1834	52.9	37.70	31,05
Kasur	—	—	1188	1530	—	—	29.00
Vehari	—	—	1027	1530	—	—	18.53

Source: Population Census of Pakistan, 1961,1972 and 1981, Differential Growth of Districts

Industrialization is usually taken as synonymous with urbanization. At the time of independence, tbe Punjab Province was industrially back~

ward. The growth of industry is quite recent and increasing rapidly. A number of small towns with cODcentration of industry has grown into sizeable cities tn certain districts of the province. An inquiry into the cause of differential growth of districts (Table 1) for the three decades raises several kindg of questions. Such an inquiry may refer to the problem of why some districts grow faster than others. Again it may refer to the type of economic forces which may steer the process of urbanization, or it may lead to the demographic question of whether the expansion is due to migration or to natural increases. There is no conclusive evidence available from which to draw concrete generalizations on differential fertility for the Punjab. Hence, a reference is being made here to selected findings on differential fertility from piecemeal studies conducted at post-graduate level at various institutions in Pakistan. Such studies as have been reviewed permit only limited conclusions as to the differences in levels, and particularly to trends over the time span. The general impression one gets from the findings of these studies is of high, nearly uniform fertility throughout all parts and all strata of the province during 1951-81. This being the case, either the district in the Punjab had differential mortality or else they were receiving a differential flow of migrants.

The data OR deaths show the absence or mortality differentials during the period 1951-81. Within Punjab, the drop in mortality has been almost simultaneous as the conditions bringing about such a change were common and similar in all the regions. Based on evidence available from a number of studies and documents, Robinson (1967)2 and Haq (1980)3 have drawn an over all conclusion that in Pakistan mortality hag been declining steadily since 1900. Khan (1962)4 draws similar conclusions on the basis of vital registration data from the Punjab. The conclusion drawn from these studies is of low, almost uniform mortality throughout all parts and all strata of the Punjab. We cannot, therefore, account for differential growth of population in different areas of the Punjab on the basis of greater natural increase. The only other demographic variable which comes to light is migration.

Unfortunately there are no precise satistics available in Pakistan for any of the provinces on geographic population mobility. The most

direct evidence is contained in the figures on the place of birth gathered at each census. These, however, suffer from certain defects:-

(i) The statistics underrate the amount of mobility, because children are often recorded erroneously as having the same birth place as their parents.

(Ii) These do not provide information on year to year movements.

(iii) They seldom show the number of people living in a village! town who were born there, but rather the number who were born in the whole district. At best, therefore, the statistics on place of birth are a mere makeshift for understanding the amount of geographic population mobility. At present, statistics on the number of life-time migrants moving from one district to other district are available only from the 1961 Census of Population and forms the basis for the present study. This study has considered life-time migration of only those persons who were born in districts of the Punjab other than the district of 1961 residence of the same province. Persons reported by the census to have been born outside of Punjab have not been included.

The Life-Time Migration Model

Migration is a process which involves the movement of people through space from a specific origin to a specific destination. In determining the migration model which most accurately fits the empirical data, it is possible to employ various types of models based upon intervening opportunities, gravitation, and other theories (Abbott and Schmid, 1969[5]; Anderson, 1955, 1956[6]; Blanco, 1963[7]; ;aright and Thomas, 1941[8]; Galle and Taeuber, *1966*[9]; Lowry, 1966[10]; Stouffer, 1940, 1960[11]; Traver, 1961, 1965[12]; Zipf, 1946[13]). Life-time migration ignores intermediate and successive moves and considers only the place of birth, the origin, and the place of permanent residence, the destination. In developing a life-time migration model for the Punjab it was assumed that each of the nineteen districts of the Punj:ib under consideration competed with one another for migrations from all districts of the Punjab. The greater the total number of migrants from a given district, the higher the likelihood that all the

other districts would receive migrants from that district. In a sense, then, each district was expected to attract migrants from a givell district direetly proportional to the total Bumber of migrants produced by that district.. On the other hand distance and population size are important factors influencing the choice of migration destinations. In this study only three rather simple models are utilized which incorporate the two explanatory variables namely distance and population size.

The first migration model assumes that the volume of movement from each district is inversely proportionate to the distance to each of the other districts. The second, which is a population model, assumes that the volume of movement from each district is directly proportionate to the population of each district including the district of origin as well :ts districts of destination, The third, which is a population-distance model, assumes that the volume of movement from each district is inversely proportionate to the distance to each of the other districts and directly proportionate to the population of each district..

The census organization of Pakistan, 1961, published inter-district migration streams for the 19 districts of the Punjab for the period 1951 to 1961. The 1951-61 data apply to all persons about one year of age and over in 1961. The data were tabulated and classified by place of birth, the origin, and place of residence, the destination. The distances from the population centre of each district to the population centre of every other district were computed from the Road Map of Pakistan prepared by the Survey of Pakistan Office, 1965.

It may by noted here that distance is really a proxy for the friction exerted upon migration by movement through space. A more accurate, although far mOre laborious, measure of this transportation friction would be actual road miles, rail road miles or airline miles. For simplicity, rail road miles from the centre of one district to the centre of another district have been used. The three models are standardized for distance and population size variables Cor the reason that different districts produCt different number of migrants. Such standardization permits the identification of other factors underlying the district to district migration flows through a comparison of observed tife-time migrants with those predicted by the models. A ratio of observeo to expected miirants was computed

with each model for each distritt to the other nineteen districts, and is presented in the appendix tables. Values for the ratio range from zero to high. A ratio of unity means that the model perfectly predicts the number of life-time migrants from a given district to another. In other words, the particular flow of migrants contains exactly the number expected on the basis of the total number of life-time migrants from the place of origin and the distance between the places of origin and destination. A ratio of less than unity indicates that the model has predicted fewer than the expected number of migrants for the district9 in question, and a ratio of for example, 3.0 means that a district has provided three times the expected number of migrants to another district.

Estimation of Inter-district Migrants

The expected migrants from each district t6 every other district were computed by each of the three migration models. The migrants from each district to every other district were laid out in 19 x 19 matrix, with the district of origin representing rows and the district of destination representing columns. The predicted out-migrants from each district were obtained by summing each of the 19 rows of the matrix. The 'expected' out-migrants were computed by three different migration models as follows:-

Migration Model I. The first migration model, which is a distance model, assumed that the volume of inter-district migration from each district was inversely proportionate to the distance to each of the other districts. The following function was fitted for the estimation of inter-district out-migrants:

$$m = ax^{-} \qquad (1)$$

were m was the number of inter-district migrants, x the distance of movements (in miles). and a (the constant of proportionlity) **aDd** b were constants to be determined:

Letting M=log m; ,\=log x; and A=log a: (2)

then

$$\log m = \log a + b \log x, \text{ or } M = A + bx \qquad (3)$$

By substitution of A into equation 2, we obtain a= lOA for a. Also, by substituting the actual points (XL' IDl) such that IDl =0 into

equation 3, we obtained the following equation for the 'expected' number of out-migrants by using the least squares method of solving simultaneous equations:

M= 105,99936, X- 1. 301540.

The 'expected' numbers of migrants from each distrIct to each of the other districts was computed by the 'distance' model.. The ratios of observed to expected migrants are presented in the appendix.

Migration Model II. The second migration model which is a population model assumed that the volume of movement from each district was directiy proportionate to the population of each district, including the district of origin as well as the district of destination. fhe following function was fitted for estimation of 'expected' migrants:

m=aPolc Porf

where m was the number of inter-district migrant; P_{oJ}. the population of the ith district (district of origin) at the beginning of migration period, P_{oJ}. the population of the jth district (district of destination) at the beginning of the migration period, and a (the constant of proporti~nality), C, and f were constants to be determined:

Letting M=log m ; P=log P_{oi} ; T=log P_{oi} and A=log a ;

then,

log m=log a+c log p+f log t, or

M=A=cP+fT

The following equation for the 'expected' number of migrants was obtained by using the least squares method of solving simultaneous equations:

m=10-13.769375 $P._{o1'}$ 869433 $P._{oJ'}$ 949138

The 'expected' number of migrants from each district to each of the other districts were computed by the population model.. The ratios of observed to expected migrants are presented in the appendix.

Migration Model III. The third migration model, which is a population distance model, assumed that the volume of movement from each di~trict was inversely proportionate to the distance to each of the other

districts and directly proportionate to the population of each district. This gravity type model is a variation of one used by Abbott and S'cbmid14 in an analyais of undergraduate student migration in the United States. The following function was fitted for the estimation Gf '6Kpeeted' migrants:

$$m = az^{-b} \quad P_{01} \cdot C. \quad P_{0J} \cdot f$$

where m was the number of inter-district migrants, X the distance of movement (in miles), P_{oi} the population of the ith disirict (district of origin) at the beginning of the migration period, P_{oJ} the population of the jth district (district of destination) at the beginning of migration period, and a (the constant of proportionality), b, c, and f were constants to be determined.

Letting M=log m, X=log x ; P=log Pot; T=log pof; and A-log a; then

log m=log a+b log x+c log p+f log t, or

M=A+b X+c p+f T.

The following equation for the 'expected' number of migrants was obtained by using the least squares method of solving simultaneous equations;

$$m=10\text{-}6{,}43659 \quad X\text{-}I.043659 \quad P_{01} \; 1{,}535635 \quad P_{0J} \; 0.612733$$

The 'expected' number of migrants from each district to each of the other districts were computed by the population distance model. . The ratio of observed to expected migrants are presented in the appendix.

Common Themes in Inter- district Migration

Each of Punjab's nineteen districts displays a distinct pattern of origins for its life-time migrants, but there are some common themes and important generalities which can be made.

Three models were tested to determine their predictive ability for finding out the relationship between migration and its determining forces in the Punjab for the period of 1951-61.. The predictive power of the models was determined on the basis of ratio of unity, A ratio of observed

to expected migrants was computed for each district to each of the nineteen districts, and this ratio is presented in the appendix tables. A ratio of unity means that the model perfectly predicts the number of life-time migrants from a given district to a given district.. A ratio of less than unity means that a district has provided fewer than the expected number of migrants to the district in question.

The predictive power of these three models suggest that the findings are not entirely consistent with those of previous studies which have shown that migration models based upon population and distance have high predictive abilty. The findings of this study, therefore, suggest that the predictive ability of the two variables namely, distance and population size is very poor. The explanatory power of these models examined here may be increased somewhat by the addition of other variables derived from relevant migration theories.

The migration origin patterns of Punjab's nineteen districts have led us to further research pursuits in the exploring of which we find knowledge of kinship structure and degree of urbanization most relevant. Certainly widely accepted factors are important in understanding tM differential streams of migration. It is strongly believed that kinship is a factor of importance in the explanation of directional pattern of out-migration. Since evalution of relative opportunities is essentially a subjective matter.

The kinship structure provides a highly persuasive line of communication between kinsfolk in the home and the new places of destination which channels information about available job opportunities and living standards directly, and most meaningfully, to the migrants. Thus, kinship linkages tends to direct migrants to those areas where their kin groups are already established. This effective line of communication among kin helps also to explain the fact that rate of out-migration is so immediately responsive to fluctuations in the rate of unemployment in migratory target areas. In addition, because of ascribed role obligations kinship structure also serves a protective function for new migrants to a new place, a form of social insurance and a mechanicm for smoother adapation during the transitional phase of adjustment. Since census of Pakistan lacks information on kinship structure, it was not possible to ipve~ti~ate its relationshIp with inter·distrct flow of migration.

The second important theme which emerged from the migration origin pattenls of Punjab's nineteen districts deals with the degree of relative urbaniza~ion in each district. Examination of 1he individual district pattern~ repeatedly projected the importance of districts with less degree of urbanization as sources for greater than expected numbers of migrants. It must be kept in mind that Punjab is an area of under employment and its people tend to migrate towards areas where more job opportunities are available. This generalization, that labour tends to flow in the direction of greater economic opportunity is well founded. However, geographical, historical and other factors must be considered too.

Table 2 presents the percentage of 1961 population in each district classified as "urban" and percentage of in-migrants received by a district from the other districts of Punjab. A linear regression was calculated for the nineteen districts which yielded the following equation:

(1) $Y = 2.63+0.14X^*$
(2.43)
$R2=O.26 \quad F=5.9$

Where Y is the percentage of observed in-migrant flows in each district from other districts, and X is the percentage of population classed as urban in the district in 1961. (Asterisk indicates significance at 5% level. T Statistic is shown in parentheses. Simply stated, the greater the degree of urbanization in a district, the higher the likelihood that the district would receive more number of migrants from other districts. Conversely, rurallbackward districts would provide largely urbanized districts with greater number of migrants, The finding of the study ~upports the theory tha~ migration flows from less urbanized or ruralJ backward places to larger urbanizeg places, although it offers no insight into the causal fa£tors produ~JIl~ geographic POPuJati9n mobility,

Tadle 2. Number of Actual Lifeime Tn-migran Flows in Each District from the other Districts and Percentage of Urban Population by Districts.

District	Urban Population 1961 (X)	Total In-migration
Campbellpur	10.2	0;7
Rawalpindi	35.8	5.0
Jheium	14.1	1.8
Gujrat	12.7	3.1
Sargodha	19.4	6.8
Mainwali	19,0	2.2
Faisalabad	21.4	10.1
Jhang	16.2	2.5
Lahore	59.1	11.5
Gujranwala	16.7	6.5
Sheikhupura	12.6	4.4
Sialkot	15.9	2.9
D.G. Khan	12.5	0,4
Muzzaffargarh	7.4	3.7
Multan	21.4	9.4
Sahiwal	11.2	8.0
Bahawalpur	18.8	5.6
Bahawalnagar	12.8	6.3
Rahimyar Khan	11.2	9,3

Source : Population Census of Pakistan, 1961.

The importance of relative urbanization is apparent in many of the individual district patterns. The district of Rawalpindi, Sargodha, Faisalabad, Lahore, Gujranwala, Multan and Bahawalpur. are near to 20 percent or over 20 percent urban, and have undoubtedly received more migrants from other districts of the Province. A provincial bias in the origin of life-time migrants can also be observed in individual district migration patterns. The bias appears to be most important in the case of provincial and national capitals, e.g. Lahore and IslamabadJ Rawalpindi. . An evaluation of the true significance of this theme must await a broad based investigation of urban migration.

The interesting relationship between urbanization and migration ,bows the role of Sargodha. Faisalabad, Gujranwala, Multan and Bahawalpur districts as places of attraction for migrants. Several factors may explain this phenomena such as kinship struct ure of migrant stock, advent of industrialization and good business prospects, but a detailed explanation must await further exploratory research. Campbell pur, Jhelum Gujrat, Jhang, Sheikupura, Sialkot, D. G. Khan and Muzaffargarh are relatively less urbanized and have, therefore, attracted few migrants from other districts. Mianwali District, 19.0 per cent of whose population was classed as urban in 1961, is an extreme case and attracted a few migrants. Sahiwal, Bahawalnagar and Rahim Yar Khan districts, however, had less than 20 percent urban population and the reason that more life-time migrants from other districts gravitated towards these three districts is less clear and needs further research.

Summary and Conclusions

In this study an attempt was made to examine differential growth among Punjab's nineteen districts. The findings show that considerable differences exist in the rates of growth among the districts of the Punjab. It is also clear that differential flows of inter-district life-time migrants account to a great extent for the differences in the rate of growth. For studying differential flow of domestic migration in depth, the gravity or potential models were used in an attempt to filter out the effects of distance and population size in inter-district migration streams. The findings of the models were not consistent with those of previous studies which have shown that migration models based on explanatory variables under investigation have predictive ability. The foregoing discussion of the research findings can provide a focus for further research into the complementary questions of ubranization and domestic migration. The findings support the theory that migration flows take place towards relatively larger urbanized districts.

References and Notes

1. The study was financed by the University of Agriculture, Faisalabad. The report of the study has been published and can be obtained at a nom inal price, from the Publication Department of the University of Agriculture, Faisalabad

2. Robinson, W.C. (1967) ••Recent Mortality Trends in Pakistan" , in Robinson W.e. , (ed) *Studies tn the Demography of Pakistan,* Karachi: PIDE.

3. Anwar-ul-Haq (1980) *Human Migration: A study into the Regional Growth Differentials in the Punjab*, Faisalabad : Agriculture University Press,

4. Khan, M.K.H. 1962 "Crude Birth and Death Rates in the Province of West Pakistan", *Proceedings of the lnternational Population Conference.* Vienna, 1959, New York: United Nations.

5. Abbot, Walter and Calvin F. Schmid. 1969 "Toward an organizational theory of migration: University prestige and first-time undergraduate student migration in the United States". Paper presented at the annual meeting of the Population Association of America, Atlantic City, New Jersey April 10-12.

6. Anderson. Theodore R. 1955 "Iiltermetropoltion Migration: A Comparison of the Hypotheses of Zipf and Stouffer", *American Sociological Review* 20 (June), pp,287-191. .

(1956) "Intermetropolitan Migration: A Correlation Analysis". *American Journal of Sociology,* LXI (March), pp. 459-462.

7. Blanco, Cicely (1963) "The Determinants of Interstate Bopulation Movement", *Journal of Regional Science* 5 (Spring), pp. 77-84.

8. Bright, Margaret S, & Dorothy S. Thomas. (1941) "Interstate Migration and Interviewing Opportunities", *American Sociologi cal Review,* 6 (Demember), pp. 773-783.

9. Galle, Omer R., Karl, E. Taeuber. . (1966) "Metropolitan Migration and Interviewina Opportunities", *Americal Sociological Review* 31 (February), pp. 5--13,

10. Lowry, Ira S. *(1966) Migration and Metropolitan Growth: Two Analytical Models,* San Francis~o ; Chandler Publishing Company.

11. Stouffer, Samuel A. (1940) "Interviewing Opportunities: A Theory Relating Mobility and Distance *"American Sociolugy Review*, 5 (December) pp. 845-867.

(1960) "Intervention Opportunities and Competing Migrant", *Journal* of *Regional Science*, 2 (Spring), pp. 1-26.

12. Tarver, James D. (1961) "Predicting Migration", *Social Forces, 39.* (March), PI'. 201~213.

(1962-5) i'Metrbpolitan Area Intercountry Migration Rates: A Test of Lrbour Market The,ory". *Indusiriai* and *Labour Relations Review* 18 (January), pp. 213-223.

13. Zipf, George K. (1946) "The PzPz/D Hypothesis: On the Intercity Movement of Persons". *American Sociological Review*, 11 (December). pp. 677~686.

14. Abbot, W. and Schmid C. F. (1969) op. Cit.

Table (a). Ratio of Observed to Expected Life-Time Migrants from each District to each of the other Districts in the Punjab

District	Ratio of observed to Expected														
To	Campbellpur			Rawalpindi			Gujrat						Sargodha		
From Model	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Cambellpur	0	0	0	1.19	12.18	2.77	1).83	3.36	3.08	1.54	1.2.11	2.52	0.15	2.35	0.39
Rawatpindi	10.99	9,40	1.82	0	0	0	2.51	8.74	4.26	2.02	2.95	2.69	0.89	0.71	1,05
Jhutum	2.13	11..17	~.67	1:00	8.41	2.39	0	0	0	<1.24	12.85	3.24	4.83	8.11	8.88
<Jujnit	1.08	1.-78	1.02	1.20	*2.16*	1..t5	11.01	5.52	1.37	0	0	0	*A.87*	4.32	4.24
Sargodha	1.5.7	1.36	1.30	0.83	0.77	0.69	:12.22	1.81	2.04	4.08	3.29	4.36	0	0	0
Mianwati	1.15	7.73	3:41	0.31	1.'38	0.85	0.53	1.39	1.46	1.02	1.47	2.33	*0.;n*	3.52	2.21
Faisalabad	0.90	0.19	0.27	0.90	0:19	0.27	0.94	0.200.32		1050.211		0.33	0.69	0;430.27	
Jhang	0.07	0.07	0.07	0.230.20		0.26	0.31	0,25	0.39	0.36	0.26	0.4'1	2.094.61		2.01
Lahore	11.36	0,47	0:53	2.07	2.77	0.81	0.81	10.38	0.38	0.57	0.30	0.25	0.98	0.28	0.38
<Jujranwala	0,49	0.670.50		0.80	1.29	0.84	0.25	0.61	0.33	0.5.7	2.83	0.79	,1,13	1,04	1,12
Sheikhupura	10.19	0.26	0,22	6.17	0.26	0.21	O.W	0.19	0.14	0.16	0.S;7	0.22	0.31	0.56	0.40
Siatkot	1,62	0.96	0.94	2,44	1,95	1,'49	0.96	1.24	0,73	1.02	2.09	0.79	4.40	1,62	2,43
Muzaffargarh	0.12	0.11	C.17	0.03	0.03	0.04	0.160.09		0.22	0.06	0.03	0.08	0.25	0.2-2	0.37
D. G. Khan	0.07	0.09	0.12	0.05	0.05	0.09	0.10	0.08	0.19	0.18	0.11	0.09	*rO.08*	0.08	0.14
Multan	0.97	0.13	0.28	1,30	0.16	0.36	0.96	0.09	0.28	16.63	0.08	2.51	0.73	0.11	0.22
Sahiwal	0.67	0.15	0.25	0.71	0.15	0.26	0.&4	0.14	0.38	0.52	0.09	0.19	0,44	0.12	0.\8
Bhawalpur	0.12	0.18	0.27	0.27	0.33	0.59	0.23	0.23	0.55	0.26	0.20	0.53	0.26	0.36	0.62
Bahawalnagar	0.02	0.02	0.04	0.01	0.01	0.02	0.04	0.04	0.08	0.11	0.08	0.19	0.03	0.04	0.06
Rahimyarkhan	0.03	0.02	0.04	0.04	0.03	0.06	0.06	0.03	0.10	0.05	0.02	2.08	0.12	0.87	0.19

Table (b). Ratio of Observed to Expected Life-time Migrants from each District to each of the other Districts in the Punjab

District	Ratio of Observed to Expected														
To:	Mian wali			Faisalabad			Jhang			Lahore			Gujraowala		
From Model:	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Cambellpur	1.19	4.64	2.62	1.38	0.65	1.78	0.78	0.61	1.59	1.54	1.06	2.20	0.52	0.44	0.91
Rawalpindi	0.37	0.88	0.59	0.09	0.80	0.17	0.41	0.28	0.65	3.43	2.37	3.95	066	0.61	0.94
Jhelnm	0.82	2.81	1.88	1.44	1.59	2.36	1.20	1.89	0.76	1.26	2.62	2.41	0.19	0.75	0.49
Gujrat	1.83	1.90	1.83	2.08	1.16	1.60	1.13	0.83	1.30	1.27	1.59	1.81	0.74	2.75	1.00
Sargodha	0.93	2.73	1.11	0.50	0.77	0.47	1.36	2.81	1.92	1.31	0.81	1.05	1.06	0.66	1.00
Mianwali	0	0	0	1.06	1.97	2.46	0.87	2.73	3.17	0.74	0.95	1.65	0.18	0.22	0.47
Faisalabad	2.72	9.96	1.04	0	0	0	1.24	1.54	0.77	1.34	0.42	0.46	1.82	0.47	0.71
Jhang	0.79	1.69	1.24	0.99	3.25	1.50	0	0	t)	0.33	0.32	0.40	0.63	0.52	0.88
Lahore	2.38	0.55	0.97	2.30	0.86	0.95	0.92	0.38	0.53	0	0	0	0.65	0.62	0.38
Gujranwala	0.83	0.96	0.94	1.45	1.37	1.40	0.88	1.02	1.25	0.63	1.92	0.70	0	0	0
Sheikhupur	0.65	1.07	0.91	1.46	2.90	1.88	0.52	1.03	0'95	0.54	5.19	0.99	1.04	5.01	1.93
Sialkot	128	0.64	0.82	5.98	1.99	3.15	1.27	0.57	1.00	3.04	2.26	1.93	2.10	4.77	1.95
D.G. Khan	0.15	0.47	0.38	0.23	0.25	0.42	0.11	0.35	0.35	0.26	0.20	0.45	011	0.07	0.21
Muzaffarghar	6.82	2.12	I.SS	0.23	0.19	0.32	0.94	2.28	2.27	0.17	0.09	0.22	0	0	0
Multan	1.02	0.33	0.39	1.70	0.26	0.50	2.51	1.33	1.35	2.10	0.21	2.59	1.34	0.11	0.43
Sahiwal	1.33	0.48	0.62	1.68	0.67	0.72	0.46	0.20	0.29	1.30	0.43	0.55	0.60	0.12	0.21
Bahawalpur	0.48	1.49	0.45	0.78	0.99	1.77	0.22	0.81	0.87	0.88	0.S5	1.95	0.30	0.30	0.92
Bahawalnagar	0.13	0.25	0.20	0.10	0.15	0.20	0.07	0.15	0.20	0.01	0.02	0.01	0.02	0.02	0.04
Rahimyar Khan	0.12	0.14	0.23	0.39	0.15	0.53	0.16	0.16	0.38	048	0.17	0.67	0.11	0.03	0•1'

Table (c). Ratio of Observed to Expected Life-time Migrants from each District to each of the other Districts in the Punjab

District	Ratio of Observed to Expected															
To:	Sheikhupura			Sialkot			D.G. Khan			Muzaffargarh			Multan			
From Model :	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
Cambelpur	0.18	0.13	0.35	0.73	0.66	1.13	1.42	0.77	2.00	1.21	0.43	1.82	3.98	1.33	3.40	
Rawalpindi	0.36	0.25	0.56	1.56	1.80	2.05	2.02	0.74	2.11	0.53	0.17	0.62	1.83	0.47	1.19	
Jhelum	0.14	0.32	0.38	0.41	1.83	0.93	1.78	1.24	2.84	1.29	0.69	2.20	3.33	1.52	3.25	
Gujrat	0.40	0.58	0.53	0.77	2.96	0.93	1.64	0.48	1.11	5.05	1.15	3.96	3.85	0.80	1.73	
Sargodha	0.86	0.36	0.43	1.76	1.10	1.47	100	0.41	0.77	2.15	0.81	1.86	4.94	0.56	0.77	
Mianwali	0.18	0.26	0.55	0.44	0.59	1.03	1.57	3.22	3.98	2.31	4.09	6.50	31.27	1.98	26.47	
Faisalabad	2.46	1.09	1.23	3.11	0.71	1.04	1.83	0.33	0.58	7.34	1.04	2.58	9.88	7.57	12.54	
Jhang	0.29	0.34	0.50	0.13	0.11	0.16	0.99	1.42	1.35	1.12	1.26	1.67	1.49	2.09	1.35	
Lahore	0.76	1.85	0.62	1.18	0.68	0.55	3.41	0.51	1.22	4.12	0.44	1.58	5.58	0.63	1.25	
Gujranwala	8.35	5.29	2.48	8.05	5.88	8.53	2.39	1.04	2.25	3.73	1.84	3.51	2.91	0.17	1.58	
Sheikhupura	0	0	0	1.22	3.29	1.77	1.61	9.97	8.76	7.19	3.29	8.46	1.91	0.88	8.30	
Sialkot	2.97	2:65	2.65	0	0	0	0.61	1.95	5.28	4.48	0.62	2,39	5.63	0.75	8.75	
D.G. Khan	0.08	0.02	0.07	0.07	0.05	0.12	0	0	0	0.38	7.37	8.47	0.24	8.62	0.43	
Muzaffargar	0.08	0.05	0.15	0.12	0.06	0.15	0.40	7.00	1.10	0	0	0	0.19	2.48	0.32	
Multan	0.83	0.09	0.32	1.35	0.11	0.39	0.64	0.76	0.30	0.33	0.75	0.02	0	0	0	
Sahiwal	1.19	0.30	0.65	1.09	0.2	0.43	1.42	0.44	0.62	2.12	0.60	1.03	2.15	0.64	0.61	
Bahawalpur	0.51	0.51	1.54	0.96	0.90	2.17	0.47	2.49	1.52	0.40	1.18	1.47	0.36	2.37	0.76	
Bahawalnagar	0.05	0.06	0.13	0.04	0.03	00.8	2.~3	3.91	5.19	0.36	0.48	0.82	0.31	0.40	0.40	
Rahimyar Khan	0.10	0.04	0.20	0.24	0.04	0.35	0.96	1.36	1.82	0.36	0.38	0.13	0.17	0.14	0.19	

Table (d). Ratio of Observed to Expected Life-time Migrants from each District to each of the other District in the Punjab

District	Ratio or Observed to Expecred											
To:	Sahiwal			Bahawalpur			Baha waIn :tgar			Rahimyar Khan		
From Model:	1	2	3	1	2	3	1	2	3	1	2	3
Campbelpur	0.60	0.46	1,04	0.55	0.39	0.95	1,23	0,88	2.31	0.32	0,46	0.60
Rawalpindi	1,69	1,16	2.30	0.64	0.34	0.84	0.27	0.21	OA1	0.11	0.12	0.14
Jhelunl.	1,25	1,64	2.58	0.52	0.55	1,04	0,46	0.65	1,05	0.27	0.51	0.54
Gujrat	0.98	0.71	0.97	1,51	0.65	1,36	1,88	0.66	1,13	0,75	0.58	0.68
Sargodha	0.55	0.54	0.57	1,07	0.73	1,05	0.9~	0.88	1.12	0.36	0.37	0.34
Mianwali	0.17	0.36	0.51	0.23	0.56	0.69	0.56	1,28	1,82	0.30	0.95	0.84
Faisalabad	1,90	1,00	8.80	5.33	1,40	2.12	J.74	1,67	1,79	6.60	1,86	2.36
Jhang	0.29	0.50	0,47	0.33	0.67	056	0,40	5.82	2.87	0.24	0.44	0.36
Lahore	4.18	2.36	2.22	1,72	0.39	0.38	0.77	1,46	0:59	1,94	0.55	0.81
Gujranwala	0.51	0.56	0.62	1,61	0.99	1,75	0.81	0.88	1,07	0.66	0.52	0.61
Sheikhupura	3.85	1,44	1,29	2.29	2.08	3.13	1,97	3.02	3.25	1,89	2.18	2,40
Sialkot	2.02	0.90	0.37	5.00	1,42	3.14	2.99	1,05	1,89	2.34	0.89	1,38
D.G. Khan	0.07	0.20	0.19	0.20	1,21	0.63	0.10	0.26	0.28	0.71	4.18	1,94
Muzaffargarh	0.07	0.16	0.14	0.18	1,16	0,47	0.07	0.17	0,17	0,46	2.01	0.27
Multan	0.98	0,44	0,44	0.11	1,25	0'51	0.22	0.36	0,44	0.81	0,46	0.34
Sahiwal	0	0	0	1,32	0.58	0.71	0.61	1,23	0,48	1,49	0.66	0.71
Bahawalpur	0.76	2,47	2.53	0	0	0	0.54	4.16	2,33	0,48	5.50	1,84
Bahawalnagar	0.18	1,81	0.61	0,49	2.57	1,47	0	0	0	0.61	2.30	1,~O
Rahimyar Khan	0.11	0.10	0.22	0,47	1,56	1,22	0.34	0.57	0,83	0	0	0

LOCATION OF GROWTH POLES IN A RUGGED TERRAIN A CASE STUDY OF THE SUBMONTANE AREA OF JHELUM TEHSIL

Dr. Miss M. K. Elahi*

Introduction

This paper seeks to develop a method for establishing an hierarchy of rural settlements in order to map the areas of relative potential and to locate growth poles within the areas of each category of settlement.

The area selected for the study is Tehsill Jhelum. This area is a part of the *barani2* tract of the Punjab province (Fig. 1). It displays great variations of landforms ranging from the active flood plain area adjacent to the river Jhelum to the Salt Range piedmont and escarpment, dissected basin plain, severely eroded land and mountain and exposed bed rocks (Table 1, Fig. 2). The soils are no less varied with a great range in productive capability. (Table 2, Fig. 3). Cultural variations are also important. Some of the settlements are located at cross-roads with access to various facilities and other eSiiential servic es, whereas some are relatively tnaccessible with natdly any amenities of life.

* Dr. Miss M. K. Elahi, Professor & Chairman, Department of Geography, University of the Punjab, New Campus, Lahore.

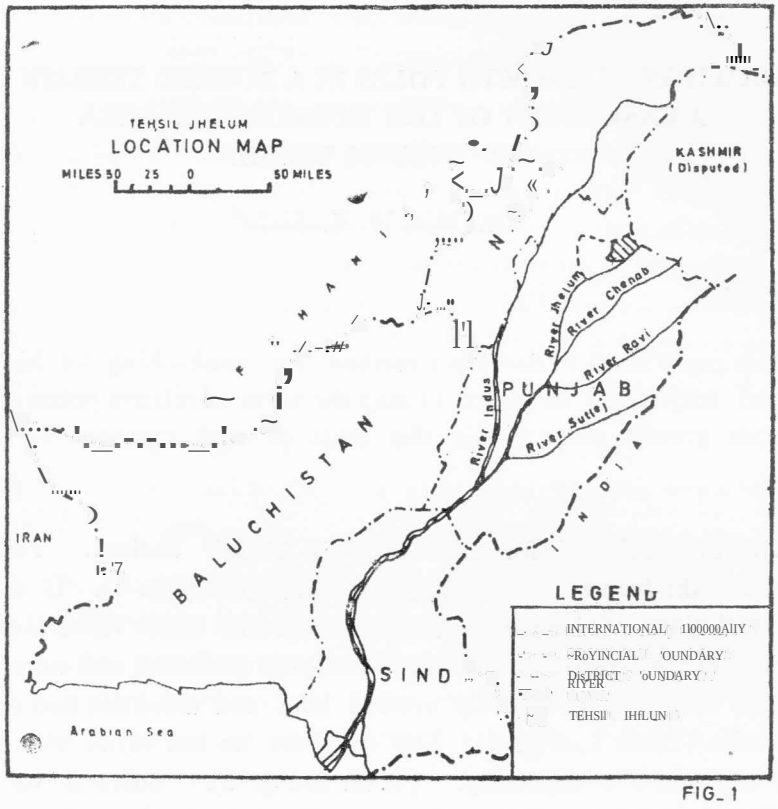
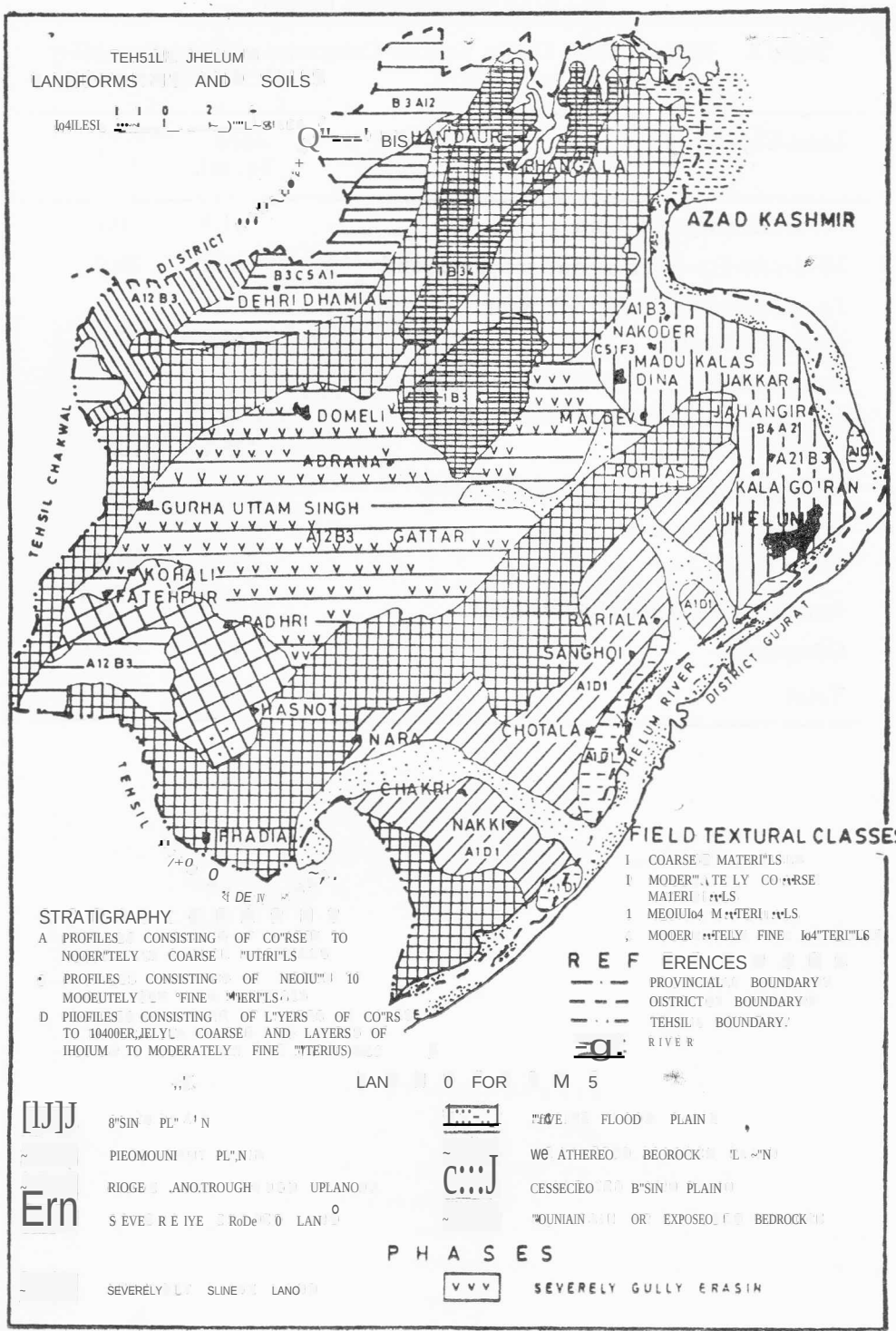


FIG. 1

Table 1. Ratio of Area Under Various Land Forms in Jhelum Tehsil

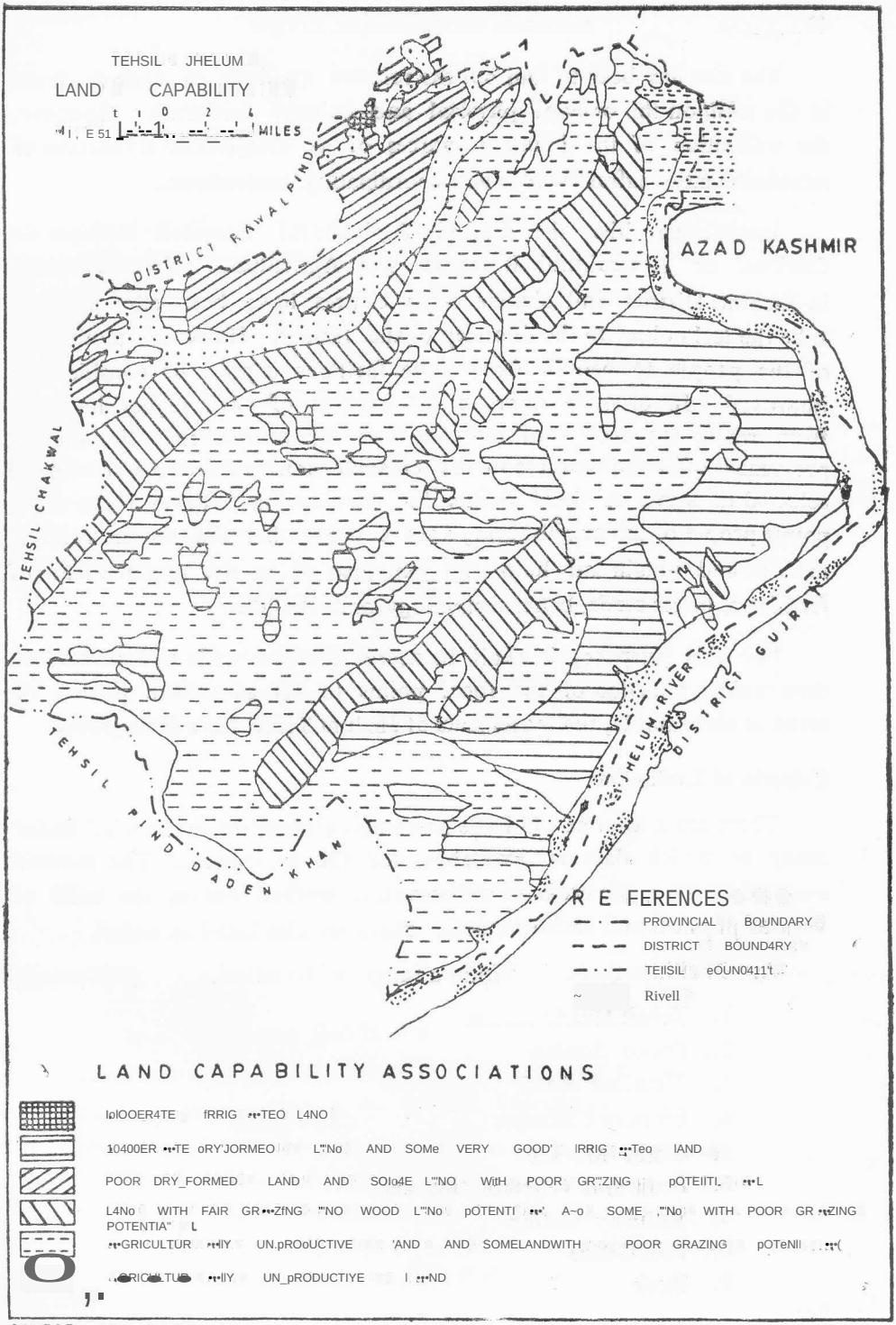
Land Forms	Area	%
	(sq. mile)	
Active Flood plain	25.1	2.8
Meander Flood plain	—	—
Basin Plain	64.8	7.2
Dissected Basin Plain	254.2	28.4
Piedment Plain	86.8	9.7
Weathered Bed Rock Plain	14.8	1.7
Ridge & Trough Upland	84.2	9.4
Mountain & Exposed Bed Rock	279.7	31.2
Severely eroded land	38.0	4.2
Other land	48.4	5.4
Total	896.0	100



SOURCE - CENTRAL SOIL CONSERVATION ORGANIZATION, MINISTRY OF FOOD AND AGRICULTURE FIG. 2

Tabie 2. Ratio of Area Under Various Categories of Land Capability in Jhelum

Land Capability	Area Sq. m!.	%
Moderate irrigated land	1,6	0.1
Moderate dry-farmed good irrigated land	183.4	20.9
Pom dry farme.d land with poor grazing potential	62,4	7.0
Land with fair grazing and wood land potential and lome land with pOQr grazing potential	125.4	13.9
Agriculturally unproductive land with some land with poor grazing potential	465.3	51,6
Agriculturally unproductive land	46.3	5.1
Other land	13.6	1.4
Total	896.0	100.0



SOURCE_ SOIL SURVEY OF PAKISTAN

FIG_3

The aim has been to find out the relative qualities of various areas in the *tehsil* on the basis of physical and cultural resources. However. the utilization of the innate resources of an area is also a function of establishment of infrastructure and coordinating institutions.

Institutions like the Barani Agricultural Research Institute in Chakwal or Agricultural Research and Agricultural Farm Network in Jhelum District and similar other centres have been attempting to take the technology to the doorstep of the farmer. However, motivation of the people to benefit from these facilities is yet to be considerably improved. In order to improve the benefits of such higher institutes from where the results of research and experiments regarding the improvement of *barani* land resources emanate, some settlements should be selected to serve as focal points for development. From these focal points people of the neighbouring area could gather the required information and obtain all help and guidance as to the procurement of fertilizers, better seeds, better technology and the like.

For this purpose, it shall be useful to evaluate the settlements and then make a selection of the focal points to act as growth poles. To serve as an example, the settlements of Jhelum Tehsil have been graded.

Criteria of Evaluation

There are a total of 455 large and small settlements in the *tehsil* under study of which data is available for 430 settlements. The method adopted to assess the ranks of settlements is worked out on the basis of various physical and socioeconomic characteristics listed as under:

A. Facilities that exist within a range of 10 miles\ (200 points)

1. Tehsil Headquarters
2. Police Station
3. Metalled Road
4. Livestock Market
5. Grain Market
6. Fruit and Vegetable Market
7. Railway Station
8. Post Office
9. Bank

10. Hospital/Dispensary
11. Veterinary Hospital/Dispensary
12. Office of the Field Assistant of Agriculture
13. Chemical Manure Department
14. Diesel Pump Depot
15. Tractor Workshop
16. Primary School
17. Middle School
18. High School
19. Drinking Water
20. Electricity

Each of these facilities have been awarded 10 points as maximum making a total of 200 points. The scale of evalution has been worked out in a manner that the points awarded to a settlement are inversely proportional to the distance between the settlement and the facility. e.g.,

Distance.'miles	Points
0	10
1	9
2	8
3	7
4	6
5	5
6	4
7	3
8	2
9	1
10	0

B. Mining and Industries 20 points

The settlement that has a mmmg centre is awar9.ed 10 points. Similarly a settlement with a manufacturing industry is given 10 points. The settlements with a no mining and no. in\iustry do not get nsy points.

C. Population Characteristics 30 points

1. Size of the settlement
2. Annual growth rate of population 1961-72.
3. Literacy ratio - 1972 census

The scale adopted for each of the above characteristics is:

Settlement sb:e	Points
250 or less	1
251-500	2
501-750	3
750-1000	4
1001-1500	5
1501-2000	6
2001-3000	7
3001-4000	8
4001-5000	9
Above 5000	10

Ann ual growth rate of population (percent)

0.50or less	2
0.51-1.00	4
1.10-2.00	6
2.12-2.50	8
2.51-3.00	9
Above 3.00	10

Minus scale has been applied in cases where the population shows a decrasse.

Literacy ratio (%)	
10 or less	1
11-20	2
21-30	3
31-40	4
41-50	6
51-75	8
Above 75	10

D. Cultivated land (30 points)

1. Per capita cultivated land 10 "
2. Ratio of cultivated area to total area 10 "
3. Ratio ot area under wheat to total c1S]tinted area 10 ••

Scale adopted for per capita cultivated area is:

Under 0.25 acres	2 point
0.26-0.50	4 "
0.51-1.00	6 "
1.10-2.50	8 "
Above 2.00	10 "

Scale for ratio of cultivated area to total area and ratio of area under wheat to total cultivated is:

Below 5%	1 point
5-10	2 "
11-20	3 "
21-40	4 "
40-60	6 "
61-80	8 "
Above 80	10 "

E. Modernization of Agriculture (20 points)

Tractors	10 "
Tubewell.	10 "

The evaluation is done on the basis of acreaie per tractor or tube well.

Tractor/Tubewel1 50 acres or less	10 poinil
51-100	8 "
101-150	6 "
151-200	4 "
201-250	2 "
Above 250	0 "

F. Land characteristics (30 points)

1. Susceptibility to soil erosion	10 "
2. Land capacity	10 "
3. Terrain	10 "

Susceptibility ta erosion has b~en gauged according to the severity of the problem

I.	Very severely erod~d	2 point
2.	Severely eroded	4 ,,
3.	Moderately eroded	6 ,,
4.	Land Wilh liltle erosion	8 ,,
5.	Very little erosion or no erosion	10 ,,

Land capability

J.	Moderately irrigated land	10 point
2.	Moderately dry land with some irrigated land	8 ,,
3.	Poor dry farmed land with some land with poor grazing potential	6 ,,
4.	Land with fair grazing and wood land potential and some land with poor grazing potential	4 ,,
5.	Agriculturally unproductive land and some land with poor grazing potential	2- ,,
6.	Generally unproductive land	0 ,,

Terrain

I.	Very steep slope	2 point
2.	Steep slope	4 ,,
3.	Moderate slope	6 ,,
4.	Gentle slope	8 ,,
5.	Very gentle or almost plain area	10 ,,

The maximum evaluation points, therefore, add to a total of 330.

On the basis of the above mef;ltioned characteristics, 430 settlemen~s of Jhelum Tehsil have been evaluated and ranked. The ranks range from I to 172. M lily s~ttlem~ntsha ve tied ranks.

Th~ settlements have finally been grouped into five categories as under:

Rank 1-33	I
35-70	II
71-105	III
]06-140	IV
Above-40	V

Significance of the Criteria

To test the soundness of this basis for establishing such a hierarchy or settlements, a correlation coefficient has been worked out between the evaluation points and the per capita income for 32 selected settlements from various ecological zones. A significant correlation coefficient of 0.6548 was established.

Dis~ribution of Settlements

Figure 4 shows the areal distribution of settlements according to population size while Figure 5 shows the distribution of settlements of various categories. Isopleths have been drawn to show the areas of settlements of categories I to V. It is very clear from the map that the distribution of settlements of variou categories is quite orderly, the areas of lower categories of settlements being arran~ed further away from the main axis of high categories which runs along the main artery of communication namely Grand Trunk Road and the railway (Fig. 6). This form of distdbution of areas of settlement of various categories may be peculiar only to the present study and may not be of general application to settlements in plain areas. Further studies will throw light on it..

Settlements of various ranks in each category are not placed in a mann~r so as to facilitate the selection of well distributed growth centres LO serve their respective areas. On the contrary the settlements in category I (Rank I - 35) are concentrated in a few privileged area and are rarely found outside these areas. Figure 7 signifies that for the development of an ar~a which abounds in anyone category of settlements (and has practically no settlement of higher category) a settieme~twith highest rank within the category. will ha ve to be selected which is better suited for the purpose.

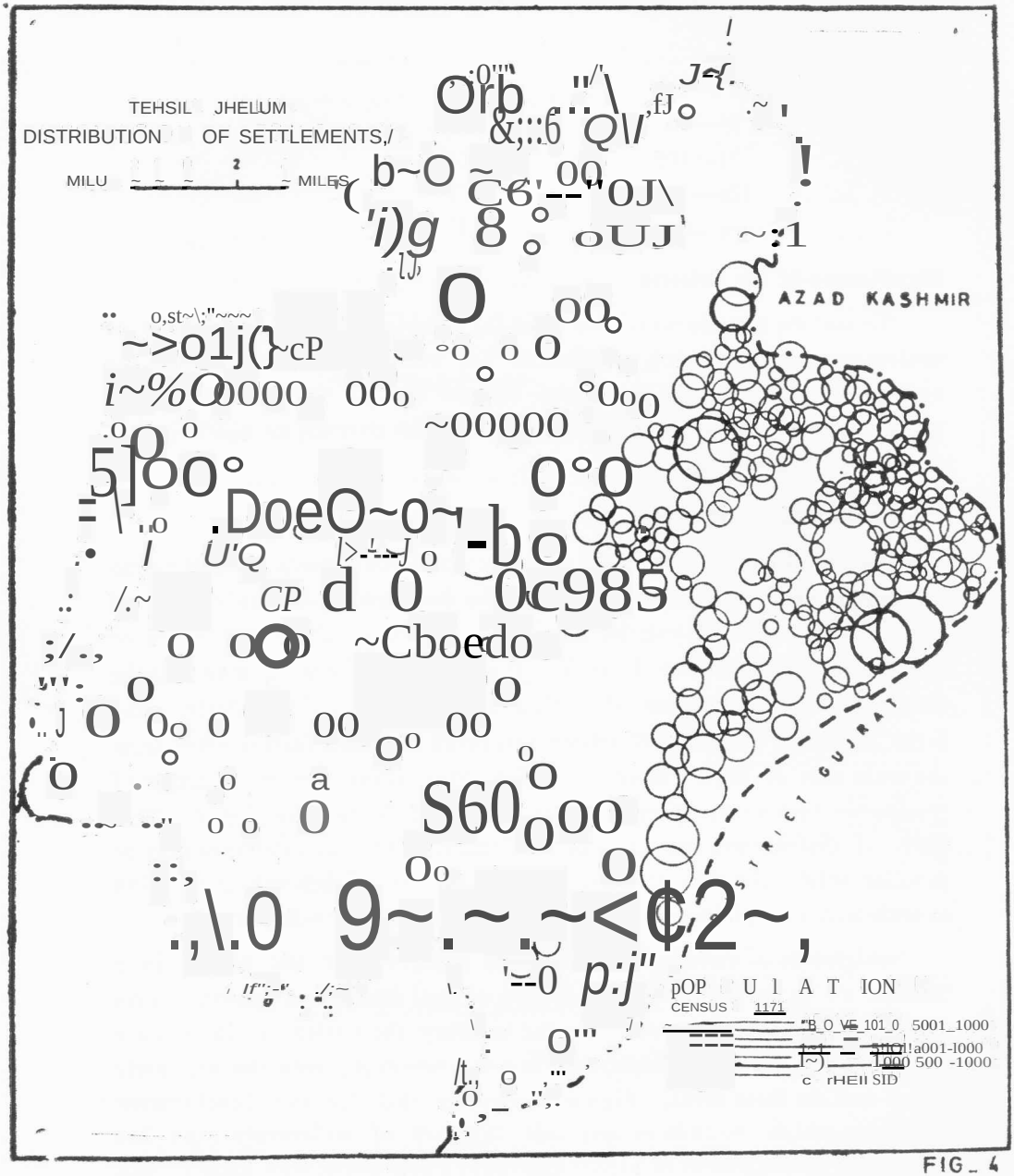

TEHSIL JHELUM
DISTRIBUTION OF SETTLEMENTS,/
MILU
MILES
AZAD KASHMIR
pOP U l A T ION
CENSUS 1171
B_O_VE_101_0 5001_1000
1000 500 -1000
c rHEll SID

FIG_ 4

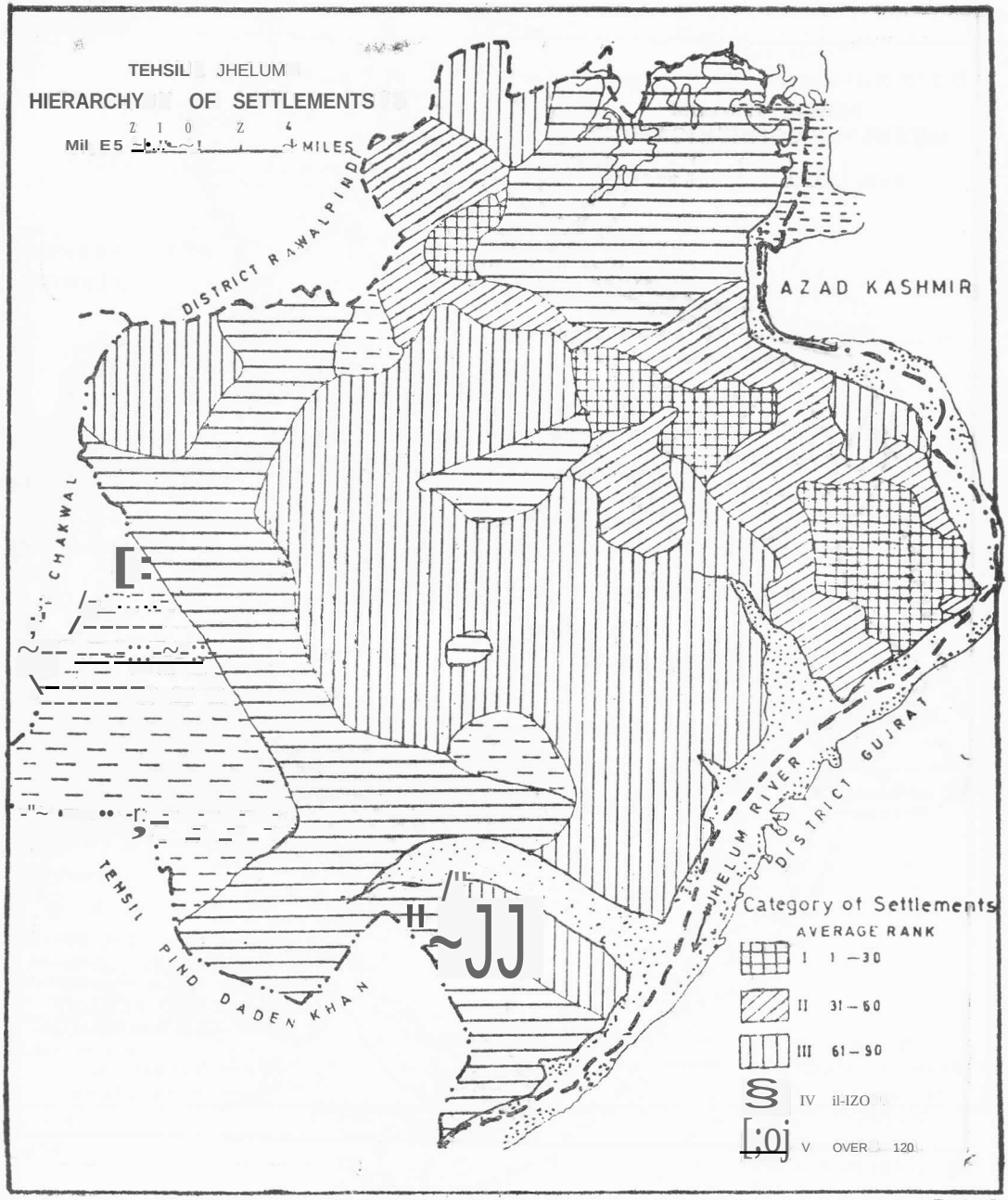

TEHSIL JHELUM
HIERARCHY OF SETTLEMENTS
MILES
DISTRICT RAWALPINDI
AZAD KASHMIR
CHAKWAL
JHELUM RIVER
DISTRICT GUJRAT
TEHSIL PIND DADEN KHAN
Category of Settlements
AVERAGE RANK
I 1 —30
II 31 — 60
III 61 — 90
IV il-IZO
V OVER 120

FIG_5

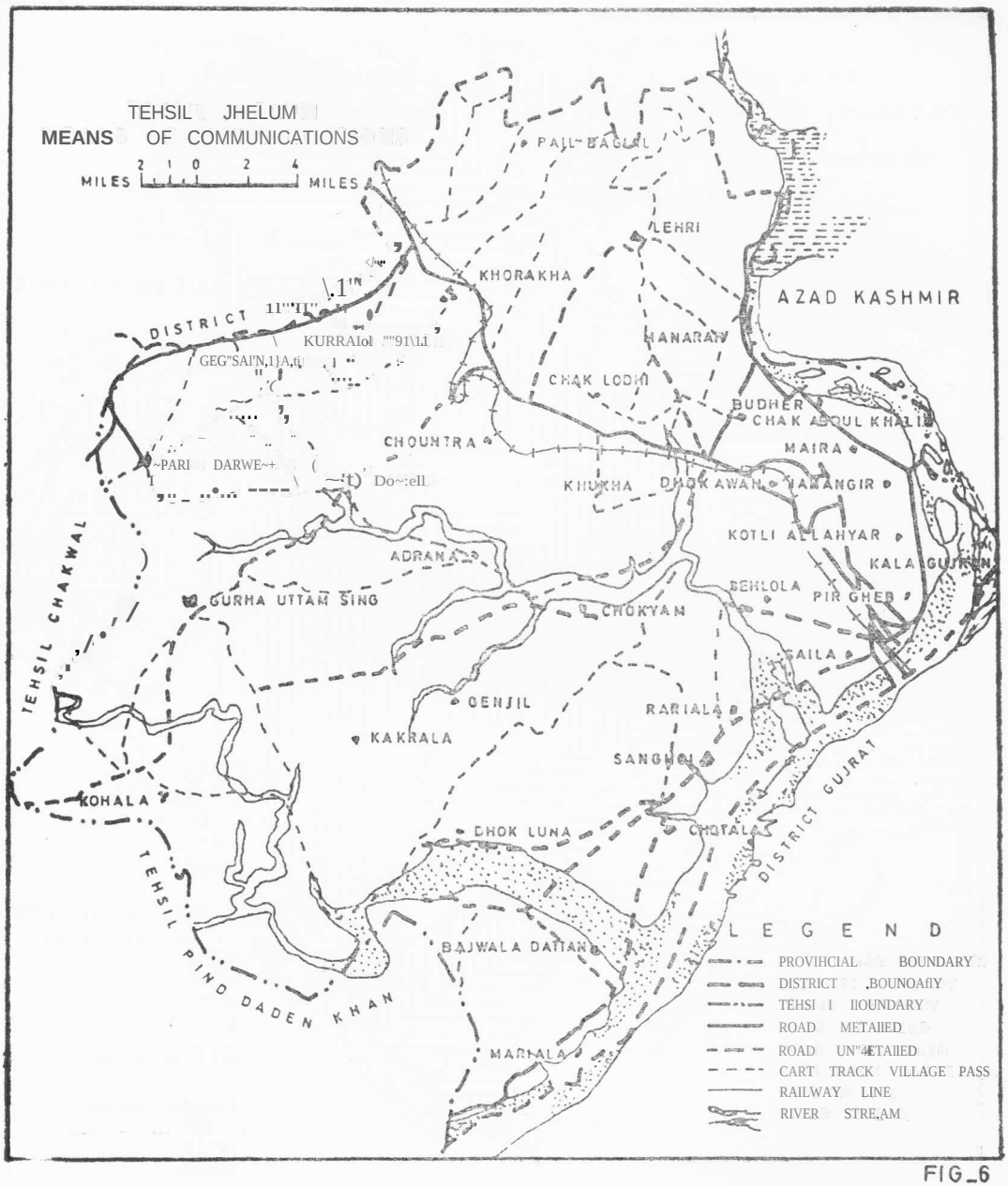

TEHSIL JHELUM
MEANS OF COMMUNICATIONS
2 1 0 2 4
MILES MILES
PAIL BAGIAL
LEHRI
KHORAKHA
AZAD KASHMIR
DISTRICT
KURRAIol
GEG"SAI'N,1}A,f
CHAK LODHI
MANARAN
BUDHER
CHAK ABDUL KHALIQ
CHOUNTRA
MAIRA
PARI DARWE~+
KHUKHA
DHOK AWAN
JAHANGIR
KOTLI ALLAHYAR
KALA GUJRAN
ADRANA
BEHLOLA
PIR GHEB
GURHA UTTAM SING
CHOKYAM
TEHSIL CHAKWAL
GAILA
DENJIL
RARIALA
KAKRALA
SANGHOI
KOHALA
DHOK LUNA
CHOTALA
DISTRICT GUJRAT
TEHSIL PIND DADEN KHAN
BAJWALA DATIAN
MARIALA
LEGEND
PROVIHCIAL BOUNDARY
DISTRICT ,BOUNOAfIY
TEHSI I IIOUNDARY
ROAD METAIIED
ROAD UN"4ETAIIED
CART TRACK VILLAGE PASS
RAILWAY LINE
RIVER STRE,AM

FIG_6

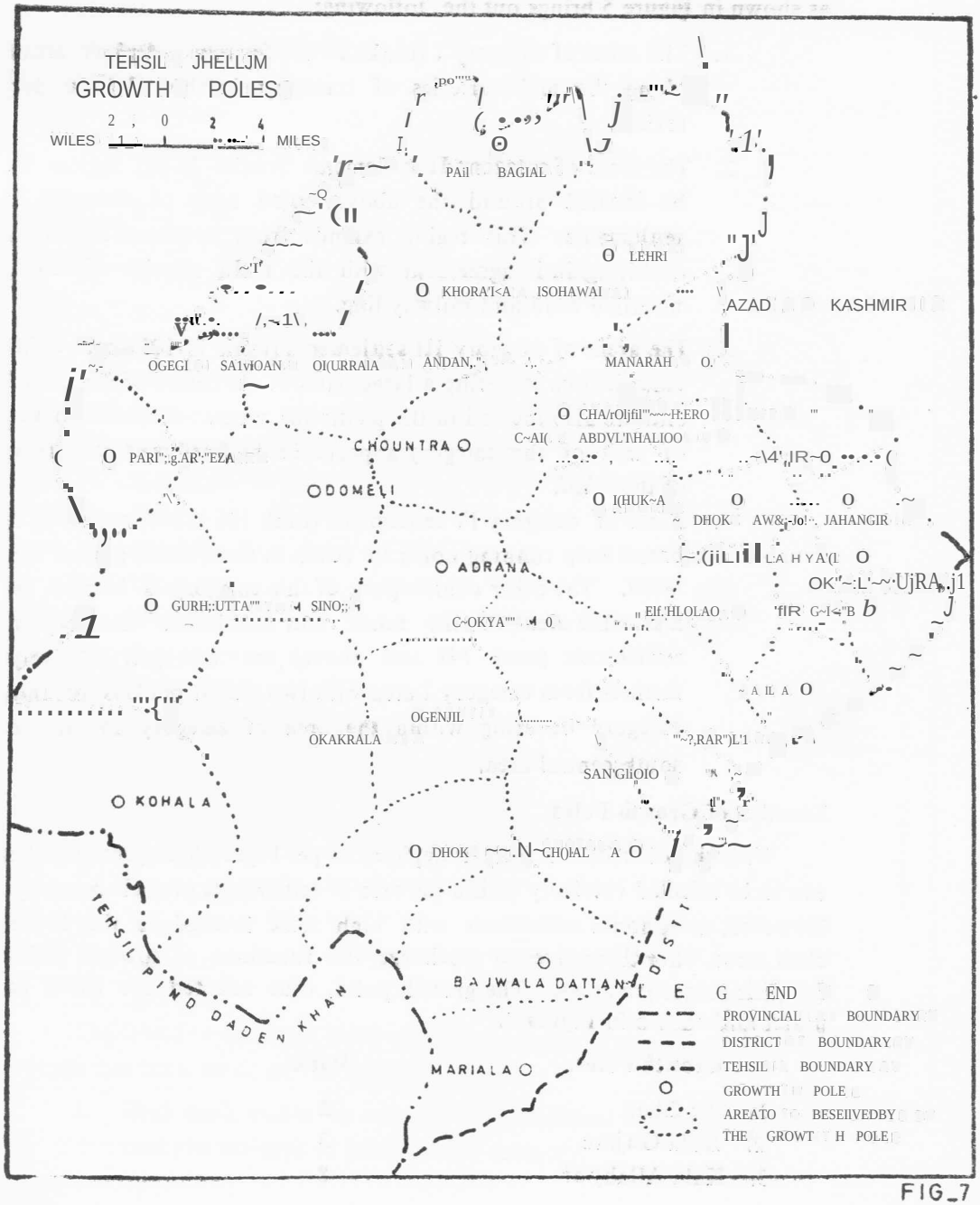

TEHSIL JHELLJM
GROWTH POLES
2 , 0 2 4
WILES MILES
PAil BAGIAL
LEHRI
KHORA'I<A ISOHAWAI
AZAD KASHMIR
OGEGI SA1viOAN OI(URRAIA ANDAN,
MANARAH O.
CHA/rOljfil'~~~H:ERO
C~AI(ABDVL'I\HALIOO
PARI",.g.AR;"EZA
CHOUNTRA O
ODOMELI
I(HUK~A
DHOK AW&;-Jo!-. JAHANGIR
ADRANA
L A H Y A'(1
OK''~:L'~~·UjRA
GURH;:UTTA"" SINO;;
C~OKYA""
Elf.'HLOLAO
'fIR G~I<~"B
OGENJIL
OKAKRALA
SAN'GIiOIO
KOHALA
DHOK ~~.N~CH()IAL A O
TEHSIL PIND DADEN KHAN
DIST
BAJWALA DATTAN
MARIALA
LEGEND
PROVINCIAL BOUNDARY
DISTRICT BOUNDARY
TEHSIL BOUNDARY
GROWTH POLE
AREATO BESEIIVEDBY
THE GROWT H POLE

FIG_7

The distribution pattern of areas of various categories of settlements as shown in Figure 5 brings out the following:

1. The areas of category 1 (ranks I - 35) form two distinct areas along the main arteries of transport in the *tehsil* under review.
2. The areas of category II settlements (ranks 36-70) appear to be located around the above noted zone of category I settlements. This region extends from southeast to north, and is again in agreement with the main arteries of flow, metalled road and railway line.
3. The areas of category III settlements (rank 71-105) are quite conspicuous covering a large parts of the centre of the *tehsil* and are also located in the piedmont zone. A small pocket of area of this category appears in the northwestern corner of the *tehsil.*
4. Areas of category IV settlements (rank 106 - 140) appear in a broad strip running north to south in the western part of the *tehsil.* The other counterpart of this category is located in a sizeable area in the north and northeast. . Category V settlements (rank 141 and above) .are arranged relatively farthest from category I area with two small pockets of this category occuring within the area of category IV in the south central area.

Location of Growth Poles

With the distribution pattern depicted as per Figure 3 the growth poles are to be selected carefully within the area of settlements of each category. However, exceptional settlements with high rank located in the lower class areas, offer themselves to discharge the functions of growth poles for their respective areas. The growth poles, thus selected are listed as under and shown in Figuret 7.

Growth Poles.	**Rank**
1. Pir Gheb	**2**
2. Kala Gujran	**3**
3. Kala Allahyar	**8**

Growth Poles	Rank
4. Dhok Luna	13
5. Saila	20
6. Chak Abdul Khaliq	25
7. Jahangir	39
8. Khukha	39
9, Budher	40
10. Shamaspur	41
11. Bhit Mast	42
12. Chak Lodhi	42
13. Munara	43
14. Behlola	45
15. Shekh	53
16. Khurd	57
17. Domeli	70
18. Sanghoi	73
19. Rariala	81
20. Chakri	84
21. Chukian	85
22. Dhok Piru	93
23. Gcgi Saiydan	95
24. Pari Darwaza	103
25. Bada Gown	105
26. Pail Bagial	106
27. Adrana	109
28. Lehri	111
29. Kurram Andan	113
30. Bhander	118
31. Bhangalah	126
32. Mariala	126
33. Raipur	144
34. Kohala	145

The selection of above listed growth poles out of the available settlements has been made on the following criteria:

1. High rank within the cate,gory or exceptional settlement (of high rank) in the area of low ranking category.

2. Centrality of location having least distance with the neighbours.

Ihe thirty four growth poles that have emerged thus seem to be well placed serving settlements ranging in number from 5 to 22 settlements with a population range of less than 5 to above twenty thousand. The average distance from the growth poles to the serivce settlements is generally less than 5 miles. It may be kept in view that in a dissected hilly region distance is an important factor and initially the growth poles have to be large in numbers.

These growth poles can further be classified so as to establish hierarchy of the growth poles for the purpose of selecting primary and secondary growth poles. In case the planner, for the given purpose wants to upgrade a lower category settlement to a higher one. he will have to comensorately add additional functions to the growth pole.

References and Notes

1. *Tehsil* is an administration unit of the fourth order after Province, Division and District in the country.

2. *Barani* area is the one which is rainfed.

3. This is obtained from Pakistan Census of Agriculture 1972. Form II.

POLICY, INSTITUTIONS AND AGRICULTURAL PRODUCTION: THE PUNJAB C;\NAL COLONY DISTRICTS, 1880 TO 1940

Dr. Fareeha Zafar*

Introduction

This paper examines the impact of colonial policies and institutions On agricultural production in the Punjab Canal Colonies.[1] The Canal Colony Districts are located in the western part of the Punjab, i.e. the portion of the province which is in Pakistan today.

Following the annexation of the Punjab in 1849, for three decades, agriculture suffered from the indifference of the government. Whereas, the Sikh rulers had given all help to the cultivators in the form of well and canal construction and clearance, loans, and other forms of assistance, albeit to extract a greater revenue, the British administration believed in leaving the cultivator on his own.[2] As a result, the number of wells declined throughout the province, canals and other water cuts and channels were closed due to non-clearance and the cultivator was forced to turn to the *bania* for his cash requirement.s, if for nothing else than to pay the land revenue.[3] Production remained more or less static, while the conditions of the peasant deteriorated.

In the Canal Colony Districts, prior to the construction of canals, agriculture prospered or perished with the success and timely arrival of the monsoon rains or their failure. The areas of *barani* cultivation were the most susceptible to the vagaries of nature, but even the areas of irrigated cultivation expanded or contracted with the amount of water in the rivers, the inundation canals, and wells. More important still than the extent of cultivated area was the area on which the crops actually matured and were finally harvested. Failure, delay, excess, shortage of water supply. could all effect the crops at any stage of their production; while the effects of a year of good harvests could seldom be carried over

---

Dr. Fareeha Zafar is Assistant Professor, Department of Geography, University of the Punjab, Lahore.

to the next by a population which lived at subsistence levels, the disaster of bad harvests had a cumulative effect which plunged the majority of the rural population into debt adding to the ranks of the landless.

Lack of a Positive Policy towards Agriculture

The policy of non-interference regarding agricultural improvements etc., however could not succeed in a region where rainfall was scanty, famine common, and wher" changes in land tenure, revenue demand and its collection, were resulting in rapid improverishment of the peasantry. The first Land Improvement Act of 1871, was a half-hearted measure by the Government to provide loans for small improvements on the land, but as these improvements including the sinking of wells-which was in the grasp of the individual cultivator-were taxed, the incentive to use *taka vi* for them was crushed. Any other private improvements such as planting trees, constructing embankments were also taxed, and this was a bar to agricultural development. .

This act was superseded by the Land Improvement Act of 1883, which was again deficient when it came to giving loans for wells even in time of famine.[4] At the same time, the Agriculturists Loan Act of 1884 was promulgated, to combat the role of the bania in the village society of the Punjab. But its sphere was very limited, extending mainly to the purchase of s~ed and cattle, when the real need of the cultivator lay in the availability of ready cash to pay the land revenue in times of scarcity.[5] The measures taken so far were aimed at reducing the dependence of the agriculturist on the *bania* rather than bringing about any positive improvements in agriculture itself.

The inception of the perennial canal irrigation on a large scale in the 1880s to create the canal colonies as the granary of India seemed to demand a simultaneous leap forward in agricultural practice. But this did not come. The creation of the Imperial Department of Agriculture in 1881 and proposals for the formation of Provincial Agricultural Depart. ments in 1882, went unnoticed. mainly because the aims were vague and directed at general issues like agricultural inquiry, agricultural improvement, and famine policy. The policy of colonisation during the 1880s and 1890s also aimed at increasing production through the extension of the cultivated area. In fact this was so successful. that factors such as the

growing indebtedness of the cultivators, falling yields, and imposition of special conditions attached to most colony grants, which were all inhibiting the development of agriculture, tended to be ignored.

Attempt to Develop Agriculture on a Scientific Basis

As it became apparent that the increase in production was solely due to the increase in the cultivated area, and in fact actual production seemed to be falling as a result of the changes caused by the canals, the Famine Commission of 1901 and the Irrigation Commission of 1903, not only stressed the development of other means of irrigation to supplement canal water, but also suggested the reorganisation of the Agriculture Departments on a scientific basis with the aim of increasing food supplies.[6] Tn 1905, the Government of Tndia took steps to give money to Provincial Departments of Agriculture for research experiment, education, and demonstraiion in new and improved agricultural techniques, and to promote such activities, the Lyallpur College was set up in 1908 in the Chenab Canal Colony. At the same time, a Cooperative Credit Movement was started so that the programme could become self-financing.

The DepartmclIt of Agriculture despite its high sounding aims did not contribute anything significant for a number of decades. The main reason for thi6 was the emphasis on importing technology at this stage. Cvnditions in the Punjab were very different from those experienced in England and other parts of Europe and America, and the technology imported from there in the form of implements or crops or techniques of farming proved to be failures in the Punjab. For example, the total number of p:oughs increased with the extension of tlle cultivated area and the increased availability of water supplies which demanded more frequent ploughing l,f the land. As such, their increase was greater in the canal-irrigated districts, but per plough the number of cultivated acres showed a negative result. . Also, it was the native plough which gained in popularity being more suitable ~ :lod cheap~r compared to the iron plough, introduced by the Colonial Government through the Department of Agriculture, as it exposed too much $oil to the sun and was only suitable for arens with heavy rainfall and heavy soils; similarly, the introduction of steam ploughing in the Canal Colonies was a total failure.

Similar failures took place in the introduction of Egyptian cotton and American cotton and wheat varieties, but experimentation in the selection of seeds continued at the Agricultural College at Lyallpur under the supervision of the Inspector General of Agriculture in India who was transferred to Lyallpur for this purpose. What did prove successful during this period were innovations on local agricultural implements and the manufacture of small, practical implements suited to the needs of the cultivator. However, although hoes, drills, harrows, reapers, fodder cutters and winnowing machines were all there waiting to be sold, those who bought them were only a handful of land owners, high cost and lack of repairing facilities being the primary deterring factors.[7] It was also evident that the implements developed were those which helped to increase the production of the major canal colony crops, cotton, sugarcane, wheat and fodder, and were the Behea sugar-mill, the saw gin for cutting cotton and the chaff-cutter.[8]

The process of selection of seeds was ultimately replaced by hybridisation, and it was in this direction that the Department of Agriculture achieved some success. Cotton and wheat were the crops most experimented with, and many different improved varieties of seeds were developed, with the Canal Colonies providing the location for the testing of the experiments, Punjab II and Punjab 8A, emerged as t'le successful wheat types. In the case of cotton, "the most famous India cotton of all time, Punjab 4F" was developed,lI but its cultivation not only required larger inputs of water, but also careful seed selection, which it was not possible for the individual small peasant farmer to undertake. The combined efforts of the Department of Agriculture and of large landowners, who devoted part of their farms to producing these seeds, and the demand by the international market for long staple cotton combined to spread the cultivation of 4F. The ordinary peasant who sold his cotton by weigb.t and not Ie gth of fibre did not stand to gain anything,

Restrictive Aspects of Agricultural Institutions and Policies

The spread of improved varieties of wheat and cotton was facilitat~d by the conditions attached to land grants in the Canal Colonies, which included the cultivation of certain varieties of crops. In fact, the tenants were forced to follow a particular rotation of crops or grow certain

varieties of crops so that a sufficient quantity of the superior varieties could be produced to allow the landowners to obtain value for quality,10

Colonial policy towards agriculture in best seen from the attitude of the Government towards the cultivation of cotton, which was developed as the major non-food cash crop of the Canal Colonies. While *desi* cotton was grown for both internal use and for export, American cotton was grown purely for export purposes. To increase the production of cotton it was obvious to the Government that "the evolution of superior strains of cotton of higher value and greater oultum and improvements in marketing arrangements should place cotton in a better position to compete with other crops."11 The demand in Lancashire was for long staple cotton and so American cotton particularly the type known as 4F was developed. In the Canal Colonies, through the granting of large land grants, a class of large landholders, had already been formed who were willing to cooperate with the Department of Agriculture in the distribution of the new seeds,12

The area under 4F spread from 80 acres in 1917, when it was introduced, to 300,000 acres by 1919. The implementation of this policy at that time was the result of the decrease in American cotton in the world market and Lancashire's dependency on long staple cotton from India and Egypt. The Indian Cotton Committee was set up in 1917 to facilitate the prod uction of cotton in India, its aim being also to restrict the movement of cotton, lint and waste by rail and sea to mills and ports for export. Together with the fact that there were restrictions on colony land being used by private owners for setting up ginning factories, it became obvious that the Government wanted to keep the commercialisation of cotton in their hands. The previous principles of free-trade were explained away by the statement,

> "We have pointed out that the cotton trade is not in a position to cope with the numerous abuses which have been so detrimental to the reputation of Indian cotton in the past without assistance from government and that a policy of laissez-faire in such matters in no longer possil;;le or Qesireable".13

The emphasis on wheat, cotton and sugarcane cultivation in general, and in the Canal Colonies in particular, led to the neglect of other crops which had previously been prominent in the rotation system and which were of great importance in the *barani* and well cultivated areas. Local administrators of other districts while giving evidence before the Royal Commission on Agriculture in India in 1927 stated that, the Lyallpur Agricultural College was only concerned with the development of cultivation in canal-irrigated areas and paid no attention to the development of the crops on well-irrigated land or the dry crops like jowar and barley so vital to the economy of the *barani* areas.[14] Within the Punjab itself. antagonism was directed at the preferential treatment given to the Canal Colonies by the Department of Agriculture. The Deputy Commissioner of Gurgaoll district explained this to the Royal Commission of Agriculture in India,

> "……the Agriculture Department is hardly a provincial agricultural department at all. It might best be described as a Canal Colonies Wheat and Cotton Improvement Department! with side lines in other things".[15]

Changes in Production Patterns

Prior to the annexation of the Punjab by the British in 1849, the Canal Colony Districts were largely self-sufficient producing areas supporting small village populations in cultivated river valleys and around wells, and scattered nomadic pastoral tribes in the wastelands of the river *doabs*. Production was largely for subsistence with small surpluses in grain, *ghi*, butter, and wool, finding their way out of the region through the rivers, the main lines of commerce. The eastern districts of Lahore, Gujrat and Gujranwala, were more densely settled, supported by a more reliable rainfall and irrigated cultivation based on wells and natunll floods. Between 1850 and 1880, the situation remained much the same, with political stability which had been disturbed under the later part of Sikh rule having been restored under the British. Irrigation was left to the devices of the landowners and cultivators, and agricultural production did not show much change. When the construction of perennial canals

was finally undertaken as a definite policy decision in the 1880s, the supply of water to large areas of government owned wasteland immediately extended the area under cultivation and increased the agricultural production of the areas irrigated.

Contrary to what has commonly been maintained, the purpose behind canal irrIgation in the Punjab was not to reduce famine as the Punjab itself was not a scarcity area, but to use the Canal Colony Districts to produce large quantities of agricultural produce, for which it was necessary that oniy members of the best agricultural tribes of the province be selected to populate the colonies, How~ver, the rising prices of agricultural produce in the international market after 1900, and the demand for cash crops like wheat and cotton, and to some extent, oilseeds, led the British administration to organise the Provincial Department of Agriculture on a scientific basis, through which the cultivation of selected crops could be promoted. At the same time, research was encouraged in evolving new improved varieties of wheat and cotton seeds to further increase production.

This emph~sis on wheat and cotton which by thc turn of the century had emerged as the major colony crops continued, so that by 1920-21, almost half the cultivated area was under these two crops. (Table 1). The rate of growth in the cottOll acreage surpassed even that of wheat, and by 1940-41, for every two acres of wheat cultivated there was one acre of cotton, and together they accounted for more than half the cultivated area. (Table 2). At the same time, the area under other foodgrains did not increase to any substantial extent, and between 1930-31 and 1940-41, even began to decline. (Fig. 1) During the same tIme the area under wheat cultivation lev~lled off as w~ll. Since 1920-21, the trend in population had been to increase rapidly. and this combined with a decline in the production of foodgrains and increasing exports was of benefIt only to the large producers and trading classes.

Production figures are only available from 1905-06 onwards, and even then for a few selected crops. Moreover, changes in the methods of estimation as well as the practice of using normals and percentage values makes the figures relatively unreliable. However. it is possible to determine trends in the production of the *major* crops. Table 3 shows the

Table 1. Punjab Canal Colony Districts, Acreage under Selected Crops, 1891 and 1941 (in '000 acres).

	Total Cropped Acreage		Wheat Acreage		Cotton Acreage		Fodder Acreage		Other Foodgrain Acreage		Oil seeds Acreage		Sugar Acreage	
	1891	1941	1891	1941	1891	1941	1891	1941	1891	1041	1891	1941	1891	1941
1. Multan	662	1852	273	622	55	456	x	399	197	333	39	55	3	10
2. Montgomery	426	1695	179	516	22	427	x	446	163	238	22	26	0	13
3. Lyallpur	x	1627	x	589	x	349	x	349	x	203	x	60	x	37
4. Shahpur	486	1479	202	478	140	228	x	227	195	410	14	36	1	9
5. Lahore	1028	1233	392	338	54	216	x	305	445	255	50	67	5	]9
6. Gujrat	764	1022	235	399	33	81	x	146	348	346	27	30	7	14
7. Gujranwala	679	1022	235	399	24	56	x	157	312	315	26	47	19	25
8. Sheikhupura	x	1019	x	356	x	115	x	159	x	309	x	45	x	19
9, Jhang	390	851	170	353	19	110	x	202	145	160	8	7	0	4
Total	4,434	11,952	1,763	4,062	254	2,038	x	2,380	1,804	2,569	186	383	35	150

Note : Areas below 1,900 acres are not shown. Figures have been calculated on a 5 year average basis.

Source: *Agricultural Statistics of British India and Report on the Seasons and Crops of the Punjab, for the years* 1885·86 *to* 1890-91 *aud* 1935·36 *to 1940-41*.

Table 2. Punjab Canal Colony Districts, Proportion of Cultivated Area under Wheat and Cotton, 1891 and 1948

	% Wheat Area		% Cotton Area		a/a Both	
	1891	1941	1891	1941	1891	1941
1. Multan	31,2	33.5	8.3	24.6	49.5	58.1
2. Lyallpur	x	36.2	x	21.4	x	57.7
3. Montgomery	42.0	30.4	6.8	25.2	48.8	55.6
4. Jhang	43.6	41.5	4.9	12.9	48.5	54.5
5. Shah pur	41.6	32.3	8.2	15.4	49.8	47.7
6. Gujrat	40.8	39.1	4.3	7.7	45.1	46.8
7. Sheikhupura	x	34.9	x	11.3	x	46.2
8. Lahore	38.1	27.4	5.3	17.5	43.4	44.9
9. Gujranwala	34.6	39.0	3.5	5.5	38.1	44.5
Total	39.8	40.0	5.7	17.1	45.5	51.0

Table 3. Total Punjab Canal Colony Districts, Estimated Production of Major Crops, 1910-11 to 1940-41 (in tons)

	Rice	Wheat	Gram	Rabi Oilseeds	Gur	Cotton (bales)	
1910-11	45,415	1,287,844	137,254	82.852	53,127	129,965	
1920-21	16S,855	1,444,335	16~,984	86,191	81,333	295,779	
1930-31	225,751	1,441,841	258,454	98,247	79,2ClO	389,137	
1940-11	216,381	1,644,371	172,138	70,093	104,014	871,982	
			Rate of Change (010)				
1910/11-1920/21	+272	+12	+19	+4	+53	+128	+16
1220/21-1430/31	-33	-0.17	+59	+14	-3	+199	+12
1930/31-1940{41	-4	-14	-33	-29	+31	+ 124	+5

Source: *Reports on the Seasons and Crops of the Punjab* for the years 1910-11,1920-21,1930-31 and 1940-41, and *Agicu/rura/ Statistics of British india* 1891 and 1941..

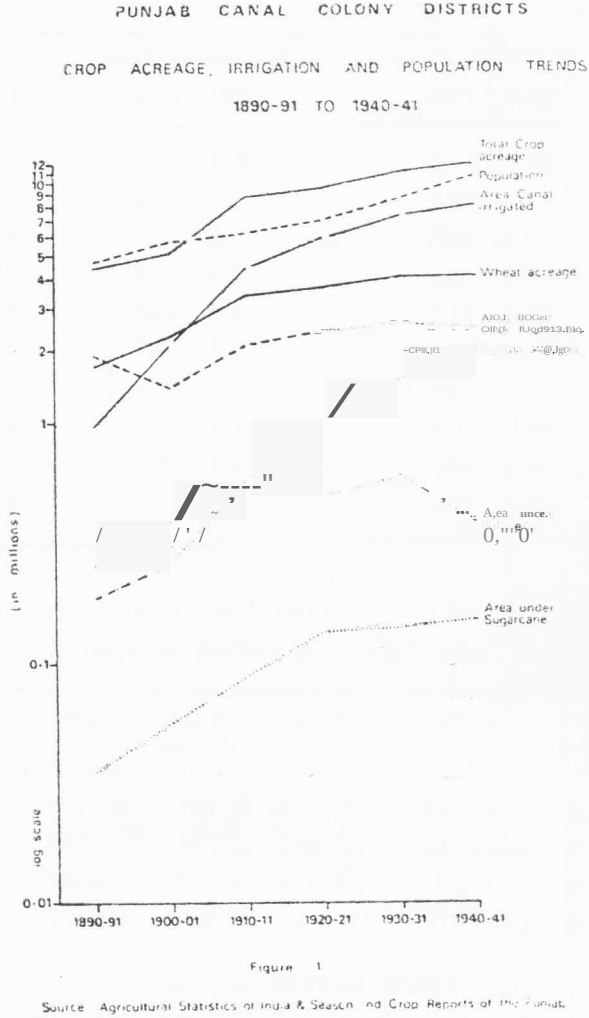


Figure 1

Source Agricultural Statistics of India & Season and Crop Reports of the Punjab.

increased production of wheat and cotton, the major Canal Colony crops, as well as of gram {the poor man's food), oil seeds and *gar,* the revenue raising crops, and the introduction of rice in the waterlogged areas of the Canal Colonies. Figure 2 shows the spectacular increase in the production of cotton compared to the <'ther crops between 1910-11 and 1940-41. Looking at the changes in production fQr three decades, it can be seen that coHon production increased steadily at more than one

PUNJAB CANAL COLONY DISTRICTS

CROP ACREAGE, IRRIGATION AND POPULATION TRENDS

1890-91 TO 1940-41

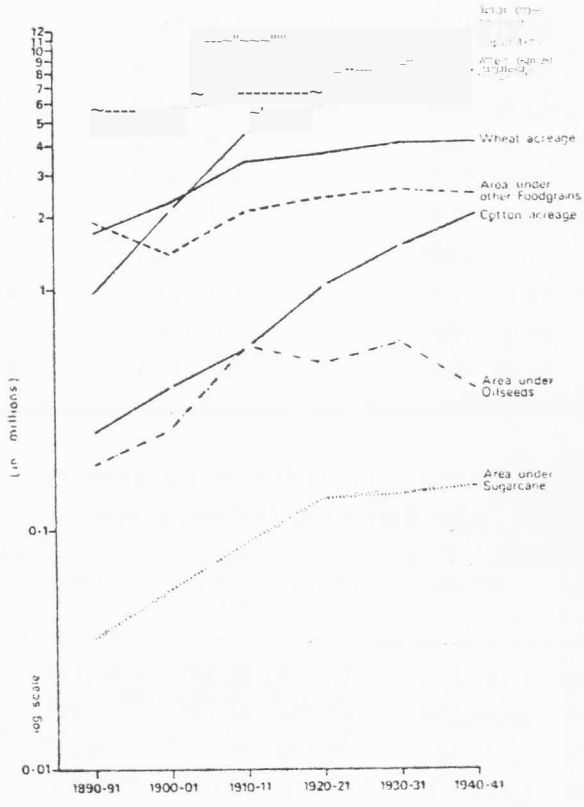


Figure 1

Source Agricultural Statistics of India & Season and Crop Reports of the Punjab.

increased production of wheat and cotton, the major Canal Colony crops, as well as of gram (the poor man's food), oil seeds and *gur*, the revenue raising crops, and the introduction of rice in the waterlogged areas of the Canal Colonies. Figure 2 shows the spectacular increase in the production of cotton compared to the other crops between 1910-11 and 1940-41. Looking at the changes in production f(Olthree decades, it can be seen that coiton production increased steadily at more than one

hundred per cent per decade, while the other crops reflected changing emphases as well as the effects of the depression at the end of 1920s. Both wheat and *gur* registered a decline in production as a result of these factors. The steady increase in the production of cotton was reflected in the very high I.e., more than five hundred per cent increase for the period 1910-11 to 1940-41. The high rate of increase in the production of rice was mainly the result of the negligible production before canal irrigation.

The development of improved varieties of wheat and cotton was also necessitated by the demands of the international market. An evaluation of *desi* cottons by the British Cotton Growing Association based at Liverpool, stated thal,,

> "..... Fibre under 3/4 of an inch is considered short and is not liked in Liverpool, therefore these cottons have not been very highly valued .....".16

At this stage, experiments were still being made with imported vareies of cotton and wheat, and it was not tin the 1930s that a breakthrough was made by developing hybrid varieties of seeds. The *desi* varieties had fitted better into the existing rotation patterns, because a rotation based on American cotton and wheat was very exhaustive of the soil besides requiring large quantities of water. Cash crops like *toria* (a *rabi* oilseed), also suffered in this competition from cotton, as the two crops required water at the same time, but its production continued as it provided cash at the time of payment of land revenue.17 The commercialisation of agriculture weeded out completely the producti6ri of items such as *ghi*, *indigo* and *sajji*, except for a small local production.18

By 1920-21, only those products which the Co-operative Department and Department of Agriculture supported, were widely cultivated.19 The provision of improved varieties of seeds given free in the initial stages, but later sold at ab:JVe m1rk~t rates to farm~r3, brou sht in further profits to the departments concerned.2o The cultivation of rice in the district of Sheikhupura where canal irrigation had from the beginning created the problem of a rising water-table, can be viewed in the same light. THe moist ground was diverted to the cultivation of rice although it was orily

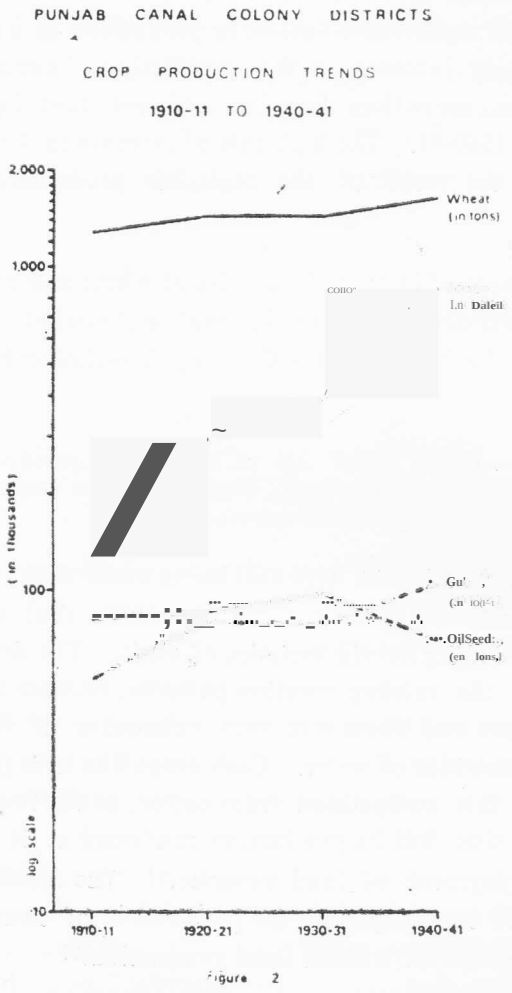


Figure 2

Source: Season and Crop Reports of the Punjab.

the big owners getting a substantial part of the *batai* who profited, while the self-cultivating petty owner and tenant got very little.[21] On the other band, the continued and in fact increased cultivation of sugarcane was for entirely different reasons. Even though sugarcane was grown at a loss in many districts, it was able o compete with wheat and cotton because, (I) it fitted into the labour slack time, (2) there was a local demand for *gur,* (3) in addition to *gur* it was used to provide cattle feed, and (4) the sale

of *gur* occured a. a time when the need arose for ready cash to pay the revenue demand after the *kharif* harvest..

It appears, therefore, that the cultivation and production of two types of crops was encouraged by the administration. First, those for which there was great demand within the country but more so in Britain, and secondly, those which helped the small cultivator to pay the land revenue promptly and without much difficulty.22 While wheat and cotton fell into the first category, oilseeds and sugarcane belonged to the second. Food crops like maize, *jowar* and *bajra,* were partially diverted towards providing the increased fodder requirements under the system of compulsory raising of animals for the needs of the army, and the decline in grazing grounds, In times of scarcity and drought, the decrease in cultivation of fodder crops was entirely met by these crops.

Conclusion

It can be c()ncluded that the ear~ier policies .of the British ~dministeration of non-interference in agricultural development and crop production changed after 1880 with the extension of perennial irrigation to the Punjab Canal Colony Districts: In the decades that followed, the 'paternalism' of the administration was reflected in the control exercised by them in the granting of land in the colonies to 'superior agriculturists. in restrictions on the use of colony land, and in the half-hearted measures regarding loan provisions to cultivators. At the turn of the century, however, an emphasis was placed on the production of cash crops by the British administration, through t~e activities of the Department of Agriculture and by direct legislation. The cultivation of two types of crops was encouraged, those such as wheat and cotton for which there was demand bo;h in,ide ani outside th'c regions, and those like sugarcane and oilseeds which provided the cultivator with ready cash at the time of the two harvests to meet the revenue demand. The internal demand for these crops rested with the growing needs of the army and the local population which was increasing at a rapid rate, while the external demand was created by the increase in the prices of agricultural produce in the international markets and by demand from Britain. Since crop experimentation was restricted to wheat and cotton, total production did not appear to have increased substantially as a result of agricultural

innovations and the impact of canal irrigation on productivity remained dominant throughout the period 1880 to 1940.

References and Notes

1. The Punjab Canal Colony Districts include the districts of Gujrat, Gujranwala Lahore, Montgomery (now Sahiwal), Multan, Lyallpur (now Faisalabad), Jhang, Sheikhupura, and Shahpur (now Sargodha).
2. Government of Punjab, 1860, *Report on the Revised Settlement of the Gujranwala District, 1960*, p. 38.
3. Government of Punjab, 1894, *Final Report of the Revision of the Settlement of Gujranwala District,* 1889-94, p. 94.
4. Government of Punjab, 1900, *Report on the Land Revenue Administration of the Punjab,* p. 1.
5. *Ibid.*
6. Government of India, 1945, *The Famine Inquiry Commission, Final Report,* p. 98.
7. Darling; M.L., 1917 (4th edition), *The Punjab Peasant in Prosperity and Debt, with a nel~ introduction by* C. *J. Dewey,* New Delhi, p. 150.
8. Dewey, C.J., 1972, "The Official Mind and the Problem of Agrarian Indebtednes in India", uiipub. Ph. D. thesis, University of Cambridge, p. 12.
9. Milne, D., 1928, *A brief outline of the Agricultural Conditions in the Punjab,* Department of Agriculture, Punjab, p. 9-10.
10. Government of India, 1927, *Report of the Royal Commission on Agriculture in India, Vol. VIlli Evidence taken in the Panjab,* p.14.
11. Government of India, 1920, *Report of the Indian Cotton Committee,* Reprinted 1920, Calcutta, p. 22.
12. *Ibid.,* p. 21.
13. *Ibid.,* p. 221.
14. *Report of the Royal Commission on Agriculture in India, op. cit.,* p.61.

15.1bid.,p.64.

16. Government of Punjab, 1910, *Annual Report of the Experimental Form, Lya/lpur, 1909-10,* p. 5.

17. Government of Punjab, 1928, *Final Report of the Fourth Regular Settlement of the Jhang District,* 1928, Lahore, p. 15.

18. Although indigo was a cash crop and widely and successfully cultivated in many of the Punjab Canal Colony Districts, its cultivation was deliberately discouraged due to the development of synthetic dyes in Europe and Britain at that time. See *Report on the Revised Settlement of the Gujranwala District, 1860, op. cit.*

19. Government of Punjab, 1925, *Final Settlement Report of the Jhang aad Gugera Bf'anch Circles of the Lyallpur District, 1920-24,* p. 17.

20. The seeds were sold at 4 annas per maund more than the market price. **In** this way the Government usually made a profit or if there was a loss it was very little. In 1924-25, the profit from the sale of cottonseed was Rs. 24,378 and from the sale of wheat· seed Rs. 10,200. See *Report of the Royal Commission on Agriculture in India,* 1921, p. 178, *op. cU.*

21. Government of Punjab, 1927, *Final Settlement Report of the Sheikhupura District (certain portions excepted),* 1923-27, p. 21.

22. Government of Punjab, 1915, *Final Report on the Chenab Colony Settlement,* 1915, p. 60.

THE RECENT GROWTH OF LAHORE'S LINEAR PATTERN OF COMMERCE

FARHAT GULZAR*

Introduction

The pattern of commerce in Lahore today is far different from what it was thirty five years ago. During this period the developments have been so great that something similar to a revolution has taken place. Commercial land-use extends for miles on arterial roads occupying most of the frontage. Small shops have changed into big, modern stores and a large number of super markets have emerged !n the expanding residential sector.. There is paucity of records on the evolution of commercial patterns in Lahore,l yet other clues permit an assessment of change which have affected the commercial fabric of the city since 1975 The paper deals with the distribution of commercial activity in Lahore after making an intensive land use survey of the axial roads (lengths shown in Table 2, Figure 1) for 1975 and 1981 and gives a clear picture of the commercial activity.2

Methodology

The classification used in the field includes seventeen major categories of urban land use. These in turn are subdivided into general land use type, most of which are broken down still further into specific land use types. Only commercial types are dealt. with here.

Commercial Land Use Classification

Table 1. Commercial Land use Classification

Group	Sub-division
L Wholesale	Whole sale dealers
2. Retail	All types of retail business which incl udes among others. petrol-p umps, cloth, building material,

Dr. Farhat GuIzar is Assistant Professor, Department of Geography. t;nivel'sity of the Punjab, Lahore.

		grocer, sweets, ice-depot, timber, timber saw, co-ops, shoes, arms & amunition, watch repair, pOl!!t~~! cO,!I, f~!ti!i~~r, leather, tea, logs, books, stati~e~ry, tob~~so, paper, kerosene oil, steel works, handicrafts, tubewell equipment, carpets, general merchandise.
3.	Ssrvice	Hairdresser, sanitary, dry cleaners, tents, chicks, £r<?~~~~y"t~P..:§i.!~fp-~~!~'lre~~taurants, canteen, pa!!1~~! ,!p';g ~SCO!!!!~~~,-t~!!~ll.p~~t<?g~~phers, el~ctric~! ~EP,H'!!lc~~
4.	Fresh Produee Market	Fresh produce ~arket
5.	Fodder	Fodder

The Spatial Analysis

Empiric;il landqse evaluatioll data ~fth~ stu~i~~ arteri~~ helped to ~r-rive at &t~t~~ents or r~~';.l!arit~e~ \l~out f~~ts sonseI1~~g the spatial distribution of commercial phenomena. In order to do so the landuse associations and relationship which may ex\s~ hetw~e!1 ~qI!1~~rcial phenomenon and other phenomena have been studied. The number of comI?ercial units, their percentage and cumulative percentage is shown in Table 3. Figure 2 shows the patterns of commercial activity and their relationship and the change in commercial pattern which has occured.

Throughout the city there has been a noticeable population migration away from the city centre in recent years as part of general social develo.pment and in ~oJl~esqon wit" tpis t£~re !!~s occurred a commercial change which is noticeabJe i~ the lill~,!r pl:\tt~rn of commerce.

The complex array of-the urban business along arterial rGads have developed to serve the residents of the city so that retail transactions are completed outside the core to provide for the residents daily con~ sumption. Gommercial land use e.xtends for miles along arterial roads occupying most of the frontage. At fairly regular intervals in the new r~sidential ichemes, business centres have developed, whe~ea5 service

Table 2. Axial Roads of Lahore City.

Name of the Road	Total Length Surveyed in (KM)	Starting Point
1. Ferozcpur Road	30.59	Mozang Chungi
2. Multan Road	12.07	ChauburJi
3. Circular Road	7.24	Bhati Gate
4. Shahrah-e-Quaid-e Azam	8.05	Town Hall
5. Grand Trunk Road (East)	16.10	Aik Moria Bridge
6. Grand.Trunk Road (North)	18.51	Old Ravi Bridge
7. Shalimar Link & Canal	16.10	Shalimar

and convenient uses predominate along the arteries. The core provides goods for different segments of the urban market and also shows trends towards specialization, but is undergoing severe stress because of the many changes in Lahore's city life that have characterized the growth of the outlying arterial commercial structure. Consumers with medium and high standard of living favour shopping in the fringe leaving the lower purchasing power communities to the core. Thus the new residental schemes which are housing the medium and high income group population have created pressure points for commercial activities along major arteries besides the fairly evenly distributed commercial centres of the city providing for the daily requirements of the community.

Commercial functions appear to be enmeshed along network of roadways such as Ferozpur Road, Multan Road, Circular Road, Shalimar Link Road, Grand Trunk Road, and the Mall Road (Figur~ I). Detailed analysis of these arteries as far as they show any commercial feature presents a mixed commercial and residental structure. Usually the ground floor fronting the street is used as a shop ~ith residences occupying the back area. But it is only on Shahra-e-Quaid-e-Azam that commercial activity is confined to the ground floor and residential apartments are placed on the second and third floors. Commercial pattern is not only an index to spatial distribution of population but also of the income density, and the living status characteristics of the inhabitants. This pattern of arterial distribution is a recent phenomena and solves the problems created by the continued population increase thus reducing pressure on planned commercial centres.

The demographic distortion of Lahore's population into the outlying areas has been accompanied by a good deal of establishments of consumer oriented retail business. The growth patterns of retail commerce during the suburban sprawl is based on the analysis of the surveyed data gathered during 1975-81. The main shopping area of Lahore is the core or the peri-core, close to places where other major commercial operations are transacted. The establishment of commerce along arteries has taken away a great deal of commercial pressure trom the core. Retail and service facilities, formerly almost exclusively concentrated in the core and peri-core have decentralized by the "pull" of the

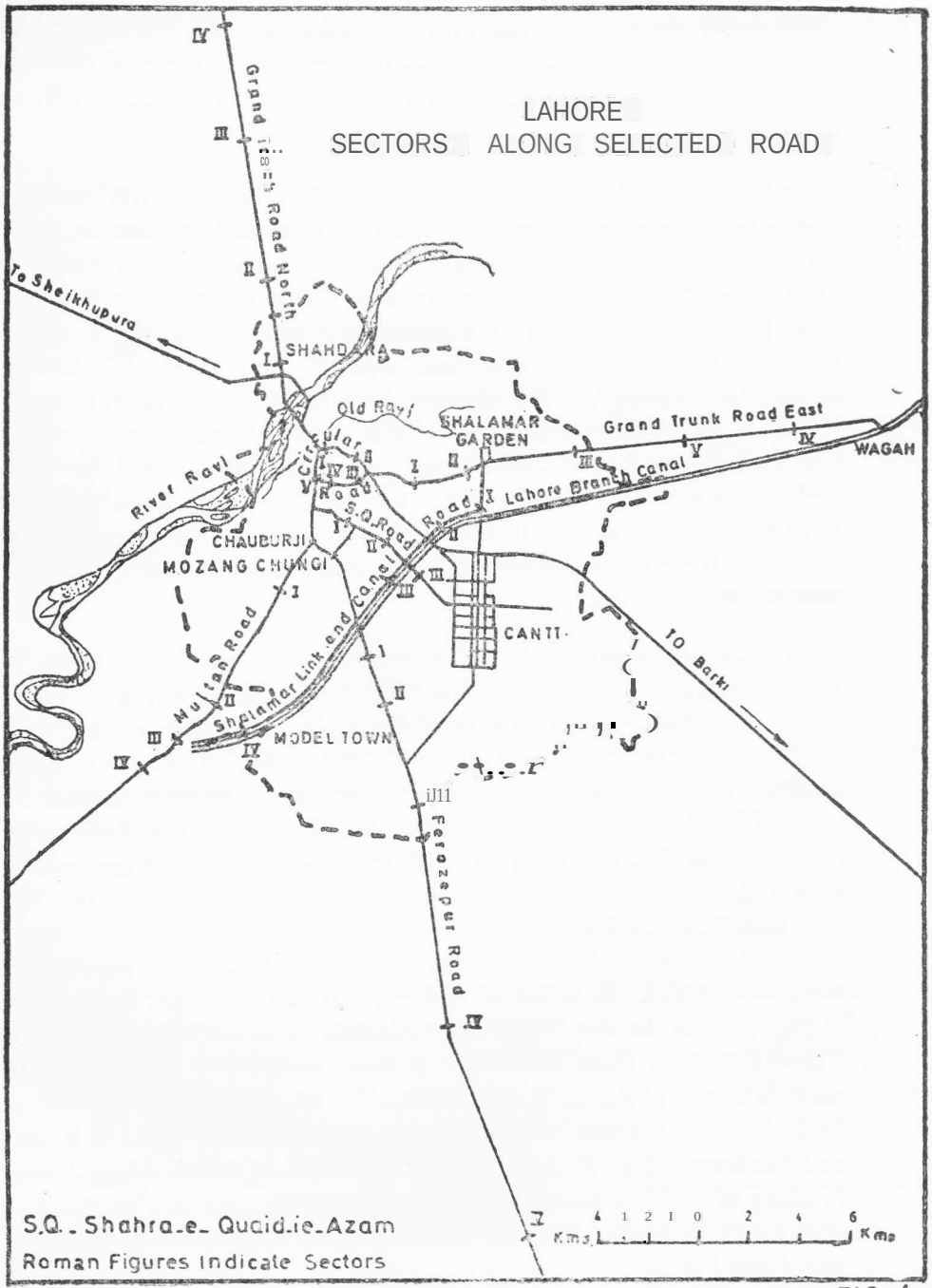

LAHORE
SECTORS ALONG SELECTED ROAD
Grand Trunk Road North
To Sheikhupura
SHAHDARA
Old Ravi
SHALAMAR GARDEN
Grand Trunk Road East
WAGAH
River Ravi
Circular Road
S.Q.Road
Lahore Branch Canal
CHAUBURJI
MOZANG CHUNGI
Multan Road
Shalamar Link Canal
CANTT.
To Barki
MODEL TOWN
Ferozepur Road
S.Q. - Shahra-e- Quaid-e-Azam
Roman Figures Indicate Sectors
4 1 2 1 0 2 4 6
Kms Kms

FIG -1

new residential growth of the urban fringe and by the "push" of the uneconomic core sites. An ever increasing demand for goods and services to all parts of the metropolitan city, particularly in the fringe area with no pre-existing retail facilities result in the linear pattern of commerce.

The commercial area acts as the cockpit for the overt economic demands. The curves (Figure 2) drawn from statistics present the various activities and their intensity with respect to distance. The Ferozepur, Multan and Grand Trunk Roads around which residential schemes are being implemented show the interdependence among commercial units for certain daily services that are close together thln those that exchange services less frequently. For example, meat shops have adjacent to them vegetable shops, grocery shops, and milk shops, Fresh food retailing is restricted to a market of comparatively shorter radius. Shops dealing in agricultural produce, though benditting by a central location, occupy large space and consequently are found only in the outer urban fringe. Thus interdependence necessitates proximity, and is dictated by the diverse uses and values of land.

As an organization of the interdependences the linear commercial pattern embraces a much wider area than the core zone. Another important feature which emerges on these arterial roads is that retailing and wholesaling on different roads have differential location. For example. greatest number of fodder stores occur on Ferozepur Road between seventh and thiqeenth miles, on circular road in the fourth *mile* and on Multan Road between I! to 6! miles, Grand Truuk Road has its entire concentration within 2! miles, Grand Trunk Road East between twelftth mile and Shalimar Link Road between I to 2 miles. The largest percentage of fodder stores occur on the out skirts of the city where the major production and consumption lies. Retailing of building material is greatest in the sectors in proximity to the area where new residential *units* are being constructed. Thus Ferozepur Road shows the greatest number of building material units in Sector **I,** Multan Road in Sector **If,** Grand Trunk Road North in Sector **I,** Grand Trunk Road East in Sector **II,** Circular Road in Sector II and Shalimar Link Road in Sector I. Shahra-e-Quaid-e-Azam shows no retailing of building material because it is a commercial and administrative area where residential schem<1S are not being implerrented (Table 2, 3 and 4 and Fig. 2).

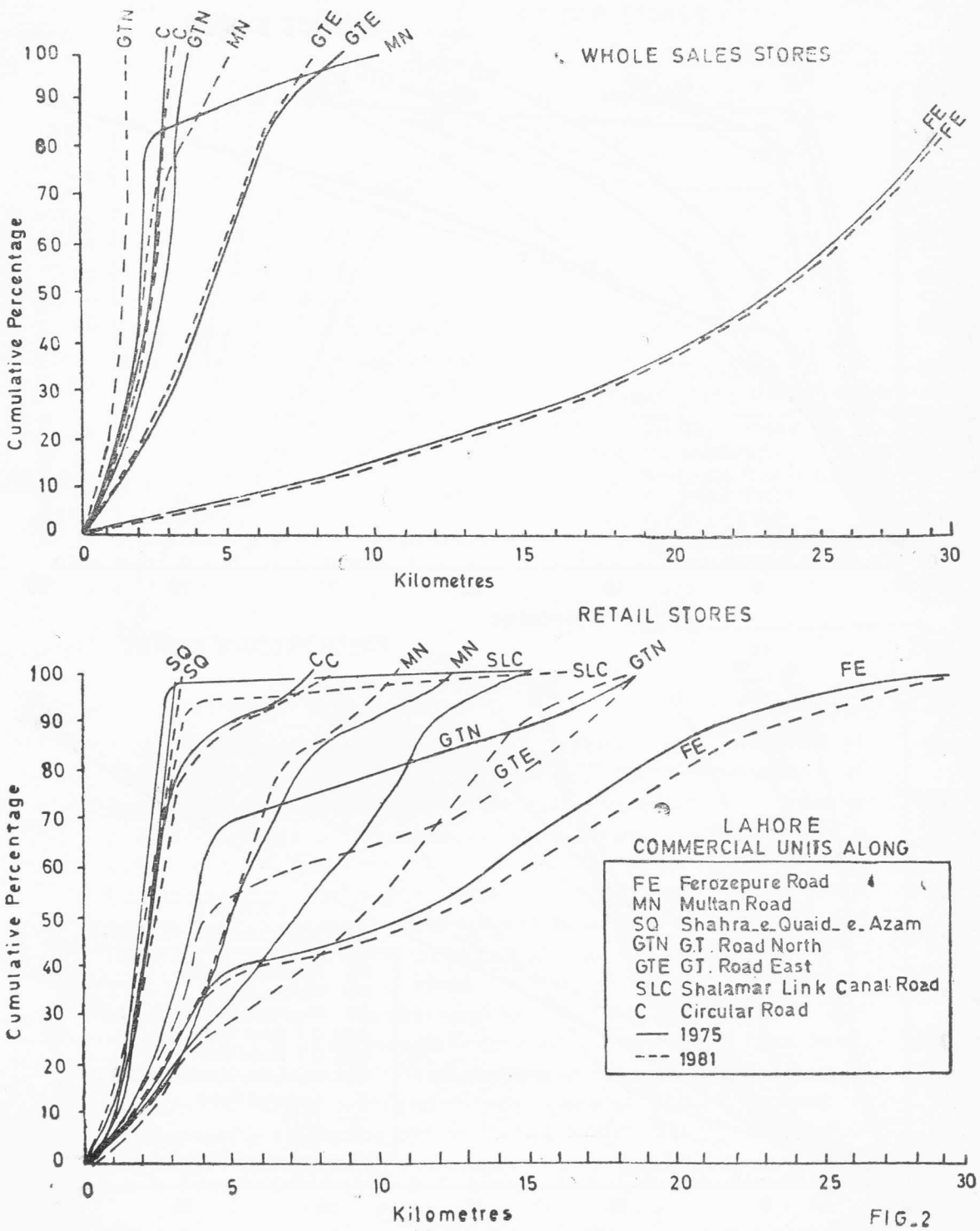
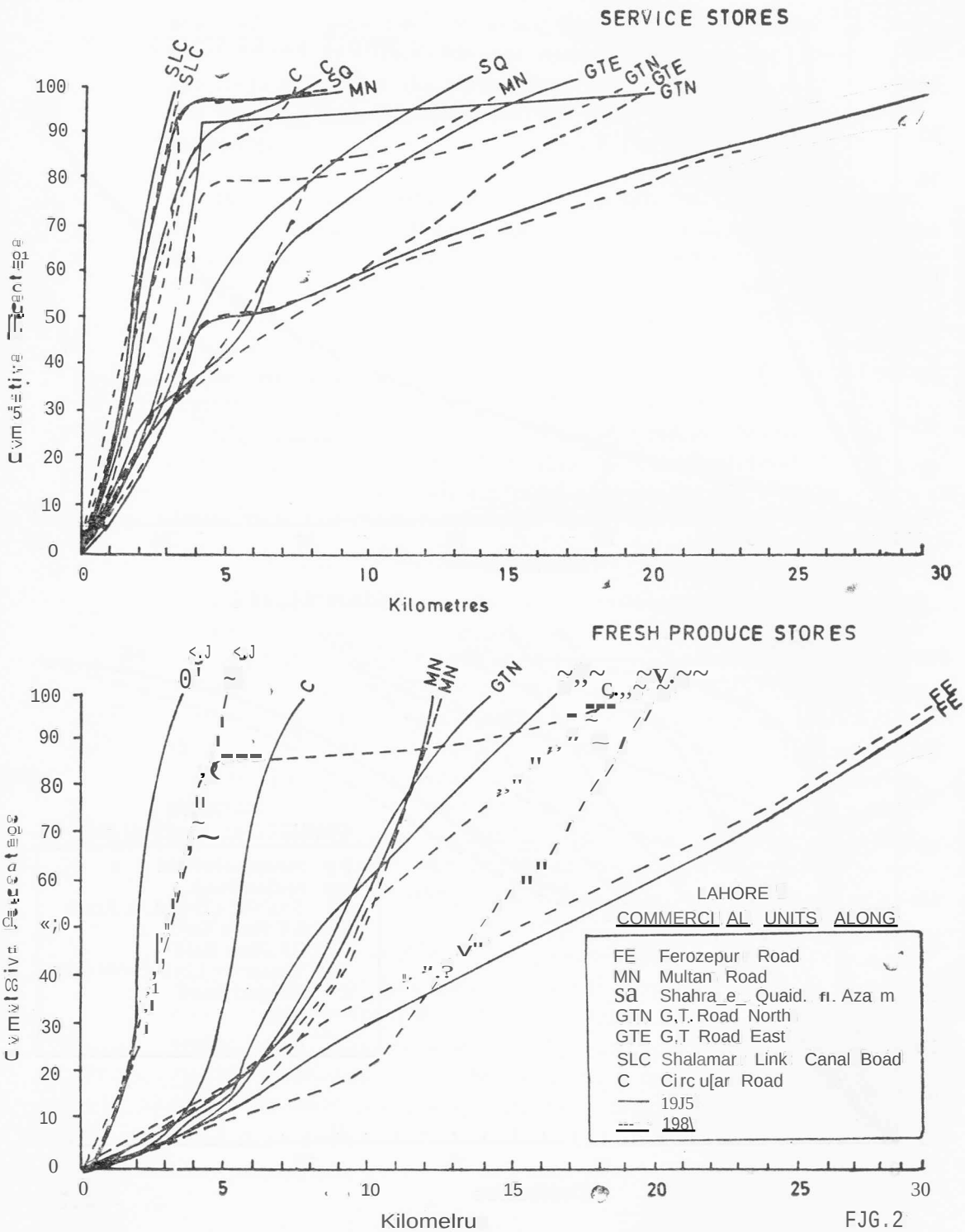

WHOLE SALES STORES
Cumulative Percentage
Kilometres
GTN
C
GTE
MN
FE
RETAIL STORES
SQ
CC
SLC
LAHORE
COMMERCIAL UNITS ALONG
FE Ferozepure Road
MN Multan Road
SQ Shahra_e_Quaid_e_Azam
GTN G.T. Road North
GTE GT. Road East
SLC Shalamar Link Canal Road
C Circular Road
1975
1981

FIG_2


SERVICE STORES
SLC
C
SQ
MN
GTE
GTN
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
Kilometres
FRESH PRODUCE STORES
C
MN
GTN
LAHORE
COMMERCI AL UNITS ALONG
FE Ferozepur Road
MN Multan Road
Sa Shahra_e_ Quaid. fl. Aza m
GTN G,T. Road North
GTE G,T Road East
SLC Shalamar Link Canal Boad
C Ci rc u[ar Road
19J5
198\
0
5
10
15
20
25
30
Kilomelru

FJG.2

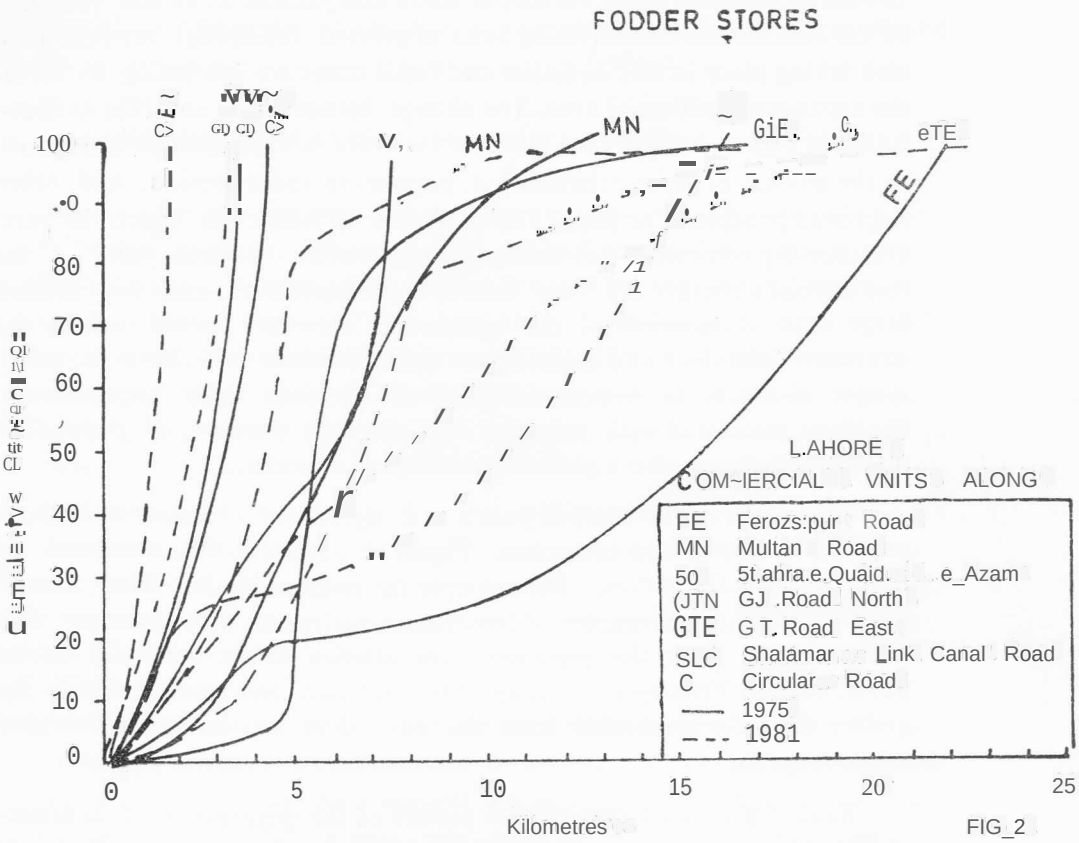


FIG_2

Cumulative curVes (Figure 2) portray graphically the distribution of economic services along arteries and show that the interdependence of distance and activities upon land are mutually opposed and also mutually determining influences. Thus although the core exercises influence over a wide hinterland it is nevertheless the centre of a rather restricted fringe. This may be seen in the gradient of the cumulative curves and the sharp decline of urban commerce at a distance of three to four miles reflecting the effects of urbanization on the pattern of commerce in 1975 and 1981.. Fig. 2. Truck is the usual means of transportation if distances are large or the volume is large, but small loads of fresh produce from farm lands outside Lahore are brought to the market in everything from hand, horse to bullock-carts, etc. Transportation and communications make it accessible to various areas and to other parts of Lahore assuming its development as a collecting and distributing centre. The intensification of

industrial activities along Ferozepur Road and Multan Road has reinforced the commercial and servicing roles as greatest residential expansion is also taking place in this direction and retail stores are increasing to serve the expanding residential area. The change, between 1975 and 1981 as illustrated in Figure 2 reveals the fact that there are radical changes going on in the context of rapid urbanization, population redistribution, and other improved prospects for social and economic development which in turn are affecting commerce distribution along arteries. Several parts of the commercial structure are very heavily interdependent, and any sudden large scale dislocation of the comme~cial structure would effect the consumer behaviour and in doing so the consumers will have to trave longer distances to commercial markets for their daily requirements. Problems associated with excessive and growing pressure of population upon commerce is also a particular ecological concern.

The results of the analysis points to a significant correlation between population density and commerce. Figure 2 supports this statement as represented by the curves. For example the retail units are more numerous on or at the convergence of important arteries and they decrease with distance away from the peri-core. On arteries where industrial estates occur, such as Ferozepur Road and Multan Road commerce extends for greater distances southward from the core than on the other surveyed roads (Fig. 2).

Table 5 presents a comparative pictur;) of the percentage of commercial activity on various roads in 1975 and 1981, Ferozepur road shows increase in all types of commerce. Multan Road shows decrease in wholesale from 7.6 percent in 1975 to 9.09 perccnt in 1911, retail from 23.45 percent in 1975 to19.32 percent in 1981 and fodd er from 37.00 percent in 1975 to 31.74 percent in 1981, because in some portions new industrial establishments and new residential schemes have taken away a small percentage of these activities from the arteries. Similar is the case for wholesale.of Grand Trunk Road North which has decreased from 13.46 percent in 1975 to 12.12 percent in 1981, Fresh produce of Grand Trunk Road East has decreased from 31.35 percent to 21.15 percent.. Shahra-e-Quaid-e·Azam has no wholesale of fresh produce and fodder commerce and the decreased percentage of retail and service stores is due to the establishment of offices and banks. The circular road shows decrease in wholesale market to avoid traffic congestion in the city centre. The Shalimar Link Road also shows decrease in retail and service activities

(Table 4). The 1975-81 commercial change is related to rising population pressure and the provision of marketing and distributional facilities. The interpretation of the findings implies that there is commercial change going on along the arteries and the differences in growth rates have a spatial basis.

The tables and curves provide a useful visual impression of the main difference between the data collected in 1975 and 1981, and helps to focus attention on the major changes which have occured. Linear commercial movement into the fringe is still going on and will continue. This trend dominates the city's commercial pattern because of socioeconomic factors. Most importantly there is a close spatial relationship between the city's system of communications and the specific locations of commerce. Although most commerce in the urban rural fringe is physically set apart from nuclei of population as in the south of Multan Road and Ferozepur Road where they are spatially linked and made accessible to dispersed units of occupance by a network of roads, tracks and footpaths.

There is at present considerable change taking place in the commercial structure of the urbanized sector. In the most populated communes the city contains the more usual urban commercial functions; as in Figure 2 commerce is highly concentrated in the first five to six miles from the city centre.

Conclusion

The findings of the present research conclude that the consistently high correlation between population density and commerce implies a high level of stability in the pattern, and the adjustment of the rates of population growth to the commercial patterns (which are based on 1975 and 1981 records) is interpreted as an expression of spatial distribution. It can be seen that until 1961 the impact of the arterial commercial distribution was hardly noticeable. Only between 1961 and 1961 was there a pronounced shift in the distribution of commerce.

In the early years of independence the distribution of population did not follow the same pattern that it is following today. Formerly it concentrated in and around the walled city and the commercial markets which were in the walled city and around it in the Anarkali shopping centre and the Mall Road shopping centre catering for the needs of the dwellers. But the explosion of population and its movement away from

the congested area, has resulted in the introduction of this new *type* of commercial development along major transportation routes.

The tendency for commercial units to compete with the markets for attracting consumers continues and is expected to accelerate owing to the growing demand. It remains to be seen whether the future population trend will precipitate commercial markets along arterial roads or will it follow a different trend. The 1981 figures (Table 2) add further weight to the conclusion that population pressure resulted as a primary outlet for commerce in becoming concentrated along arterial roads. It is quite clear from what has already been stated that commerce has undergone significant changes in the past thirty-five years.

References **and** Notes

1. See Mushtaq M., 1968, "The Pattern of Retail and Wholesale Trade in Lahore", *Pak. Geog. Rev.* Vol. 23, 1, pp. 37-53.

2. The data for 1975 is derived from Chapter 5 of the author's Ph. d. theses titled "The Urban Fringe of Lahore City: A Functional Study", Department of Geography, University of the Punjab, Lahore.

Table 3. Table showing Number of Commercial Units, Percentage of Commercial Units and Cumulative Percentage of Commercial Units Along Principal Arteries, 1975.

Wholesale

Name of Road	Fcrozepur Road					Multan Road				Grand Trunk Road North				Grand Trunk Road East				
Seclor	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5
Miles	21-	11-	3	6	6	It	31	1!	1	21	2	4	3	Ii	It	3	3	3
No. of Units					3	4		1		7						5	I	
% of Total Units					100	80		20		100						83.33	16.66	
Cumulative %					100	80		100								83	100	

Retail

No. of Units	84	3	18	82	23	30	139	15	15	48	5	8	12	18	7	22	30	11
% of Total Units	40	1.43	8.57	39.05	10.95	15.07	69.85	7.54	7.54	65.75	6.85	10.96	16.45	20.45	7.95	25	34.09	12.50
Cumula..dve %	40	41	50	89	100	15	85	92	100	66	73	84	100	20	28	53	87	100

Service Shops

No.orUnin	98	1	26	39	24	59	125	19	13	17			1	47	21	30	33	21
% ofTotai Units	51.85	1.05	13.70	20.63	12.69	27.31	57.87	8.79	6.02	94.49			5.55	30.92	13.81	19.74	21.71	13.81
Cumulative %	52	53	67	b7	100	27	85	94	100	94			100	31	45	65	87	100

Fresh Produce

No. of Units	18	19	32	50	68	18	88	90	98	1	4	11		22	25	76	87	91
%oftotal Units	9.63	10.16	17.11	26.75	36.36	6.12	29.93	30.68	33.33	6.25	25.00	68.70		7.31	8.20	25.24	28.90	30.23
Cumu lative %	10	20	37	64	100	6	36	67	100	6	31	100		7	15	40	69	100

Fodder

No. of Units	2		1	6		2	28	6	1	3				3	28	6	1	
% of Total Units	22.22		11.11	66.66		5.40	76.67	16.21	2.7	100				7.89	73.63	15.78	2.63	
Cumulative %	22	33	100			5	81	97	100	100				8	81	97	100	

Continued

Wholesale

Name of Road	Mall Road			Circular Road					Shalimar Link Road and Canal Road			
Sector	1	2	3	1	2	3	4	5	1	2	3	4
Miles	1	1	3	1	1	1	1	1	1	1	2	6
No. of Units					31							
% of Total Units					100							
Cumulativo %					100							

Retail

No. of Units	.15	<46		40	68	11	8	7	13	27		I
% of Total Units	24.59	75.41		29.85	50.75	8.21	5.97	5.22	31.71	65.8'		2.44
Cumulative %	25	100		30	81	89	95	100	32	98		100

Service Shop

No. of Units	14	46	1	27	42	8	I	4	40	47		
% of Total Units	23.70	74.54	1,06	32.92	51.21	9.75	1.2	14.8	45.97	54.02		
Cumulative %	24	98	100	33	84	9~	95	100	46	100		

Fresh Produce

No.ofUnih				1	8	64		68	4	17		
% of Total Units				1,7	15.67	39.39		48.22	19.04	80.95		
Cumulative %				11	17	52		100	19	100		

Fodder

No. of Unit.				I	2	3		3		3		
% of Total Units				10	20	30		40		100		
Cumulative %				10	30	60		00		100		

Table 4. Showing Number of Con;rnercial Units Percentage of Commsrcial Units and Cumulative Percentage of Cumulative Units Along Principal Arteries, 1981.

Wholesale

Name of Road	ferozepur Road					Multan Road					Grand Trunk Road					G.T.B				
Sector	·	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Miles	11	It	3	6	6	Ji	31	11	1		2t	2	4	3		11	13	3	3	1
No. of Units					JO	6		3			12							10	4	2
% of Total Units					109	67		33			100							62.52	25.00	12.50
Cumulative %					JOO	67		100			100							62.50	87.50	

Retail

No. of Units	150	2S	48	148	63	40	200	30	98	15	24	48	72	28	118	100	44			
% of Total Units	34.~6	5.76	J1.05	34.10	J4,51	J3.33	66.66	10.00	52.97	8.10	12.97	25.94	20.51	7.95	25.00	34.09	12.50			
Cumulative %	34.56	40.32	51,37	85.47	99.98	13.33	79.99	89.99	52.97	61.07	74.04	99.99	:L0.51	28.46	53.46	87.55	100			

Service Shops

No. of Units	120		4	30	49	35	70	163	25	17	25		6		53	28	40	45	30	
% of Total Units	!~0.42	1.68	J2.(O	20.~8		J4.70	25.45	59.27	9.09	6.18	80.64		19.35	27.04	14.28		20.40	22.95	15.30	
Cumulative %	50.42	52.JO	<54./0	f 5.28		99.99	25.45	84.72	93.91	99.99	80.64		99.99	27.04	41.32		61.72	84.67	99.97	

Fresh Produce

No. of Units	29		25	38	60	75	25	98	100	110	98	1	4	11		22	25	86	97	
% of Total Units	12.77	11.01	16.74	26.43		33.3	7.50	29.42	30.03	33.03	85.96	0.87	350	9.64	9.56		10.86	37.39	42.17	
Cumulat!ve~%	]2.77	23.78	≤:0.52	t:6.95		S9.£8	7.~0	36.92	66.95	99.98	85.96	86.80	90.33	99.97	9.56		20.42	57.81	99.98	

Fodder

No. of Units	4			3	9	3	30	6	1		4					4	30	8	2	
% of Total Units	25.00		18.75	56.25		7.50	75.00	15.00	2.50		100					9.09	68.J8	18.18	4.54	
Cumulative %	25.03		43.75	100.00		7.50	82.50	97.50	100.00		100					9.09	77.27	95.45	99.99	

Continued

Wholesale

Name of Road				Mall Road					Circular Road				Shaiimar Link & Canal Road			
Sector	1	Z	3	1	2	3	4	5	1	2	3	4				
Miies	1	i	3	1	1	1	1	%	1	1	2	6				
No. of Units					52											
% of total					100											
Cumulative					100											

Retail

No. of Units	16	50	50	78	15	10	9	15	3~		3	
% of Total Units	24.24	75.75	30.86	48.14	9;25	6.17	5.55	28.30	66.03		5.66	
Cnmulative %	24.24	99.99	30.86	79.00	88.25	94.42	99.97	28.30	94.33		99.99	

Service Shops

No. of Units	14	16	1	30	52	10	3	8	51	49
% of Total Units	45.16	51.61	3.22	29.12	50.48	9.70	2.91	7.76	51,00	49.00
Cumulative %	45.16	96.77	99.99	29.12	79.60	89.30	92.21	99.97	51,00	100.00

Fresh Produce

No. of Units	3	12	69	72	6	21		
% of Total Unils	1,92	7.69	44.23	46.15	22.22	77,77		
CNmulative %	1,92	9.61	53.84	99.99	22.22	99.99		

Fodder

No. of Units	2	5	6	5	4			
% of Total Units	11,11	2777	33.33	27.77	100			
Cumulative ~	H.ll	38.88	72.21	99.98	100			

Table 5. Total Percentage of Commercial Activity on Various Roads

	Ferozepur Road		Multan Road		GTN		GTNE		Mall		Circular		Shalimar	
	1975	1982	1975	1981	1975	1981	1975	1981	1975	1981	1975	1981	1975	1981
Wholesale	5.76	10,10	9.6	9.09	13.46	12,12	11,54	16.16			59.61	52.52		
Retail	24.56	27.96	23,45	19.32	8.96	11.92	11.28	22.68	8.07	4.25	8,36	10,43	5.31	4,41
Service	23.54	24,43	26.90	28.23	2.24	3,18	18.93	20.12	7.35	3.18	0.21	10.57	10.83	10.26
Fresh Produce	19.47	20.60	30,62	30,63	1,66	]0,48	31,35	21,15			]4.68	14.35	2.18	2,48
Fodder	9.00	12.69	:)7.00	31,74	3.CO	3.17	38.00	34.92			10.00	14.28	3.00	3.17

IMPORTANCE OF POPULATION CENSUS IN POPULA TIOX GROWTH AND POPULATION PROJECTION

AMIR KHAN

Introduction

Since the independance of Pakistan four censuses have been carried out; in 1951,1961,1972 and 1981 respectively. Prior to this, censuses were held in Pakistan as a part of India from as early as 1867-1872. So far twelve census have taken place. An important aspect of these population censuses is that they provide vital satistics on population growth, structure and composition. This data helps in assessing not only the past population trend but also in projecting future population. Almost all of the population projection models are based on calibration of past data, therefore, the role of census in po.pulation growth and projection can hardly be over emphasised.

Population Growth and Projection

Growth of population in our country can be divided into three phases.

(1) farly phase
(2) Pre-pariition phase.
(3) Post partition phase.

(1) *Early Phase.* The area now called Pakistan was thriving with life, even thousands of years back. As -indicated by historical accounts and archaeological excavation, five thousand years back a highly civilized community flourished in Indus Valley with small and large urban centres for example Harappa and Taxila in Punjab, Mohenjo-Daro in Sind, Sanghao Khanpur, Gandhara, Rehman Dheri and Lewan in North-West Frontier Province.

-Mr. Amir Khan is Lecturer, Department of Geography, University of Peshawar.

(2) Pre-Partition. The population census in India started in the middle of ninteenth ceRtury, however the data is av~ilable only since 1901. (S~e Tuble 1)~ In Pakistan the gro~th oCpOp~lation since

Table 1. Pre-Partition Pakistan Population Growth 1901—1941

Census Year	Population	Variation		Percent Annual growth rate
		Number	Prevent	
1901	16,576,000	—	—	—
1911	19,382,000	2,806,000	16.9	1,5
1921	21,109,000	1,727,000	8.9	0.8
1931	23,542,000	2,433,000	11,6	1,1
1941	28,282,000	4,740,000	20.1	1,9

(Figures include special aad added areas under Deputy Commissioners and Agencies).

Source: *Census of Pakistan Vol.* 3, *West Pakistan Population, 1961.* Ministry of Home and Kashmir Affairs, Government of Pakistan.

1901 shows a gradual and continuous increase. In the year 1901 the total enumerated population was 16,576,000 and it rose to 19,382,000 by)911.. During the intercensual period of 1901-1911 the decennial population increase was 16.9 percent with a compound annual growth rate of 1.6 percent.. (including frontier regions). The next decade 1921 recorded the total population of 21,109,000 with lowest decennial increase: of 8.9 percent, showing a compound annual growth rate of 0.8 percent. The decrease in growth mainly resulted due to high mortality rate becau~e of malaria and influenza epedemic; and casualties during first world war. In the next dacade, that is 1931, the population rose to 23,542,000 showing a higher decennial increase of 11.5 percent with 1.1 percent annual growthrate. The d~cade 1941 recorded a population of 28,282,000. The decennial population increase during this period waS 20.1 percent with 1.9 percent annual growth rate. This increase was chiefly because of imrovement in health facilities as well as wrong reporting for political motives from both the communities of Hindus and Muslims to gain more seats in the legislature on communal basis.

(3) Post Partition Phase. Since independence four censuses of population were conducted. The census year 1951 recorded a total population of 33, 740, 000 showing an annual growth rate of 1.8 percent. . (See Table 2. The annual growth rate incr~as~d to 2.4 percent by the

Table 2. Post-Partition Pakistan Population Growth, 1951—1972

Census	Population	Variation		Percent annual growth rate
		Number	Percent	
1951	33,740,000	5,458,000	19.3	1,8
1961	42,880,000	9,140,000	27.1	2,4
1972	65,309,000	22,429,000	52.3	3.6
1981	83,782,000	18,473,000	28.3	3.0

(Figures include special and added areas under Deputy Commissioners and Agencies).

Sources :-(1) *Censns of Pakistan Vol.* 3, *West Pakistan Population 1961,* Ministry of Home and Kashmir Affairs, Government of Pakistan.

(2) CeflSUS of Pakistan, 1972, Census Organization, Ministry Interior, State and Frontier Region, Islamabad.

(3) Housing and Population Census of Pakistan, 1980-81, Bulletin No. 1. Population Census Organization, Islamabad.

census year 1961.. The census of 1972 showed a much higher and sharper increase, recoTding a total population of 65,309,000 with annual growth rate of 3.6 percellt. This was attributed to a continuous high rate of natural increase resulting from accelerated fertility and better facilities of health which increased the life expectency from 27 years in 1947 tOI 3:0 years in 1972.

Coming to the situation of 1972-81 period the population of the country has increased by 18,473,000 persons or 28.3 percent with an annual growth rate of 3.0 percent which shoWs a declining trend.

This because of decline in fertility rate with rising standard of living as well as migration of the working labour force abroad for the search of better jobs opporunities. Still a growth rate of 3. 0 percent is too high when compared with the world which is I. 8 percent.. If the population projection is made on the basis of 1972-81 growth rate i.e. 3.0 percent at a constant factor, the population of the country will be 109,066,000 in 1990 and 146, 204, 000 by the year 2000 (See Table 3). When the population increases rapidly the proportion of young

Table 3. Population Projection of Pakistan 1990 and 2000

Year	1961	1972	1981	1990	2000
~oPula-tl0n	142,810,000	\65,309,000	83,782,000	109,066,000	[146,204,000

Population Projection is made on the basis of 1972 and 1981 population growth.

people and old people and of people in the ages inbetween begin to alter, some times quite radically. The usual effect is to increase the number of young and old more than those inbetween. Thus each working age person has to support more dependents.

In 1972 in our country as a whole, childern below 15 years constituted about 43. 8 percent of the total population. The working age population (15-64 years) formed about 52.0 percent of the total population. This age group (15-64 years) will have to support the 43. 8 percent youngsters and 4.2 percent very old (65 and above years) people. Thus the dependency ratio in 1972 was very high. (See Table 4). The age structure changes caused by rapid population growth has two undesirable consequences for development purposes. Firstly, the number of young people becoming parents **in** much greater than the number of parents leaving the child bearing years. This population dynamic once begun continues for a long time even if fertility falls. The women in the child bear-

Table. Pakistan Age Structure of Population, 1972

Age group	Population	Percentage share
0-14	27,380,153	43.8
15-64	32,491,353	52.0
65 and above	2,590,377	4.2
Total	62,461,883*	100.0

*(Excluding the population of FAT A, Kohistan Area of Hazara Division and PAT A adjoining Hazara Di vision).

Source :-*Census of Pakistan* 1972 Census Organization, Ministry of Interior, State Frontier Region, Islamabad.

ing years (aged 15-49) in our country were 12, 735, 000 in 1972, by the end of the century they will total 34,574,000, all of them potential mothers. This big increase in numbers will increase pressure on the meagre resources thus making the task of development increasingly difficult. Secondly more childern mean more education, if they are to be epuipped to work and earn a good living. In our country the number of school-age children (5-19) has been rising fast.. In 1972 their number was 23, 210, 000 and at present there are approximately 31,183,000

Children of School going ages because of the present Government there has been considerable expansion in educational facilities but still the progress made has not made been sufficient to cope with this increase. Current enrollment ratios in most parts of our country is still very low. It is expected that by the end of this century about 63, 257, 000 will have been added to the number of school-age children.

Demand for education has been expanding and will continue to expand owing to rising social aspirations. Furthermore, provision of education opportunities is regarded as one of the effective instruments for removing privileges and class barriers. This issue has become more

complicated in the context of increasing unemployment, particularly educated unemployment. . Not only has educational development to be closely linked with employment but also changes in technology and techniques of production call for a reorientaton of the educational system to suit the requirements of development. . It is difficult to save and invest enough from th~ m3agr~ an1.ual income for economic development at a satisfactory paceeven in the ab3enc~ of rapid population growth, and prevailing high rates of population growth tend to increase current consumption, resulting in a smaller volum~ of investment which means in turn a smaller increase in national income. Population growth also warps investment by increasing the gap between demand and supply. Every year capital has to;be diverted to supplying food, clothing, health, housing and other welfare measures, and little is left for the future developmental needs. This competition for resources has become severe. If populat!on is rising fast then so is the labour force. Falling death rates mean longer lives, so more people stay in the labour force longer. High fertility is the cause of young persons entering the labour force every year.. This increase in labour force, however. is not paralleled by an equally high rate of growth in employment opportunities.

The inability of creating sufficient number of jobs has resulted in open unemployment in both rural and urban areas. This will resnlt in a number of problems. The expansion of the rural work force will further increase the pressure on arable land and complicate the problem of unemployment. . The result. will be further fragmentation and reduced economic size of land holdings and fall in marginal productivity of the worker. This heavy pressure exerted by the swelling of the rural population will continue to be the main cause of the mass exodus of rural population to urban areas. Apart from adding to the already severe problem of urban unemployment, the flight of the young and able-bodies away from rural areas leaves behind only the relatively less productive older and younger persons in the rural areas, thus adversely effecting productivity of the farm sector.. Because of this high growth of population there may be the shortage of food. Although our country is trying to become selfsufficient in food grains but if the population growth is not checked then it will be difficult. to meet the food requirements.

Conclusions

The past trend of population growth in Pakistan shows a very high growth which has nullified much of the developmental efforts consequently resulting in several socio-economic problems. It is suggested that the following steps should be taken for solving the problem:

1. Stress may be given on the control of the rapid growth of population on the one hand and increasing the rate of economic growth on the other..
2. Adaptation of methods of fertility regulation.
3. Steps to interrelate fertility and development.
4. Promotion of literacy.

References

1. Kingsley Davis, *The Population uf India and Pakistan, 1951*, Princeton University Press.

2. Rafat Rizvi, Jamila Choudhary, 1979. "Some Aspect of Population Mobility in Pakistan", M.Sc. dissertation, Department of Geography, Univeriity of Peshawar.

POPULATION STUDIES IN GEOGRAPHY : A REVIEW

NASREEN. A. KHAN*

Introduction

The systematic study of population is a comparatively recent phenomenon in geography. Nevertheless, the history of growth of the field goes back to the days of Greek and Hellenistic science. Three chief periods can be identified in the development of population geography since that time. The first of these extended for mOre than a thousand years up to the second half of the nineteenth century, This was the phase during which elementary ideas were formulated in the field. Geographic writings on population in this period were mainly concerned with 'earth' as the abode of man rather than 'man' as the inhabitant of earth-in other words the focus of primary attention was 'earth' and not 'man'. The second period began in the latter part of the nineteenth century with the works of Carl Ritter (1779-1859) and Friedrich Ratzel (1844-1904). Acdording to Dickinson,! Ritter placed man as the focus of geographical study. This new 'anthropocentric orientation' in geography had a profound effect on the rapid growth of basic concepts in the field. The seed of German innovation spread rapidly to other countries-notably France, U.K. U.S.A., and U.S.S.R. With growing interest in human geography, the number of publications on population and associated phenomena also multiplied. While credit must be given to German anj French geographers for giving an anthropocentric orientation to geography, the most important scholar to elevate population geography to a prominent position among various branches of geography has undisputedly been Glenn T. Trewartha. His presidential address to the Association of American Geographers in 1953 is linked with the dawn of the contemporary period in the field.[2] It evoked fresh interest of geographers in the study of man as an area-characterising and area-differentiating element and led to the recognition of population geography as a distinct topical speciality.

*Nasreen A. Khan is Lecturer, Frontier College for Women, Peshawar.

First Phase: Elementary ideas in the field of population geography can be traced back in the writings of Greek scholars. Like all innovative people, the Greeks were great borrowers and part of what they put together in logical and useful order also came from much older civilizations with which they were in contact, including Egypt, Sumeria, Babylonia, Assyria and Phoenecia. The Greek scholars provided a framework of concepts and models, or paradigm of scholarly methods that guided western thinking for many centuries.3 Greek contributions within the field of population studies can be described under the following headings:

(i) Gazetteer type work on particular areas, including a description of their population.

(ii) Traveller accounts of places and characteristics of their population.

(iii) The concept of varying habitability of the world-identification of habitable (Ekumene) and uninhabitable world.

(iv) Doctrine of environmental determinism- influence of environment on man.

Among the first type were the work of Hecataeus (550-475 B.C.) and Strabo (64 B.C. - 20 A.D.), The former was the first writer of Greek prose who used Europe, Asia and Libya as regional divisions for his world geography.4 The latter wrote several books for the use of Roman administrators. The major part of his work is devoted to detailed descriptions of the various parts of the known world. He devoted eight books to Europe, six to Asia and one to the then known Africa. After dealing with Egypt and Ethiopia in his last book he went on, "Now let me describe Libya, which is the only part left for the completion of my geography as a whole."5

The second type of works are exemplified by those of Herodotus and Pytheas. The contributions of Herodotus (484-424 B.C.) were based on his own personal observations during extensive travels, which look him to the Russian steppes, the Persian Empire and Egypt. pytheas (d. 28.5 B.C) was the explorer of Great Britain and the coast of western Europe.

The concept of varying habitability of the world was postulated by Aristotle (384-322 B.C.). His notion of habitability was a function of latitude. The Ekumene, the inhabited part of the world according to Aristotle was in the temperate zone but much of it was not inhabited because of the ocean. Other contributors towards this concept included Eratosthenes {273-139 B.C.) and Posidonius (135-50 B.C.).

The Greeks also introduced the concept of environmental determinism by their assumption that people living near the equator had turned black because of exposure to intense heat.. Such statements as. "Warmer climates breed softer people," by Aristotl~ clearly show strong determinist thinking.

Unlike the Greeks, the Romans produced little that was new in the field. However, shortly before the time of Christ one Marcus Terentius Varro (116-27 B.C.) set forth a theory of cultural stages that remained almost unchallenged until the nineteenth century. He described man's culture as progressing through a regular sequence. According to him, man passes through a primitive stage to pastoral nomadism then through an agricultural stage and finally to the stage of contemporary culture.[6] (Glacken, 1956, pp. 72-73). Varro's stages were generally accepted until the 19th century when Alexander von Humboldt (1769-1859) pointed out that there had been no pastoral stage in the Americas and that the theory of stages cannot be applied everywhere. In addition to this concept there were other compendia of descriptive writing by Romans on Greek traditions (Mela. writing in 43 A.D, produced such a work).

During the fifth century after Christ the Roman world with its system of centralized administration fell apart.. For Greeks the geographic horizons (the limits of the area that was known at least to merchants and scholars) had been extended from the Indus River to the Atlantic and from the Russian stepp~s north of the Black Sea to Ethiopia. For the Romans the geographic horizons included the vast area brought under their jurisdiction. But now geographic horizons closed in again until many of those who lived in Christian Europe after the fifth century were really familiar only with their immediate surroundings. The world beyond was peopled with fantastic creatures conjured up by imaginations unfettered by facts.? Little by little curiosity concerning the other

possible worlds that might lie beyound the horizon again prompted some adventuresome people to travel and explore, and the Crusades took many people out of their localities who came back to teU of the strange people and landscapes they had seen. From the thirteenth century on there were extended travels by explorers, missionaries and merchants who reached all the way to China. The most celebrated of these was Marco Polo whose travel accounts contained a wealth of information on places and their people.

The primary efforts of early medieval scholars in Europe was to reconcile geographic ideas recorded in the documents with the scriptures. The documents used were in Latin and it was only in the later period that Greek material reached Europe through Arabic sources. For example, the geographical ideas of Aristotle were first made available in the twelfth century. The first medieval writer to make use of Aristotle was Albertus Magnus[8] whose book on the nature of places anticipated the ideas on environmental determinism. The Greek theory of equating habitability with latitude became strongly implanted in the medieval writings. Albertus even went beyond the Greeks, from them he aceepted the idea that people who lived too close to the limits of the habitable earth turned black, but then he insisted that if black skinned people should move into the temperate latitude they would gradually turn white.

One of the events of far reaching importance in the medieval period was the spread of Islam. The Muslim scholars made the important contribution of translating Greek material, which was ultimately used by the west. Muslims contribution to population field however remained limited to travel accounts (especially that of 11>nBatuta) and environmentalism. The most important work on the latter aspect was that of Ibn Khaldun whose well known work, *'Muqaddimah'* begins with a discussion on man's phyiical environment and its influence and distinguishes man's characteristics that are related to his culture or way of living rather than to the environment.

It may be mentioned that the medieval period also saw contribution iu the field of population by the Chinese. Their studies were of four kinds: (a) human geography (b) description of population and other characteristics of regions within China (c) accounts of travel mentionIng

different kinds of people, and (d) description of foreign countries including their population.

In spite of these contributions in the medieval period, (5th-15th century) the geographic knowledge gained by one group was diffused only slowly to others. Howevcr, in the late 15th and 16th centuries geographical ideas in Europe were transformed very rapidly as a result of voyages of discovery, consequently there was a great increase in information. The first compendium of geography published after the early voyages of discovery was, 'Cosmographia universalis' (1544) by a German, Sebastian Munster.. This has six volumes and in the first of these the author adds a discussion on the dispersal of mankind over the earth after the flood. The other volumes describe land and people in different regions of the world. Among the general geographies of the time which contained references on population were the works of Bodin (1529-96), Cluverious (1580-1626), and Varenius (1622-1650)

The middle of the seventeenth century also saw the first efforts towards a scientific study of population. In 1662 William Petty and John Graunt suggested the kinds of statistical studies that could be made if adequate data were available. Graunt showed that certain statistical regularities made prediction of births and deaths possible on the basis of probability. Petty blazed new paths in the study of population and economy even where statistical data were lacking.[10] In another contemporary work the first mortality rates were calculated for 1687-91 for the city of Breslau by Edmund Halley.[11] These pioneer studirs led a German scholar, Sussmilch, to demonstrate for the first time the existence of statistical regularities in pJpulatioll data. He observed that sex ratio tended to remain more or less balanced and birth and death rates could be forecasted. These studies ultimately promoted the collection of population data by gO'l'ernments. Beginning of regular census taking started in Sweden in 1749 and the process gradually diffused to the rest of Europe and the U.S.A.

Meanwhile debate on the influence of environment on human character and behavior continued in the works of Abbe de Bos (1719), Montesquieu and BuffoD. Bos in an interesting wbrk found that weather had definite effect on suicide and crime rates in Paris and Rome.[12]

The beginning of the 18th century also witnessed more useful ways of generalizing, explaining and communicating. The effort to provide more exact description was replaced by efforts to develop theory. Some of the earliest attempts to formulate general theory regarding population is associated with a group of Scottish scholars at the University of Edinburgh. The group developed theories regarding population and resources and include such people as David Hume (1711-76), Adam Ferguson (1723-1816 and Adam Smith (1723-60). Adam Smith's study, 'Wealth of Nations' was published in 1776. According to him, "the real source of a nation's wealth lies in its annual labor, and its use of productive sources". His work was followed by "Essays on population" by Thomas Robert Malthus (1718). Malthus insisted that the construction of a truely happy society would always be hindered by the tendency of population to increase faster than food supply. The work of Malthus on population and food supply is recognized as one of the most brilliant achievenents of this period. One phrase in his essay referred to the "struggle for existence". Decades later Charles Darwin and Alfred Russel Wallace both realized independently that this was 'the keynote' of the process of natural selection among organisms.V

The world of scholarship underwent basic change during the nineteenth and twentieth centuries. No only the fields of learning-academic disciplines-were gradually elaborated but also the total number of scholars reached unprecendented size.14 Apart from progress in the mainstream, of geography, a major shift in focus was the growth of an anthropocentric orientation. This was an important turning point in the development of geographic aspects of population.

Second Pbase.

During this phase a considerable amount of literature was added in the field of population geography. However no mention was made of the field in the authoritative reviews of tIte evolution and nature of geography in English (Harthshorne, 1939,15 Dickinson and Howarth, 1933,16and Woor.Iridge and East, 1951)17indicating the late entry of population geography as a recognized systematic branch of the mother subject. Nevertheless, a substantial amount of material was c;ontributed in the field after a shift in focus from the study of the

natural environmcnt to the study of man as the main inhabitant of the of the earth. An idea of the nature and amount of this literature can be obtained from the bibliographical work of Dorries (1940)18 who lists nearly 5000 titlei contributed in the field between 1908 and 1938. A number of these reference however, were on settlement geography and as Trewartha19 points out, only 15 out of 51 pages of Dorries' book list references on population georaphy.

While credit must also be given to Ratzel (1844-1904) and Vidal de Ca Blache (1848-1919) for giving an anthropocentric orientation to geography in Germany and France, respectively, the scholar who gave an important status to population geography during the second phase of its growth was a German, Alfred Hettener (l85<}-1941). He singled out population as a prime element of geographical study. In this treatment of the various branches of geography, "Die Geociraphe des Menschen" is recognized as a major field and population geography, or "Bevokerungll-geographie," is catalogued as the prinicpal division of the larger field of human geogaphy.20

The overall contribution to geosraphic study of population in the second phase, following James can be divided into six types :21

(i) Theory and methods

(ii) The mapping of population

(iii) The reconstruction of pre-census populati6n

(iv) The analysis of population trcndil

(v) Migration

(vi) Cultaral characteristics of population

The first type of study can b~ eX1m~litbd by th~ works or Aurousseau (1921, 1923)22and Jefferson (1909,1931, 1939),23 The former wrote on the measures of population increase and defined the ultimate limits of population in an area. He also tried to find out a workable formula for a rural-urban distinction. Jefferson expressed dissatisfaction with enumerations within arbitrary census areas. He distinguished the geographical city from the political city and argued that political cities were not at all comparable because of their arbitrary boundaries. **He**

also studied the urban population all over the world and from this he formulated his famous law of primate cities

Among the important co.tributions in the second category was Stan de Geer's (1922)2' populatiol'l map of Sweden, using dots for rural people and pro~ortional sph~res for urban concentration~. Among other work in the same category were those of Brigham (1916),25 CUilhing (1921)26, Batschelet (1927)27, Wolf(I928):!8, and Stilgenbauer (1933)2g.

Geo~raphers have shown interest not only in population distribution as a static phenomenon but also in the reconstruction of population patterns in the pre-census era. Some of the important contributions to this aspect have been those of Darby (1952)29 and Green (1932)3Q.

The study of population trends led geographers to the analysis of curves of growth and decline. Dodge (1932, 1935)31 approached the geographical study of differences in population growth rates by accepting the concept that all communites in time reach a peak of population and th,~reafter decline. On the theoretical curve there are two significant points: first. the date of the first settlement and, second, the date of the peak or the beginning of decline. If there are two or more peaks, the dates of the low points between are also significant. The significant dates for specific communities, iuch as counties, can be recorded on a map, and lines connecting the same dates can be drawn. The result. is an isochronic mllp. Using somewhat similar techniques. James (1938)32 studied the' changing patterns of population in Sao Paulo State, Brazil, Mirkowich (1941)33 studied population trends in California, and Kohn (1945)34 examined the trends in the United States as a whole since 1940.

Another method of analyzing the trends in population and the movement of the frontier of new settlement involved the preparation of a series of dot maps, each for a different census. This required a caseful study of enumeration districts for each census in order to make certain that the series was in fact comparable. Examples of such studies include the paper by Guy-Harold Smith (1928)35 on Wisconsin, and the paper by L.S. Wilson (1940)36 on Minnesota.

Another aspect of population covered by geographen was migration. Two examples of such studies are those of Smith (1929)37 and Thornthwaite

(1934).38 In the former, movement of people in and out of Ohio were presented on maps, while the latter was an extensive study of internal migration illustrated with colored maps.

Finally the study of cultural characteristics of population are examplified by the works of Hartshorne (1938),39 dealing with the racial minorities in U,S.A. and that of Broek (1944),40 analyzing the possibilities of unity and disunity among the emerging nationalities of Southeast Asia.

Despite these works, however, as Trewartha[41] pointed out, the study of population had been one of the inferior concerns for geographers. He gave several evidences to support this argument.

(1) The number and quality of publications on populatio:l by geographers. (A survey made of publications of American Geographers on substansive aspects of population revealed a total of only 45 titles over a period of 25 years (1925-1950). Similarly, another survey of three standard geographical magazines of Europe indicated only 41 titles on population over a period of 40 years (1910-1950).

(2) Little attention to the population element in holistic regional studies. (Revealed by emphasis on man's creations-houses, settlements, fields and communications-rather than on the originator and creator of the whole cultural scene.

(3) The number of doctoral dissertations in Geography focusing on population themes. (Out of a total of 343 dissertations completed at American universities, only 11 or slightly over 3 percent were on population).

(4) The amount and quality of professional training offered in the geography curricula in universities. (An inventory of the programme offered in the 20 largest or most distinguished American universities in, 1952 showed that none of them had a separate course in population geography).

Trewartha suggested three reasons for this neglect of population geography. The first of these was the organizational division of geography, which splits the field into physical and cultural, giving rise

to the familiar breakdown of physical and cultural landscape. This division has failed to provide a special niche for population geography. The second reason suggested, a corollary to the first, was the general inclination to define geography as the study of th~ landscap~ and to make the two terms geography and landscape synonymous. The third reason for the relative neglect of population geography was the increasing emphasis on geography as a direct observational science utilizing skill in field observation. This inability to make an abundant us~ of direct observational methods in the study of population as compared with many other phenomenon may have tend~d to turn geo.sraph~rs away from the demographic aspect of th~ir subject.. Z~linsky (1966)42 has given two other very important factors responsible for the relatively late development of the field of population geography. Pointing to the first he states, "in almost every instance in which a geographic specialty has flourished, its non-geographic counterpart has fared well.." The interwound careers of geoglogy and ge,o.sraphy of landform;, economics and economic geography, and anthropology and cultural geography were cited as examples. "In the case of population geography, the late arrival of its companion science, demography, has delayed the optimal growth of the discipline." In addition, Zelinsky also attributes the dearth of statistics and maps especially for sub-national areas as a serious constraint in the growth of population geography.

Third Phase

It was in the early 1950's that population geography emerged as a systematic branch of geography in the sense that it dealt with recognizably distinct groups of phenomenon and systematically related processes, the study [of which involved a particular form of training43 The most important scholar who elevated population geography to a prominent position among various branches of geography was Glenn T. Trewartha (1953),44 whose presidential address to the Association of Amer!can Geographers presented the most powerful case for population geography. According to him population was the point of reference from which all other elements are observed and from which they singly or collectively derive significance and meaning. "It is population that furnishes the focus". While defining population geography, Trewatha stressed that its essence lay in the understanding of regional differences in the

earth's covering of people. Trewarthll's viewpoint served a useful purpose and population geography since than has been accepted as a distinct branch of geography. The immediate outcome of this address was the inclusion of a chapter, "The geographic study of population," in the classic volume, *American Geography inventory and Prospect.*[45] The growing realization of the importance of this subfield provided corresponding acceleration in its development bo:h in teaching and research. The diffusion of population geography as a full-fledged course in the universities of the world was accomnanied by the appearance of several introductory texts (George, 1959;[46] Clarke, 1965,[47] Zelinsky, 1966;[48] Beaujeu Garnier, 1966;[49] Wilson, 1968;[50] Trewartha, 1969[51]). Indicators of growth in research was the volume of papers in population geography, which increased from three percent in 1962 to thirteen percent in 1972 of papers presented at the annual meeting of the Association of American Geographers. The papers published in the leading American journals during the same period increased from 5 to 12 percent.[52] A further landmark in the development of the field was the establishment of a commission on population geography in the International Geographical Union in 1963. The commission still exists and has carried out several activities including organization of a number of international symposia, initiation of research projects and publication of several volumes on population.

Approaches to the Study of Population Geography : Changing Emphasis

Two questions have dominated the traditional approach of the geographer to population study: where? and why there? The first has been responsible for depicting patterns of spatial distribution while the second takes the poputation geographers' approach further into an essentially ecological field.[43] Historically, spatial distribution and areal differentiation of population have been clearly the unifying factors within population geography. Thus Trewartha[54] saw its purpose as "an understanding of the regional differences in the earth's covering of peoples," while Jam~s'5 thought "the obj)ctive of p()pulation geography is to define and to bring forth the significance of differences from place to place in the numb::r and kind of human inhabitants," The role of the population geographer was regarded by ZelinskyS6 to be the ~tudy of "the

spatial aspecti ef population in the context of th6 aggregate nature $[places," and by B~aujeu-Gar'lierS1 to describe "the demoqrauhic facts in their present environmental context.'. More explicitly, Clarke~8 stated thlt population geography" is concerned with demonstrating how soatial variations in th~ distribution, comoosition, migrations and !!rowth of popl11lltion are related to spatial variations inthe nature of places."

In th~se traditional approaches a focus on spatial distribution was thou1ht sufficient to distin~uish poryuhtion geoqraphv from democrraphy which is much more concerned with the intrinsic and universql attributes of populations and with a temporal, rather than spatial dimension. But a problem had always existed in soecifving pool1lation attributes appropriate for direct study by the population geographer. There is agreement on a core comurising distribution, density, aqe, sex, and marital composition, fertility. mortality and mi'!ration. Opinion however, differ widely on the inclusion of attributes like occupation, religion language and ethnicity, A neat rule-of-thumb way of circumscribing the field, suggested by ZelinskyS9 is that attention should be confined to those human characteristics "appearing in the census enumeration schedules and vital registration systems of the more statistically advanced nations," but inevitably there are data recording variations between such nations, and, more critically. there is no theoretical justification for the liuggestion,fiO

The Soviet viewpoint of pOi'ulation geography do~s not correspond to the population ~eography as developed in the West.. Melezin61 puts the Soviet concept of population geography as, "the study of population distribution and productive relationships existing within various population groups, the settlement network and its fitness, usefulness and effectiveness for productive goals of society," This productive aspect of population is most important to Soviet geographers who regard population as part of economic geogr:aphy. According to Kovlev62 distributional pattern_ of population is basically represented by a network of settlements and becam.e changes in settlement pattern are influenced primarily by types of production, geographic study of population should therefore be identified with the analysis of territorial groupings of settled places, with emphasis upon their economic functionality. There is an inherent fear in accepting such a concept of population

geography which takes it more towards settlement geography and one may be tempted to agree with Wilson[63] who indicates that the study of size, spacing, and functions of man's residential agglomerations (settlement) may be probed into by settlement geography while the study of his individual attributes may be left to population geography.

While spatial and ecological approaches to population phenomenon still remain the dominant and distinctive dimensions of population geography, the practice of the subject has changed appreciably in response to the conceptual and quantitative ehange which has swept through human geography in the last two decades (Chisholm, 1975;[64] Johnston, 1979[65]). Jones[66] analyzed these methodological transformations under seven groups, as follows:

(i) Qualification: Statistical analysis of areally based data sets on population.

(ii) Computer graphics: Mapping of population phenomena by computers.

(iii) Models: As devices for uncovering a theoretical order In the processes leading to the distribution of people.

(iv) Process study: Explanation of the dynamic components of fertility, mortality and migration affecting the spatial structure of population.

(v) Behavioral focus: Socio-psychological studies of migration.

(vi) Applications and relevance: Construction, for example, of spatially disaggregated population forecasting models,

(vii) Ideology: Associated with calls for a more socially relevant and humane approach.

Almost all these changes followed methodological development in the mainstream of geography and indeed this confirms an earlier statement by Preston James[67] "To recognize population geography as a distinct topical speciality is not to think of it as separable from the whole field of geography. "

Although there are innumerable studies on various attributies of population, it may be of interest to cite the example of migration. It

is perhaps an aspect which has attracted the maximum interest from population geographers. It is most fundamental to understanding the: ever-changing 'space content'. and space relatioas of an area.[68] 1961). However, the first scientific study related to migration is attributed to the statistician Revenstein. Revenstein,62 presented his work b~fore the Royal Statistical Society as 'Laws of Migration." Despite strong criticisms, Revenstein's papers have stoJd the test of time and remain the starting point for work in migration theory. Ever since, this field has continued to be an important area not only to geographers and demographers, but also to economists, sociologists, anthropologists, psychologists and political scientists.

This variety of interests has led to discipline-oriented treatments of migration. The vast amount of literature generated can broadly be classified into the following five types:

(i) Studies laying emphasis on distance, direction, volume, streams, counter-streams and multistage migrations (Stouffer 1940, 1960;70 Hagerstrand, 1962;71 Lee, 1966;72 Zacharia, 1967;73and Forde and Harvey, 1969[74]).

(ii) Studies primarily concered with the determinants of migration including the push-pull concept as well as behavioral aspects of decisions to move (Tachi;75 1964: Wolpert, 1965;76 Hart, 1973;77and Fany, 1974[18]).

(iii) Studies dealing mainly with the consequences of migration, i.e. impact of migration on migrants and/or places of origin and/or destination (Goldstein, 1971;79 Jordan and Munda, 1976;80 Dutt, 1976;81 Beier, 1976;82 Remple and Richard, 1976;83and Gaude, 1976[84]).

(iv) Studies with a major focus on the characteristics of migrants (Greenwood, 1971;35 Simkin and Wernstedt, 1971;86 Wenlang, 1972;87Ulack, 1972;88 and Simmons et at, 197789).

(v) Studies concentrating on population migration/redistribution policies (Albert, 1973;SOPryor, 1975;£1Findley, 1977;92and Pry,or and Kosinski, 1978)93.

These different types of studies, however, are in actual facts, parts of a whole and complementary rather than competitive. These studies have utilized a variety of dlta sall~~~3 in.:;ludin~ both national and international statistical references. The bulk of existing work on internal migration shows that a relatively limited number of studies have used primary or direct survey data, whereas the basis of analysis for the majority of migration studies has been secondary sources such as population censuses, registration data, statistical year books, government reports, health statistics and transportation data. Because of this variation in data, comparative studies sometimes become difficult. .

As a whole, social scientists in both western and non-western countries have contributed to migration research. Nevertheless, the field has received more serious attention in western than non-western areas. For years, attempts have been made In the west to codify what is known about internal migration, and to compile bibliographies. The last decade has, however, seen some important attempts to survey the literature on internal migration in _the Third World. Findley[94] reviewed issues and policies for internal migration in the developing countries. During the 1978-80 period, I.G.U. Commission on population geography held four symposia. Three of these were concerned specifically with the non-western_ countries (Clark and Kosinski, 1978[95]; Kosinski and Elahi, 1980[96]; and Kosinski et aI., 1980[97]). Among other important works on non-western countries are two annotated bibliographies-one on internal migration in Africa, Asia and Latin America (IDRC, 1977),[98] and the other on internal migration in Arab world (UNECWA. 1980[99]).

A number of studies in developing countries have revealed that the phenomenon of migration is accompanied by increasing uneveness of population distribution. Poles of population growth are the urban areas of intense economic activity, while the rura.l areas suffer from the problems of stagnation. The problem may vary from region to region but governments of most of the developing countries want to take steps to check the unbalanced growth both of population and of economic development. It is here that the population geographers can come forward and help their governmentG in understanding; alild solving the problems in the right perspective.

Population Geography Future Prospects

Population geographY is a relatively young sub-division of geography but it appears to have good prospects o(development in the future. James 100 has set two goals for a branch of geography to be a.ttJactive. First, it must make a clear co ntribution to th~ overriding problems with which mankind is presently faced. Second, it should be able to satisfy the curiosity of younger s;;holars by providing varifiable answers to questions. Population geography offers both, and its increasing popularity, particularly in the developing countries, is a clear indicator of its value.

References

1. Dickinson, R.E. (1969), *The Makers of Modern Geography*, London: Routledge and Kegan Paul, p. 118.
2. Trewartha, G.T. (1953), "A Case for Population Geography", *Annals of the Association of American Geographers*, June, pp. 71-97.
3. James, P.E., and Martin, G.J. (1981), *All Possible Worlds: A History o/Geographical Ideas*, 2nd Bd., New York: John Wiley and Sons, p. 16.
4. *ibid.*, p. 19.
5. Strabo, *The G~()graphy of StrabfJ*, Trans. Jones, H.L.. (1917), New York: G.P. Putnam's Sons.
6. Glacken, C.J. (1956), "Changing Ideas of the Habitable World" in Thomas W.L.. (ed.), *Man's Role in Changing the Face of the Earth*, Chicago: University of Chicago Press, p. 72-73.
7. James, P.E. and Martin, G.J. (1981), *op. cit.*. p. 40.
8. Tillman, J.P. (1971), "An Appraisal of the Geographical Work of Albertus Magnus and His Contribution to Geographical Thought", *Publication No.4.* Department of Geography, University of Michigan, Ann. Arbor, p. 71.
9. Glacken, C.S. (1956), *op. cit.* p. 265-271.
10. *Ibid.*, pp. 398-389.

11. Peschel, O. (1865), *Geschichte del' Erdkunde bis auf a.v. Humboldt and Carl Rillel',* Munich, JG. Gota (quoted by James, P.E., 1981), p.685.

12. Glacken, C.J. (1966), *op. cit.,* pp. 556-558.

13. James, P.E. and Martin, G.J. (1981), *op, cit.,* p. 108.

14. *Ibid.,* p. 1-37.

15. Hartshorne, R. (1939), *The Nature of Geography: A Critical Survey of Current Thouhgt in the Light of the Past,* Lancaster, Pa: Association of American Geographers.

16. Dickinson, R.E. and Howarth, O.J.R. (1933), *The Making of Geography,* Oxford: The Clarendon Press.

17. Woolridge, S.W. and East W.G. (1951), *The Sprit and Purpose of Geography,* London: Hu(chinson University Library.

18. Dorries, H, (1940), "Siedlungs and Bevolkerunge Geographie *(1908-1938)," Geographische Johrbuch, 55.*

19. Trewartha, G.T. (1953), *op. cit.*

20. Hettener, A. (1927), *Die Geographie-ihre Geschichie, ihre Wesen und ihre Methoden,* Breslau : Ferdinand Hirt, (Quoted in Trewartha, 1953).

21. James, P.E., (1954), "The Geographic Study of Population,,', in *American Geography Inventory & Prospects,* Association of American Geographers: Syracruse University Press, pp. 106-122.

22. Aurousseau, M. (1921), "The Distribution of Population: A Constructive Problem", *Geographical Review,* II, pp. 563-592, and (1923), "The Geographical Study of Population Groups. *Geographi cal Review,* 13, pp. 266-282.

23. Jefferson, M. (1909), "The Anthropogeo graphy of Some Great Cities, *Bulletin of the AmeriCan Geographical Society,* 41 pp. 527-566 ; (1931), "Distribution of World's City Folks: A Study in Comparative Civilization," *Geographical Review,* 21, pp. 446-465: and (1939), "The Law of Primatee City," *Geographical Review,* 29, pp. 226-232.

24. DeGeer, S. (1922)," A Map of the Distribution of Population in Sweden, *Geographical Review,* 12, pp. 72-83.

25. Brigham, A.P. (1916), "The Population of New York State", *Geographical Review,* 2, pp. 206-217.

26. Cushing, S.W. (1921), "The Distribution of Population in Mexico," *Geographical Review,* 11, pp. 227-242.

27. Batschelet, O.E. (1927), "A Picture of the Distribution of Population in Pen'1sylvania," *Geographical Review,* 17, pp. 429-433.

28. Wolf, A.B. (1923), "Some Population Gradients in the United States," *Geographical Rel'ieH',* 18, pp. 291-301.

29. Darby, RC. (1952), *The Domesday Geography of Eastern England,* Cambridge: Cambridge University Press.

80. Green, E.B. and Harrington, V.D. (1932), *American Population Before the Federal Census of 1970,* N~w York.

31. Dodge, S.D. (1932), "A Study of Population in Vermont and New Hampshire," *Papers of the Michigan Academy of Science, Arts and Letters,* 18, pp. 131-136, and (1935), "Population Regions of the United States," *Papers of the Michigan Academy of Science. Arts, and Letters,* 21, pp. 343-353.

32, James, P.E. (1938), "The Changing Patterns of Population in Sao Paulo State, Brazil," *Geogvaphical Review,* 28, pp. 352-362.

83. Mlrkowic (1941), "Recent Trends in Population Distribution in California," *Geographical Review,* 31, pp. 360-307.

34. Konn, C.F. (1945), "Population Trends in the United States Since *1940," Geographical Review,* 35, pp. 96-106,

35. Smith, G.H. (1928), "The Population of Wisconsin," *Geographical Review,* 18, pp. 402-421.

36. Wilson, L.S. (1940), "Some Notes on the Growth of Population in Minnesota," *Geographical Review,* 30, pp. 650-564.

37. Smith, G.H. (1929), "Inter-state Migration as Illustrated by Ohio." *Bulletin oj the Geographical Society of Philadelphia.* 27, pp. 301-312.

38. Thornwaite, C.W. (1934), "Internal Migration in the United States," *Study of Population Redistribution, Bulletin* 1, Philadelphia: University of Pennsylvania.

39. Hartshorne, R. (1938), "Racial Maps of the United States," *Geographical Review,* 28, pp. 276-288.

40. Broek, J.O.M. (1944), "Diversity and Unity in Southeast Asia," *Geographical Review,* 34, pp. 175-195.

41. Trewartha, G,T .. (1963), *op. dt.*

42. Zelinsky, W. (1966), *A Prologue to Populaiion Geography,* New Jersey: Prentice Hall, Inc.

43. Jones, H.R. (1981),, *A Geography of Population.*

44. Trew.lrtha, GT. (1953), *op. cit.*

45. James, P.E., (1954), *op. cir.*

46. George P.o.L. . (1959), *"Questions de Geographic de la Population,"* Paris: Presses Universitaires de France.

47, Clark, J.I, (1965), *Population Geography,* Oxford: Pergamon Press.

48. Zelinsky, W. (1966), *op. cit.*

49 Beaujeu-Garnier, J. (1966), *Geography of Population,* London: Longmans.

50. Wilson, M.G. (1958), *Population Geography,* London: Nelson.

51. Trewartha, G.T. (1969), *A Geography of Population-World Patterns,* New York: John Wiley and Sons.

52. Hansen, J.C., and Kosinski, L.A. (1973), "Population Geography," *1.G.U. Commission Population Geography,* Edmonton, p. 12.

53. Jones, H.R. (1981), *op. cit.*

54. Trewartha, G.T. (1953), *op. cit.* p. 87.

55. James, P.E., (1954), *op. cit.,* p. 108.

56. Zelinsky, W. (1966), *op. cit.,* p. 5.

57. Beaujeau-Garnier, J., (1966), *op. cit.,* p. 3.

58. Clark J.I.. (1965), *op. eit.,* p. 12.

59. Zelinsky, W. (1966), *op. cit.,* p. 7.

60. Jones, H.R. (1981), *op. cit.*

61. Melezin, A. (1963), "Trends and Issues in the Soviet Geography of Population," *Annals 0/ the Association of American Geographers,* June, pp. 144·160.

62. Kovlev, S.A. (1959), Nekotoryye Printsipial'nyye Voprosy, *Tipologii Russeleniya, ': Voprosi Geografii,* 45, p. 8 (Quoted in Melezin, S., 1963).

63. Wilsgn M.G. (1968), *op. cit.*

64. Chisholm, M. (1975), *Human Geography: Evolution or Revolution,* Harmonds-Worth: Penguin.

65. Johnston, R.J. (1979), *Geography and Geographers: Anelo American Human Geography Sinc421965,* London: Arnold.

66. Jones, H.R. (1981), *op. cit.,* pp. 7-13.

67. James, P.E.. (1954), *op. cit.,* p. 108.

68. Gosal, G.S. (1761), "Internal Migrations in India. A Regional Analysis," *Indian Geographical Journal,* 36, pp. 106-121.

69. Revenstein, E.G, (1885), "The Law of Migration," *Journal of Royale Statistical Society,* 68, **2,** June, pp. 167-227.

70. Stouffer, S.A. (1940), "Intervening Opportunities: A Theory Relating Mobility alld Distance," *American Sociological Review,* 5, pp. 845-867, and (1960), "Intervening Opportunities and Competing Migrants," *Journal of Regional Science,* **2,** J, pp. 1-26.

71. Hagerstrand, T. (1962), "Geographical Measurement of Migration," *Eetretiens de Monaco on Sciences Humaines.*

72. Lee, S.E. (1966), "A Theory of Migration," *Demography,* 3, pp. 41-57.

73. Zacharia, K.C. (1967), "Internal Migration and Urbanization," *Population Change: Asia and Oceania Report of the 1USSP,* Sydney Conference.

74. Forde, E. and Harvey, M.E. (1969), "Migration to Freetown," *Sierra Leone Geogwphical Journal,* 13, pp. 13-27.

75. Tachi, M. (1964), "Regional Income Dispality and Internal Migration of Population in Japan," *Economic Development and Cultural Change,* January.

76. Wolpert, J. (1965), "Behavioral Aspect of the Decision to Migrate," *Papers and Proceedings of the Regional Science Association,* 15, pp. 859-169.

77. Hart, R.A. (1973), "Economic Expectations and the Decision to Migrate: An analysis of Socia-economic Groups," *Regional Studies,* 7, pp. 271-285.

78. Fany, K. (1974), *Multi-sector Adaptath'e Medel of Economic Developmeni and Rural Urban Migration,* Madison: University of Wisconsin.

79. Goldstein, S. (l97I), "Inter-relations between Internal Migration and the Environment in the ECAFE Region," *Asian Population Studies Series,* 10, Bangkok: ESCAP.

81: Dutt, J.S (1976), "Population Movement and Gene Flow," in Baker, P. and Little, M.N. (eds.) *Man in the Andes,* Dowden, Pennsylvania: Autchins and Rose.

82. Beier, O.J. (1976), "Can Third World Cities Cope," *Population Bulletin,* Washington, D.C : Population Reference Bureau, inc. 31, p. 4.

83. Remple, H. and Richard, A.L. (1976), *The Rural Impact of Rural-Urban Migration,* Department of Economics, University of Manitoba. Winnipeg.

84. Gaude, J. (1976), *Causes mId Repercussions of Rural Migration in Developtng Countries: An Analysis,* Geneva: ILO, p. 12 and Gaude, J. and Feck, P. (1976), "The Economic Effects of Rural Urban Migration," *International Labour Review,* 114, 3, pp' 329-338.

85. Greenwood, M.J. (1971), "An Analysis of Determinants of Internal Labour Mobility in India," *Annals of Regional Science, 5,* pp. 137-151.

86. Simkin, P.D. and Wernstedt, F,L.. (1971), "Philippine Migration: The Settlement of the Diges Padada Valley, Davao Province," *Monograph* 16, S.E. Asia Studies, New Haven: Yale University.

87. Wenlang, L. (1972), "Migration Differential in Taiwan, 1920-1940: A Comparative Study," *Journal of Developing Areas,* 6, pp. 227-238.

88. UIack, R. (1972), "The Role of Industria:lization upon the Migration and Demographic Characteristics of Liigan City, Mindanao," Ph. D. Dissertation, Penn. State University U.S.A.

89. Simmons, A. et aI, (1977), *Social Change and Internal Migration,* Ottawa: International Development Research Centre.

90. Albert J. (1937), *The Process of Urbanization and Spatial Population Redistribution Policies,* Rome: FAO, Forestry Department, p. 14.

9 }.' Pryor, R.J. (1975), "Migration Trends, Population Redistribution Policies and Development Strategies in Malaysia," Presented in *Symposium on Alternatives for Development Strategies in Asia and the Pacific.*

92. Findiey, S. (1977), "Planning for Internal Migration," *A Review of Issues and Policies in Developing Countries,* Washington, D.C ; U.S.D. Dept.. of Comm~rce, Bure~u of Census.

93. Pryor, R.J. and Kosinski, L.A. (1978), *Population Redistributioll Policies: A Preliminary Enquiry,* Edmonton.

94. Findley, S. (1977), *op. dt.*

95. Clark, J.T. and Kosinski, L.A, (eds.) (1978), "Population Redistribution in Africa," *Proceedings of the I.G.U. Symposium Oil Population Geography,* Zaria, Nigeria.

96. Kosinski, LA. & Elahi, M., eds. (1980), "Population and Development in South Asia," *Proceedings of the I.G.U. Symposium,* Karachi.

97. Kosinkski, L.A. et al. (1980), "Migration and Population Redistribution in Asia and the Pacific," *Proceedings of the I.G.U. Symposium,* Nagoya.

98. Jriternational Development Research Centre (IRDC), 1977, *Internal Migration in Africa, Asia and Latin America: Bibliography.*

99. United Nations Economic Commission for Western A&ia (UNECWA), 1980, *Bibliography of Population Literature in the Arab World,* Beirut..

tOO'. James, P.E. and Martin, G.J. (l9~I), *op. cit.,* p. 425.

Pakistal1 Geographical Review was instituted in 1949, replacing *Punjab Geographicul Review* which was started in 1942. The object of this publication is the dissemination and exchange of scholarly knowledge. Its volumes contain research articles on various topical and regional themes of Geography with particular reference to Pakistan. The Review is published half-yearly in January and July.

Submit all manuscripts and publications for Review to the Editor, *Pakistan Geographical Review,* Department of Geography, University of the Punjab, Lahore - 20.

Address all communications regarding subscription and purchase of the back number to the Editor, *Pakistan Geographical Review,* Department of Geography, University of Punjab, Lahore - 20.

ANNUAL SUBSCRIPTION

Foreign	*Inland*
$ 6.60	Rs.20.00

Printed at the Zahid Iqbal Printing Press
4 - Fleming Road, Lahore
Published by K. U. Kureshy, Editor, *Pakistan Geographical Review.*