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NEWS AND NOTES

BOOK REVIEWS

Pakistan Geographical Review

Volume 21 July, 1966 Number 2

URBANIZATION OF WEST PAKISTAN IN RELATION TO ARIDITY

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WEST PAKISTAN is on the margin of the monsoon region of Indo-Pakistan, and the availability of water for agriculture has always been an important factor in influencing the distribution of population and growth of settlements. The relationship between aridity and urbanization in West Pakistan has been attempted to be established in the present paper by collating aridity with town size frequencies.

ARIDITY

Aridity signifies the deficiency of precipitation in relation to the water requirements of evapotranspiration (evaporation plus transpiration). The water requirements refer to potential evapotranspiration that will take place if water were available, as against the actual evapotranspiration.

Thornthwaite has worked out a method of evaluating potential evapotranspiration from the temperature data of a place in two ways :

1) with the help of a formula devised for the purpose

2) with the help of specially computed tables and a monogram.[1]

The mathematical formula given in Thornthwaite is "far from satisfactory" and is "completely lacking in mathematical elegance".[2] The present writer has utilized the second method for the calculation of the potential evapotranspiration of twenty-seven meteorological observation stations of West Pakistan.[3] The values of potential evapotranspiration are taken for water need and compared with the corresponding values of rainfall for each month. Water budget is prepared to assess the water deficiency (or surplus) for each month of the year. In the estimation of water surplus an allowance of ten centimetres is made for storage in the soil. The storage

[1] C.W. Thornthwaite, "An approach towards a rational classification of climate," *Geographical Review*, Vol. 38 (1948), pp. 55—94.

[2] *Ibid*, p. 90.

[3] Assessment of the aridity of Pakistan and the contiguous areas of India on Thornthwaite's method is made in an unpublished article "Arid Zone of India and Pakistan : a study in the water balance and delimitation" by S.S. Bhatia. The present writer has not been able to see the maps in Bhatia's article. But in that article deductions are based on a relatively meagre data of only fourteen stations in West Pakistan.

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water in the soil is considered in the calculations of the water budget for the succeeding month. The annual water deficiency (or surplus) is obtained by the summation of monthly values. The annual water deficiency and water surplus when expressed as a percentage of annual water need are respectively termed as aridity index and humidity index. In the general term, moisture index, humidity index is expressed by positive values, and aridity index by the negativec. In the moisture index "the humidity index has more weight than the aridity index : the latter has only six-tenths the value of the former".[4] The formula for the moisture index is :

$$Im = \frac{100s - 60d}{n}$$

Where 'Im' is the moisture index, 's' water surplus, 'd' water deficiency and 'n' water need.

The climatic types based on moisture index in Thornthwaite are as follows :

TABLE 1—CLIMATIC TYPES ON MOISTURE INDEX ACCORDIN , TO THORNTHWAITE

Climatic Type	Moisture Index
A Perhumid	100 and over
B4 Humid	80 to 100
B3 Humid	60 to 80
B2 Humid	40 to 60
B1 Humid	20 to 40
C2 Moist subhumid	0 to 20
C1 Dry subhumid	—20 to 0
D Semiarid	—40 to —20
E Arid	—60 to —40

Source : C. W. Thornthwaite, "An approach Towards a rational classification of climate" *Geographical Review*, Vol. 38 (1948)

The annual potential evapotranspiration, water surplus, water deficiency and moisture index of twenty seven stations in West Pakistan are given in Table 2.

[4] The humidity index is weighted by Thornthwaite because "Deeply rooted perennials may make partial use of subsoil moisture and thus minimize the effect of drought" Thornthwaite, *op. cit.*, footnote 1, p. 76.

TABLE 2—ANNUAL POTENTIAL EVAPOTRANSPIRATION, WATER SURPLUS, WATER DEFICIENCY AND MOISTURE INDEX.

Station	Potential evapotranspiration in cms.	Water surplus in cms	Water deficiency in cms.	Moisture index $\frac{(100s-60d)}{n}$
	(n)	(s)	(d)	
Drosh	94.0	12.4	61.2	—25.8
Murree	70.9	82.0	0.0	+115.7
Parachinar	80.6	14.5	20.1	+3.0
Fort Sandeman	112.4	0.0	85.1	+45.6
Chaman	105.1	3.0	83.2	—44.6
Quetta	80.1	1.3	58.2	—42.0
Nokkundi	134.0	0.0	129.3	—57.9
Panjgur	120.1	0.0	108.3	—54.1
Pasni	140.4	0.0	125.2	—53.5
Las Bela	141.8	0.0	119.6	—50.6
Peshawar	127.0	0.0	93.2	—44.0
Rawalpindi	122.6	2.3	33.9	—14.7
Bannu	133.9	0.0	105.6	—47.8
Miranshah	115.9	0.0	88.4	—45.8
Sialkot	131.7	0.0	52.6	—23.9
Khushab	140.3	0.0	102.8	—44.0
Dera Ismail Khan	139.5	0 0	116.7	—50.2
Lahore	127.8	0.0	80.0	—37.6
Lyallpur	136.9	0.0	107.1	—46.9
Montgomery	138.8	0.0	114.2	—49.9
Multan	139.8	0.0	122.6	—52.6
Sibi	151.9	0.0	140.4	—55.4
Jacobabad	152.3	0.0	143.7	—56.6
Sukkur	151 2	0.0	141.8	—56.3
Hyderabad	154.7	0.0	136.7	—53.0
Karachi	147.8	0.0	128.8	—52.3
Badin	157.5	0.0	134.6	—51.3

Source : Figures for this table have been computed on the basis of the data from Meteorological Office, Lahore.

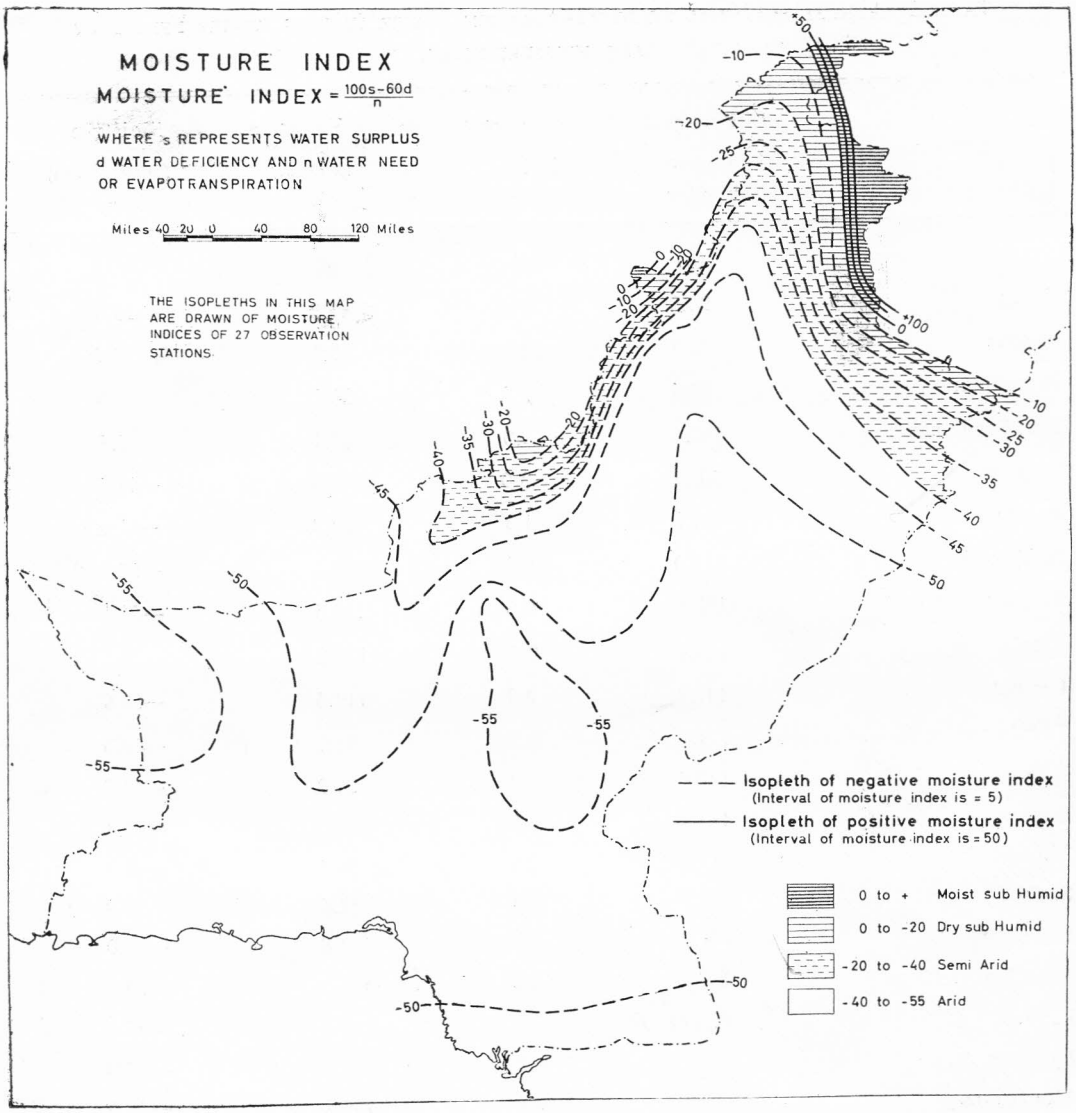

FIGURE 1

Isopleths of moisture index, interpolated from the values given in Table 2 are shown in Fig. 1, which reveals :

1) Excepting a narrow strip of land along the former North West Frontier Province-Kashmir border and a small area around Parachinar (Kurram Agency, Tribal Territory, N.W.F.P), the moisture index is negative over West Pakistan. It signifies that the climate of most of the region of study is dry.

2) Aridity is highest in two distinct areas enclosed by the isopleth of lowest moisture index (−55) in West Pakistan. These areas are : *a*) the desert lowland of north-western Baluchistan, and *b*) the area around Jacobabad, which place has the highest recorded absolute maximum temperature (126°F) in the sub-continent and a low normal annual rainfall of 3.60 inches. The former area has an eccentric position with reference to West Pakistan as a whole. The moisture index increases irregularly outwards from the latter area.

3) The isopleth of −40 moisture index lies south of Lahore from where it trends north-westward upto a point north of Peshawar. From here the isopleth has a general south-western trend upto a point northwest of Quetta whence it turns northward. The area of West Pakistan lying south of that isopleth has an arid climate (Type E of Thornthwaite's classification given above). It includes most parts of the trans-Indus districts of N.W.F.P. (excluding Mardan district), most of Punjab and Bahawalpur (excluding parts of the sub-montane districts) and the whole of Sindh and Karachi and Baluchistan.

4) Most of the remaining areas of West Pakistan have a moisture index of −40 to −20 and − 20 to 0, and have semiarid (Type D of Thornthwaite's classification) and dry subhumid (Type C of Thornthwaite's classification) climates respectively.

5) The narrow strip of land along the N.W.F.P.-Kashmir border and the area around Parachinar having a moisture index of over zero, increasing upto a recorded maximum of +115.7 at Murree, comes under moist climate. The number of observation stations is only one each in these areas but the general trend of isopleth suggests that water surplus increases from west to east in the strip along the N.W.F.P-Kashmir border, and from east to west in the area around Parachinar. The climate varies from moist subhumid (Type C of Thornthwate's classification) to perhumid (Type A of Thornthwaite's classification) in the former area. In the latter area the climate is moist subhumid at Parachinar and tends to be more humid further westward.

6) The spacing of isopleths over the area of West Pakistan indicates that the rate of change of moisture index per unit distance seems to vary directly with height above sea level and annual precipitation. Over the Indus plain with a generally level surface the normal annual precipitation

decreases from over thirty inches in the northeast to five to ten inches in the southwest. The isopleths are nearer together (signifying higher rate of change of moisture index per unit distance) in the northeast and farther apart in the southwest. The rate of change of moisture index per unit distance in the hilly areas of N.W.F.P. and Baluchistan, with a normal annual rainfall of ten to thirty and five to ten inches respectively, is generally higher than in most of the Indus plain, excepting its northern strip. It is low

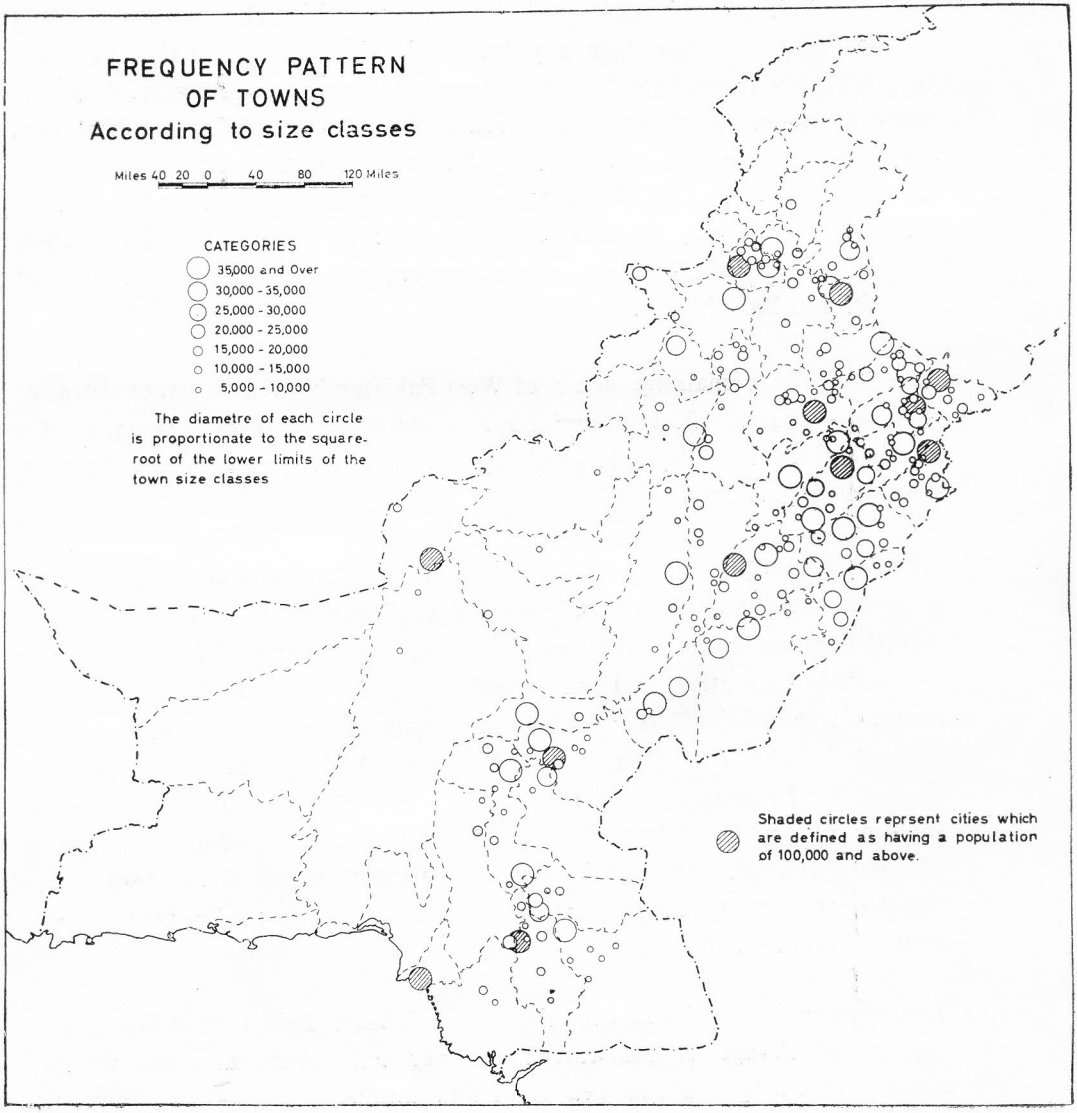

FIGURE 2

in southwestern Baluchistan, where the relief is low in comparison with the hilly areas of N.W.F.P., and the rest of Baluchistan, and the normal annual rainfall is only under five inches. The areas with positive moisture index are terrains of high relief (Murree 7,250 feet and Parachinar 5,748 feet above sea level) and comparatively heavy normal annual rainfall (Murree 58.36″ and Parachinar 29.25″). The rate of change of moisture index per unit distance is exceptionally high in these areas. It may be noted that the interval of positive isopleths on Figure 1 is a moisture index of fifty while that of negative isopleths is five. The maintenance of two intervals on the same map seems to be a justifiable device as more than one contour interval is maintained, for example, in the Survey of Pakistan maps.

7) The Isopleths appear to have a broad general alignment with the main orographic features of the land. However, a perfect alignment of these two cannot be traced.

Town Size Frequencies in West Pakistan, 1901—1961

The frequencies of town size distributions for West Pakistan have been worked out with the help of Simon's method which has been developed on the assumption that these frequencies belong to a family of distributions having some common characterstics.[5] The set of simplified equations derived from Simon's probability model and used in the present study is as follows:[6]

$$f(1)=n_k/2-l \quad \text{--------} \quad (a)$$

$$\frac{f(i)}{f(i-1)}=\frac{i-1}{1+i} \quad \text{--------} \quad (b)$$

Where k is the total urban population in n_k cities of greater than threshhold size, and $f(i)$ is the number of towns of population i. From the equation (a) and successive application of equation (b) the theoretical frequencies of town sizes may be computed.

The theoretical or expected frequencies of town sizes have been construced for West Pakistan by, (former) provinces, for the year 1901 and 1961 (tables 3 and 4). The theoretical town size frequencies have been compared with the observed frequencies and the significance of differences has been computed (Fig. 2). The (former)

[5]For detailed discussion see B. J. L. Berry and W. L. Garrison, "Alternate Explanations of Urban Rank-Size Relationships". *Annals*, Association of American Geographers, Vol. 47 (1958), pp. 83-91.

[6]*Ibid.* p. 88.

TABLE 3—TOWN SIZE FREQUENCIES IN WEST PAKISTAN, BY FORMER PROVINCES, 1901

Town sizes f (1), f (2) ... f (7) (Population in thousands)			N.W.F.P. Number of towns		Punjab and Bahawalpur Number of towns		Baluchistan Number of towns		Sind and Karachi Number of towns	
			Theoretical	Observed	Theoretical	Observed	Theoretical	Observed	Theoretical	Observed
5—10	...	f(1)	5	5	25	33	Zero	Zero	7	6
10—15	...	f(2)	2	1	8	4	Zero	Zero	2	4
15—20	...	f(3)	1	1	4	5	Zero	Zero	1	Zero
20—25	...	f(4)	1	Zero	3	3	Zero	1	1	Zero
25—30	...	f(5)	Zero	2	2	1	Zero	Zero	Zero	Zero
30—35	...	f(6)	Zero	Zero	1	Zero	Zero	Zero	Zero	1
35+	...	f(7)	1	1	7	4	Zero	Zero	3	3

TABLE 4—TOWN SIZE FREQUENCIES IN WEST PAKISTAN, BY FORMER PROVINCES, 1961

5—10	...	f(1)	14	8	78	71	4	6	22	20
10—15	...	f(2)	5	9	26	28	1	2	7	7
15—20	...	f(3)	3	2	13	16	1	Zero	4	4
20—25	...	f(4)	1	1	8	7	1	Zero	2	2
25—30	...	f(5)	1	Zero	5	6	1	Zero	1	Zero
30—35	...	f(6)	1	2	3	5	Zero	Zero	1	2
35+	...	f(7)	4	6	22	22	1	1	7	8

Source: Table 3 has been compiled from the data obtained from *Census of India, 1901*, Vols. N.W.F.P., Punjab and Bahawalpur, Baluchistan and Sind, whereas table 4 has been prepared on the basis of the data from *Population Census of Pakistan, 1961*, Bulletin 2.

provinces, and not the physiographic divisions, have been taken as the areal units of treatment for the purpose. The computation of the frequencies, by physiographic divisions was cumbersome, and also there was no special advantage in accepting these divisions as areal units of treatment. The trends of isopleths of moisture index are as roughly comparable with the trends of the boundaries of the Provinces as with those of physiographic divisions. Moreover, the final objective is to determine the relationship between aridity and town size frequencies for which provinces form more appropriate units.

Significance of Differences

The significance of differences between the theoretical and observed frequencies has been worked out by the chi square test. The test is widely used in ascertaining the degree of fit. The fit is good when the differences are insignificant, and bad when the differences are significant. Assuming the hypothesis to be of wide applications in well urbanized areas, the badness of fit in parts of West Pakistan would imply that the distorting factors (tending to bring about departure from the theoretical frequencies), are effectively operative.

The chi square test is accomplished by comparing the observed data, expressed as frequencies in various categories or groups with the theoreitical or expected results in the same categories. The value of chi square is computed with the help of the following formula :

$$\chi^2 = \Sigma \left[\frac{(fo - f)^2}{f} \right]$$

where

fo=observed or actual frequencies
f=theoretical or expected frequencies

If a calculated value of Chi square lies between .0 and .50 levels of significance on the Probability Table of Chi square for 6 degrees of freedom[7] the difference is interpreted to be significant, and the fit bad. Alternatively, if the value lies between .50 and .99 levels of significance for 6 degrees of freedom, the difference is interepited to be insignificant, and the fit good ; whereas .5 level of significance is a critical level at which a weak fit is assumed. The calculated chi square values for the former provinces of Pakistan, viz., N.W.F.P. Punjab and Bahawalpur, Baluchistan, Sind and Karachi for the two censuses of 1901 and 1961 are embodied in Tables 5 and 6.

[7]Degree of freedom=(no. of rows—1) (no. of columns—1)
In the present case there are 7 rows and 2 columns (fo and f). Therefore, the D.F. is (7—1) (2—1)=6

TABLE 5—CHI SQUARE COMPUTED FOR TOWN SIZE FREQUENCIES BY FORMER PROVINCES OF WEST PAKISTAN, 1901

Size classes	N.W.F.P.	Punjab and Bahawalpur	Baluchistan	Sind and Karachi
f (1)	0	2.56	Data Insufficient	0.14
f (2)	0.50	2.00		2.00
f (3)	0.03	0 25		1.00
f (4)	0.50	0.50		1.00
f (5)	8.33	0		0.47
f (6)	0.23	1.19		1.33
f (7)	0	1.28		0
Chi sq.	9.59	7.73	×	5.94
For 6⁰ of freedom Chi sq. probability	.10 <P <.20	.20 <P <.30	×	.30 <P <.50

Source : Chi square for various provinces have been computed from Table 2 ; Chi square probabilities have been obtained from R.A. Fisher and F. Yates, *Statistical Tables for Biological Agricultural and Medical Research* (London : Oliver and Boyd, 6th ed., 1963), p.47

TABLE 6—CHI SQUARE COMPUTED FOR TOWN SIZE FREQUENCIES BY FORMER PROVINCES OF WEST PAKISTAN, 1961

Size classes	N.W.F.P.	Punjab and Bahawalpur	Baluchistan	Sind and Karachi
f (1)	2.57	0.46	1	0.09
f (2)	3.20	0.04	1	0
f (3)	0.33	0.73	1	0
f (4)	0	0.12	1	0
f (5)	1.00	0.20	1	1.0
f (6)	1.00	1.33	0	1.0
f (7)	1.00	0 05	0	0.14
Chi sq.	9.10	2.84	5.0	2.23
For 6⁰ of freedom Chi sq. probability	.10 <P <.20	.80 <P < 90	.50 <P <.70	.80 <P <.90

Source : Chi squares for various provinces have been computed from Table 3. For Chi square probabilities Fisher and Yates, *op. cit.* has been used.

Table 5 reveals that the differences between the theoretical and observed town size frequencies were generally significant in West Pakistan in 1901. There was, therefore, a bad fit of Simon's hypothesis of town size frequencies in the region of study and the distorting factors were effectively operative. Among the physical distorting factors the infertility of land and the deficiency of water for agricultural purposes seem to be the most important in West Pakistan, which has a dominantly agrarian basis of urbanization.[8] In the plain areas of West Pakistan, having a broadly homogeneous and fertile land, the most important single distorting factor is aridity.

Before the advent of canal irrigation, towards the beginning of the present century, the cultivated acreage was restricted, on account of general aridity, mostly to the submontane districts of Punjab, some plain areas of N.W.F.P. and the riverain tracts of the Indus plain. The submontane districts of Punjab and the above referred to plain areas of N.W.F.P. have a semi-arid or dry subhumid climate (of Thornthwaite's classification) and a generally high water-table. The riverain tracts enjoy the facilities of flood-irrigation and have a generally high water-table. The density of population was comparatively high in these parts of West Pakistan in 1901. Most of the remaining areas of West Pakistan had an extremely low density of population. Urbanization was in a low stage, and therefore, the town size frequencies were far from the theoretical frequencies worked out.

The rural settlements of West Pakistan, particularly of Punjab, attained a remarkably large size. The general aridity of the region of study might have contributed, along with other social and historical factors, to the large size of rural settlements. Settlements having a favourable location with regard to surface or sub-surface water resources in a generally arid region, are apt to attain a large size.

A somewhat detailed analysis of Table 5 reveals that in 1901, on account of the practical absence of towns in Baluchistan (there was only 1 town of larger than the threshold size), the differences between the theoretical and observed frequencies were most significant, and the Simon's hypothesis was completely inapplicable to that province of West Pakistan as the distorting factors, an intense aridity and the generally uncultivable land, were most effectively operative.

In N.W.F.P., the differences were significant. There was, therefore, a bad fit of Simon's hypothesis. The causes were again aridity and the limitedness of

[8] The dominantly agrarian basis of urbanization of West Pakistan is established by a broad coincidence between the incidence of urban population and the density of total population (see K.U. Kureishy, *Urban Development in West Pakistan.* (London : University of London, unpublished Ph. D. Thesis, 1957) figs.48-49.

cultivable land. The —40 isopleth passes to the north of Peshawar, and, therefore, most of the plain areas of the province come under arid type of climate of Thornthwaite's classification.

In Punjab and Bahawalpur, the differences were also significant and there was a bad fit, though not very bad (Table 5). The distorting factor in the case of Punjab was aridity, to the exclusion of infertility of land. The aridity was operative in parts of the Punjab other than the northern sub-montane districts and the riverain tracts.

The differences were significant at .50 level of significance in Sind and Karachi. The .50 level of significance is a critical level at which the fit though not bad, as it was in Baluchistan, N.W.F.P. and Punjab, was a very weak one. Even this very weak fit in Sind and Karachi in its comparison to the bad or no fit in Punjab and Bahawalpur is noteworthy. In both the Provinces the Indus plain is broadly of homogeneous fertility. The aridity is less pronounced in Punjab than in Sind. But, as explained earlier, the rate of change of aridity per unit distance in Sind is less pronounced than in Punjab. It seems to suggest that aridity becomes less operative as a distorting factor in Sind, where its rate of change per unit distance is less pronounced.

The availability of water through canal irrigation to parts of N.W.F.P. most of Punjab, parts of Bahawalpur, and a sizable tract on both sides of the Indus in Sind largely obviated the influence of aridity as a distorting factor in these areas by 1961. The practice of *karez* irrigation in parts of Baluchistan during the period 1901—1961 has also tended to obviate the distorting influence of aridity in town size frequencies, although to a lesser extent than in Punjab and Sind.

In 1961, the differences are insignificant at .70 level of significance in Baluchistan (Table 6), signifying a good fit, though not very good. The fertility of land remaining more or less the same as it was in 1901, the effect of aridity as a distorting element has now been considerably obviated.

In N.W.F.P. the differences are significant at .20 level of significance, showing a bad fit though not as bad a fit as in 1901.

In Punjab (and Bahawalpur) and Sind (and Karachi) a remarkable improvement in the town size frequencies is noticeable. The differences are insignificant at .90 level of significance in both Punjab (and Bahawalpur) and Sind (and Karachi), signifying a good fit.

Conclusions

On the basis of the remarkable improvement in the town size frequencies of West Pakistan, notably the Indus plain, with the advent of canal irrigation and its extension over the period 1901—1961, it can be safely argued that the future extention of irrigation in these plains will further accentuate the process of improvement, to the practical elimination of the effect of aridity as a distorting factor, provided that:

1) The ameliorating influence of irrigation on town size frequencies in the region of study, with a dominant agrarian basis of urbanization, is not allowed seriously to be marred by salinization and water-logging.

2) The growth rates of towns, by size classes, are stable.

The deduction that there is an increasing tendency in the region of study of a closer approximation between the actual and the theoretically computed town size frequencies, seems to be full of meaning for future urban planning. The urban size classes have their distinctive characteristics and the resultant specialised problems, which shall have to be carefully studied for future planning.

A COMPARISON OF ALLUVIAL FANS IN WEST PAKISTAN AND THE UNITED STATES[1]

ROBERT L. ANSTEY

ALLUVIAL fans have been defined as sector-shaped features, consisting of rock debris washed out of parent highlands and deposited at the mouths of canyons emptying into wider valleys. Because of their relatively gentle slopes, good drainage and sorted composition material, alluvial fans are frequently used for roads, sites for urban development, agriculture, etc., especially in desert regions where the playa is too soft and saline, and the mountains are too steep and composed of materials that are too hard for these purposes.

Quantification of landform measurement and description, essential to frequency of occurrence determinations, has not been previously conducted over large areas or for a single type of landform. Numerous pilot studies have been made to test quantification techniques or theories, but these have treated very small areas. This statement is a summary of findings obtained from field surveys and map research to quantify alluvial fan characteristics in two areas, each containing approximately 20,000 square miles.

Research Methods

Research was conducted by the writer 1) to measure, quantify, and show the frequency of occurrence of the physical characteristics of alluvial fans, 2) to determine their areal distribution, and 3) to compare the facts obtained for alluvial fans in similar climates and physiographic regions in West Pakistan and in southwestern United States. The two most important environmental factors in the development of alluvial fans are 1) the amount and intensity of rainfall, and 2) the type of terrain on which that rain falls. The folded-faulted terrain in the Basin and Ranges region (Mojave Desert) of the United States is quite similar to that of the Baluchistan Group of mountains in West Pakistan. The mean annual rainfall in the Mojave Desert varies from 1.6 to 10 inches; in Baluchistan it varies from 1.4 to 11 inches, but more than three-fourths of the area has closely analogous climatic conditions.

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[1]This paper reports research undertaken at the U. S. Army Natick (Mass) Laboratories, and has been assigned No. Tp-33 in the series of paper is approved for publication. The findings in this report are not to be construed as an official Department of the Army position.

Sincere appreciation is extended to Drs. K.S. Ahmad, M. K. Elahi, and Mr. A. Abbassi, of the Department of Geography, University of the Panjab, for their assistance in this study.

*Dr. Anstey is associated with Natic Laboratories, Masschusetts, U.S.A.

Every identifiable alluvial fan detected on small scale (1:250,000) hypsometric maps covering the study areas, were measured on the corresponding large scale (1:62,500) topographic maps. A total of four degree quadrangles (1° Latitude × 1° Longitude) were investigated, two in each region. Unfortunately, identifiable alluvial fans were not found on the available map coverage for several of the other degree-quadrangles size areas in West Pakistan. A reconnaissance of selected sites in these areas disclosed 1) large alluvial landforms of questionable classification, and 2) distinct alluvial fans too small and too numerous to map at scale 1:62,500.

The alluvial fan is indicated on a topographic sheet by contour lines which curve or bend downstream. Contour lines along stream channels or in valleys bend upstream. In the mountain canyon the contour lines bend upstream but at the apex of the fan near the mouth of the same canyon, they will bend downstream, indicating a levelling of the gradient in the mountain drainage at that point. The spacing of contour lines increases gradually downslope on the fan, but usually, on the apron or fan outskirt, these lines are widely spaced or may not be shown by any symbol if the contour interval is too great. Where underlying pediment surfaces are exposed, or where talus covers the alluvium the contour line is frequently irregular or may bend sharply upstream or downstream at these points. The alluvial fan frequently has a stream or intermittent stream channel indicated at or new mid point on the contour arcs. A backwasting slope, which may be shown on a topographic map by a series of downslope arcs, will not have a stream channel.

Where the topographic sheet has a contour interval of forty feet or less, nearly all alluvial fans will be shown by their characteristic shape in the contour symbolization; and where the interval is ten feet or less, nearly all of the physical characteristics of the fans will be shown. The use of hatchures, form lines or shading to show landforms on a map precludes the interpretation of their individual, physical characteristics unless these symbols are accurately plotted and based on field measurements. Even with closely spaced contour lines, some maps are difficult to read because of careless drafting or insufficient datum points for the cartographer to determine the nature and dimensions of the landform to be portrayed.

Classification

Alluvial fans shown on topographic maps may be classified by size. Small fans have shallow distributaries, are steep and usually less than 3500 feet in radius. Medium-size fans are deeply trenched, and may have old fan surfaces isolated between active distributaries. These fans are usually two-thirds of a mile to three

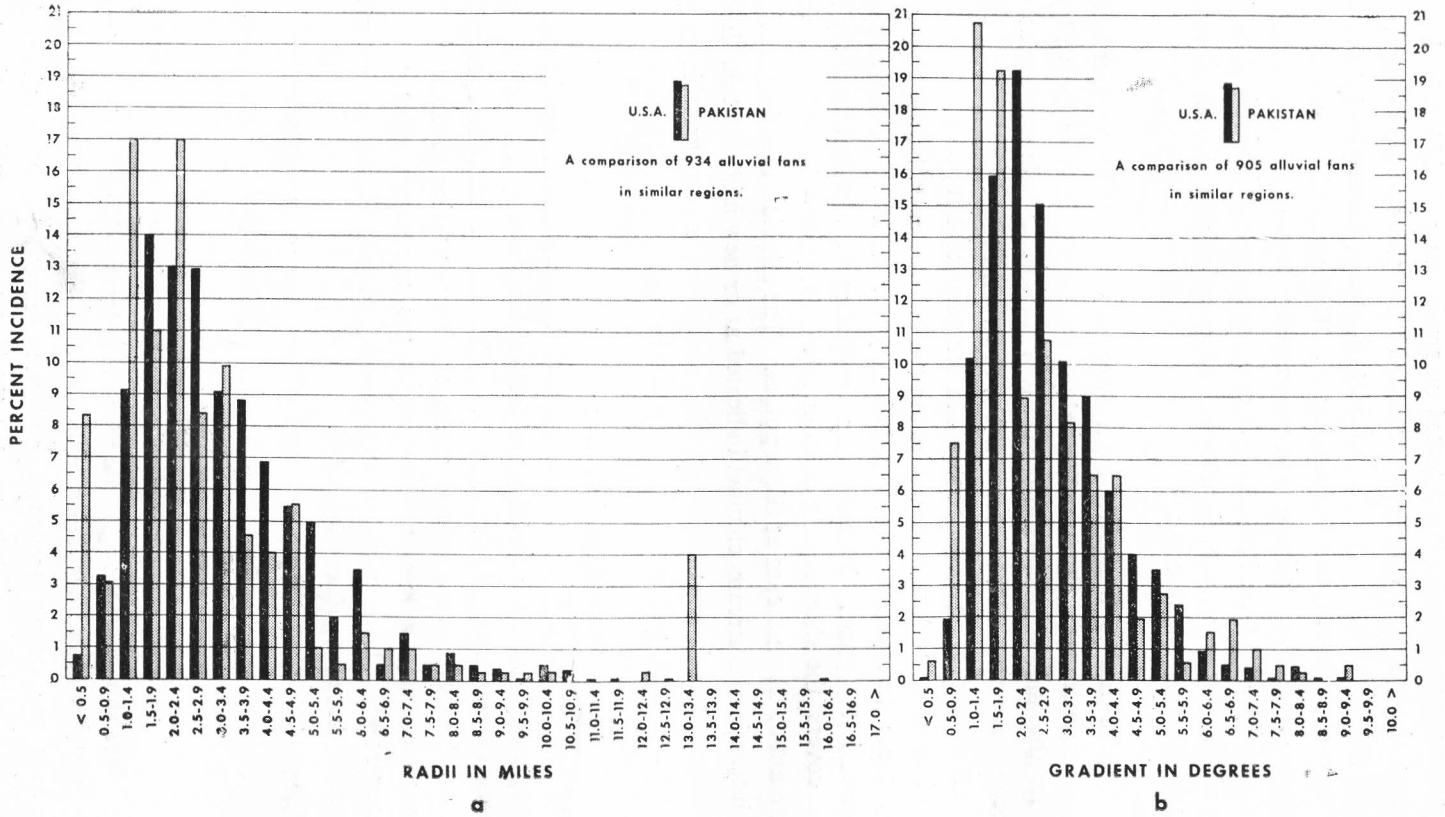

FIGURE 1. The formulas for calculating the gradient in degrees and the plan radii are :

$$\text{Gradient in degrees} = \frac{\text{Relief in feet}}{\text{Length or radii in miles}} \times .1085227272$$

$$\text{The plan radii} = \frac{\text{Slope distance}}{\text{Cosine slope angle}}$$

miles in radius. Large fans, greater than three miles in radius, are widely trenched, may contain inselbergs, and may extend back to the watershed boundary. Other studies, however, have found alluvial fans with a radius of forty or more miles.

In West Pakistan a total of 346 large alluvial fans were identified and measured on 32 topographic sheets in two degree-quadrangles (an average of 10.8 alluvial fans per topographic sheet, scale 1:62,500). Only twenty-nine small and medium-size fans were measured in this study. An average of 173 large fans were found in each degree-quadrangle. However, numerous other small fans were noted during the field investigation and on aerial photographs which could not be positively identified on one inch to one mile scale maps. The 317 large fans in this region exhibited physical characteristics analogous to those studied in the United States desert.

Physical Characteristics

Gradients of 90 per cent of the measured alluvial fans in West Pakistan were 4.5° or less, and 40 per cent were between 1° and 2° (Fig. 1b). As in south-western United States, the upper surfaces of the alluvial fans, or fan mesas, were not steep, but the sides of dry washes at the base of these features or near their apices may be vertical cliffs.

The maximum radii of 90 per cent of the measured fans in West Pakistan were 4.5 miles or less, and 45 per cent were between 1 mile and 2.5 miles (Fig. 1 a). On the Afghanistan-Pakistan border north of Nushki, 12 fan slopes were estimated to be 13.3 miles in maximum radius, and may actually be longer, but accurate delineation of slope termini could not be made in Afghanistan. Some alluvial fans in this region may have much greater radli than those measured. A larger sample would probably extend the incidence of extreme values. For example, longer fans may be identified in the Chagai region west of Nushki. A great proportion of the landforms on the west flank of the Tabina Plateau extending to the floor of the Dasht-i-Margo are alluvial plains, however, rather than fans, and some of these features may be class fied as backwasting slopes.

Only 11 of the true alluvial fans in the 317 large fan sample were more than 4.5 miles in width. Approximately fifty per cent of all the fans measured were between one mile and two miles in width. The alluvial fans in West Pakistan were less frequently coalesced than those in southwestern United States, and therefore width data could be obtained more readily. The indistinct delineation of landforms on the maps used, however, impose a possible error of 0.1 to 0.3 mile in these measurements.

No pattern of incidence of alluvial fans could be found from an analysis of the thirty-two individual fifteen minute topographic sheets included in the two

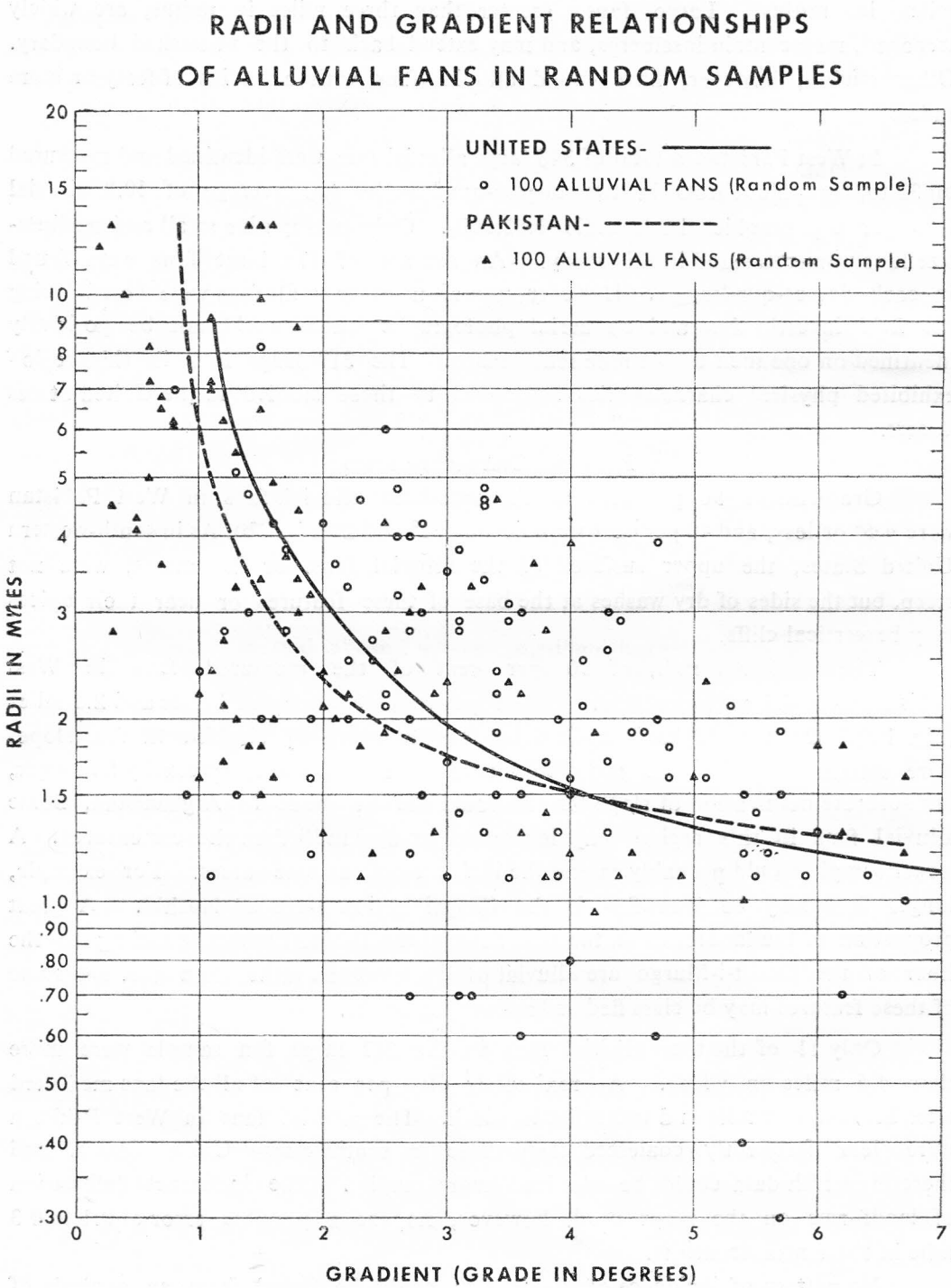
RADII AND GRADIENT RELATIONSHIPS
OF ALLUVIAL FANS IN RANDOM SAMPLES
UNITED STATES-
100 ALLUVIAL FANS (Random Sample)
PAKISTAN-
100 ALLUVIAL FANS (Random Sample)
RADII IN MILES
20
15
10
9
8
7
6
5
4
3
2
1.5
1.0
.90
.80
.70
.60
.50
.40
.30
0
1
2
3
4
5
6
7
GRADIENT (GRADE IN DEGREES)

FIGURE 2

degree-quadrangles investigated in West Pakistan. The greatest number of fans identified on any of these sheets was thirty-eight (sheet K-10) and the next greatest number was twenty-three on an adjoining sheet (K-11). Three sheets covering other parts of this quadrangle showed three fans each, and three showed five fans.

Comparability of the two Regions

In order to test the comparability of the alluvial fans in southwest United States with those in West Pakistan a random sample of 100 fans in each of these regionswas evaluated (Fig.2). It was noted that approximately seventy per cent of all alluvial fans in the samples were from one to five miles in length and had gradients from one to five degrees in both regions. Some alluvial fans in United States deserts were shorter than those in West Pakistan, but more gentle gradients were noted in West Pakistan at all lengths. In the two 100 landform samples, West Pakistan had nineteen alluvial fans longer than six miles, United States had three. The United States sample had ten alluvial fans with less than two miles radius, the sample for West Pakistan had two. The United States sample had seventeen alluvial fans with gradients greater than five degrees, West Pakistan had ten ; but the West Pakistan sample had seventeen alluvial fans with gradients less than one degree, the United States sample had three. In general, these regional differences were not statistically significant.

Alluvial fans occupy 31.4 per cent of southwestern United States deserts. However, in smaller areas these features dominate the landscape. It is estimated that alluvial fans occupy less than two per cent of the West Pakistan deserts.

A total of 408 large alluvial fans were identified on 32 topographic sheets in two degree-quadrangles (an average of 11.4 per topographic sheet) in southwestern United States. The major difference in the comparative study was the number of middle and small size fans measured in the United States, namely 704 and 506 respectively. The latter could not be considered in the comparison because of the relatively small sample obtained in West Pakistan. An average of 194 large fans per degree quadrangle were found. The largest number of fans of all sizes identified on a single one inch to one mile sheet in this study was 116.

Agreement was close between the total gradients (difference in elevation of the highest and lowest points on an alluvial fan, divided by the horizontal distance between these points, multiplied by 100 to find precentage) found in the two regions. Approximately three quarters (296) of the large fans had gradients between 1.5° and 3.5°. The greatest angular measurement found for an entire fan was 9.0° in these sample studies in the United States. It is recognized that much steeper slopes are found in small areas within the fan itself. Surface angles greater than 5.0° are characteristic of the upper half of small alluvial fans.

Although the United States sample contained some large, but questionable, landforms that could not be verified in the field, 277 fans were found to be three miles or more in length, only 55 fans were longer than 5.9 miles. The longest landform in this group, over sixteen miles, may be more properly classified as an "alluvial plain". Measured radii show definite deformation to the right or left on medium or large-size fans. Where only one radius is short, an old raised fan surface will be found on that side. Where radii are of the same length, the fan is frequently in the medium or small category. In many instances the actual radial distance is almost impossible to determine because of aeolian deposition or highly irregular deposition which leaves a thin serrated apron pattern which may change shape with each wind storm or flash flood.

The number of coalesced alluvial fans in the sample taken from southwestern United States precluded a determination of true width data for these landforms. Coalesced fans are narrow, bordered by wide washes on either side, and are highly irregular due to the meandering of these washes resulting in a variety of widths.

Conclusions

From the reconnaissance surveys in both regions, it was noted that alluvial fans are valley features rather than mountain features they depend upon the relief obtained with low mountain elevation for their greatest development, and upon the type of material and erosion within the tributary mountain valleys and drainage basins for their specific material constituency and growth. Alluvial fans are usually *not* found ; 1) in high mountains, especially those that are deeply dissected ; 2) on the floors of large valleys which are covered with dunes or lava fields ; 3) in well-developed drainage or in large washes ; 4) in very low relief ; 5) in areas with large water bodies ; or 6) in places with numerous small hills of insufficient height for alluvial fan development.

The results reported above require verification by additional research on alluvial fans in other desert areas, and on the relationships between climatic factors and alluvial fan development in various types of rock. Specific studies of individual alluvial fans, especially those which relate these features to the structure and form of the parent mountain mass, the gradient of the stream bed in the mountains, the relief of the mountain front, and the length of this front, should be conducted. The frequency of incidence of alluvial fans in given areas should be investigated together with the per cent of incidence of critical features (such as cliffs, deep ditches, pot-holes, boulder trains, etc.) in these areas. Further investigations of the alluvial fans included in the present study areas, particularly studies of micro-relief, will be a welcomed contribution to the state of knowledge in this field.

SETTLEMENT PATTERN AND HOUSE-TYPES IN CHITRAL STATE

ISRAR-UD-DIN

"HUMAN establishments add colour to the land-scape," says la Balache[1]. A settlement or '*abadi*' in Chitral often surrounded by luxuriant fruit and shade trees, presents a startling contrast to the barren and dry rock of the counrty. Water is a primary need of man kind. In a region of low rainfall, therefore, water availability must be of primary importance in the establishment of settlements. Most settlements are found on the alluvial fans, or on certain elevated river-terraces, where soil fertility coincides with easily available water. Villages are also located in the beds of abandoned river courses where similar conditions obtain, as, for example, in Sargooz, Jinal Koch, Rooji and Scen. But vast tracts of land are uninhabited. This is due in part to social and economic, but more especially to adverse physical factors. The country is extremely rugged and mountainous and many valleys, which are occupied by huge glaciers, are uninhabitable. Certain glaciated valleys such as Ziwar gol, Uzhnu gol, Shah Jinali, and Lonkuh gol (Fig. 1), although potentially habitable in the lower parts, remain devoid of population. Apart from a distaste for the cold climate, there is a marked cultural resistance expressed in current superstitions about the glaciers being the abode of demons and fairies. The once settled and prosperous valley of Ziwar, abandoned in the latter half of the eighteenth century because of glacial advance, is once again inhabitable. However, because of the tradition that 'an area once abandoned is not to be resettled', people hesitate to return. In contrast with the majority of the uninhabitable areas mentioned above, there are those which have fertile soil, but are at present unsettled because of precarious conditions of water supply.

"Settlement distribution reminds one of a wave washing the mountain side, sometimes high, sometimes low..... There is a reflection of society's needs at any one point of time"[3]. In Chitral 'the wave' has reached 12,000 feet contour line at Baroghil, during the last thirty years or so. Before that, the Baroghil area was

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[1]V. de la Balache, *Principles of Human Geography* (London : 1926), p.271.

[2]For details see Israr ud-Din, *A Social Geography of Chitral State* (London : unpublished M.A. Thesis, London School of Economics), pp. 13-16 and 189-191.

[3]E. Jones, *Human Geography* (London Chatto and Windues, 1965), p. 116.

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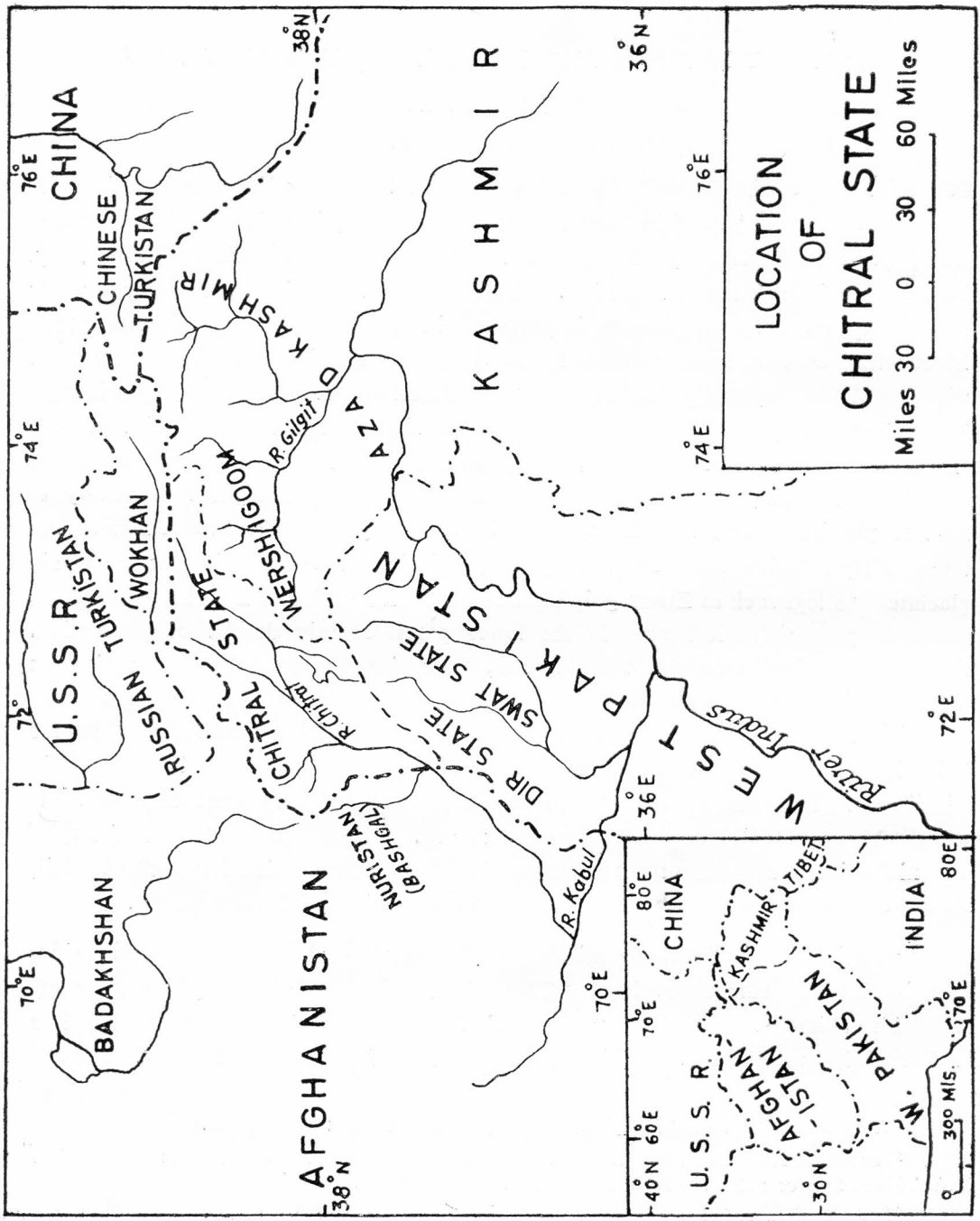

FIGURE 1

used only as a summer pasture by the Wokhis who later started settling there permanently. Similarly, Gobor, Shiekhan Deh in Bumborat, and Shiekhan Deh in

Rumboor valleys (Fig. 2) which lie between 9,000 and 11,500 feet, have been settled during the last seventy years. Due to the forceful conversion of the Bashgali tribe or Red Kafirs of Kafiistan by the Amir of Afghanistan in the 1890s, many Bagshalis immigrated to Chitral. The above-mentioned areas were given to this tribe by the then ruler. As these areas have rich pastures and are very near to their original home valleys, so they made a natural choice for the tribe to settle.

In contrast to these settled areas, the village of Madaklasht (9,000 ft.) for example, inhabited by the Badakhshi, is about two hundred years old. Introduced as blacksmiths and gunsmiths to the royal house in the second half of the eighteenth century, they, according to traditions, were offered any territory they wished. They chose to occupy this village. The explanation for the choice of such an isolated area at such an altitude among hundreds of other better places, probably lies in the fact that the tribe belongs to the Ismailia Sect of Islam. The other tribes surrounding them in lower Chitral were either *Sunni* Muslims or Kalash Kafirs. The appeal of such a place hence lay solely in its isolation. Naturally, a description and possible explanation of the pattern of settlements and house types in the Chitral State needs to be attempted.

Location and Site of Settlements

Settlements are generally sited on the raised side of alluvial fans. One reason for this is that the *Kareez* type of soil, unsuitable for crops, often occurs there. Another reason is that the roads mostly run along the river banks and the people generally avoid settling alongside them. They prefer, for privacy's sake, to build their houses one or two miles distant from roads, water availability permitting.

Hill torrents and streams are also important determining factors, several being avoided because of their proneness to flooding. The banks of deeper and less dangerous streams are, on the other hand, favoured sites for settlements. Examples of the former are found in Hon-deh and Denin in Chitral, and Gromal and Langa in Drosh. Examples of the latter are found throughout the state.

Apart from such considerations of a physical nature, there are also social and economic factors in settlement foundation and location. Thus individual dwellings and hamlets are often found by the cultivated fields. From place name evidence and ties of kinship, it is evident that many such settlements are due to the increase in population on older raised sites. Another reason lies in the land tenure system which prevailed in Chitral before the reforms in 1953. Before this date most village lands were regarded as the state property. The *Mehtar* (ruler

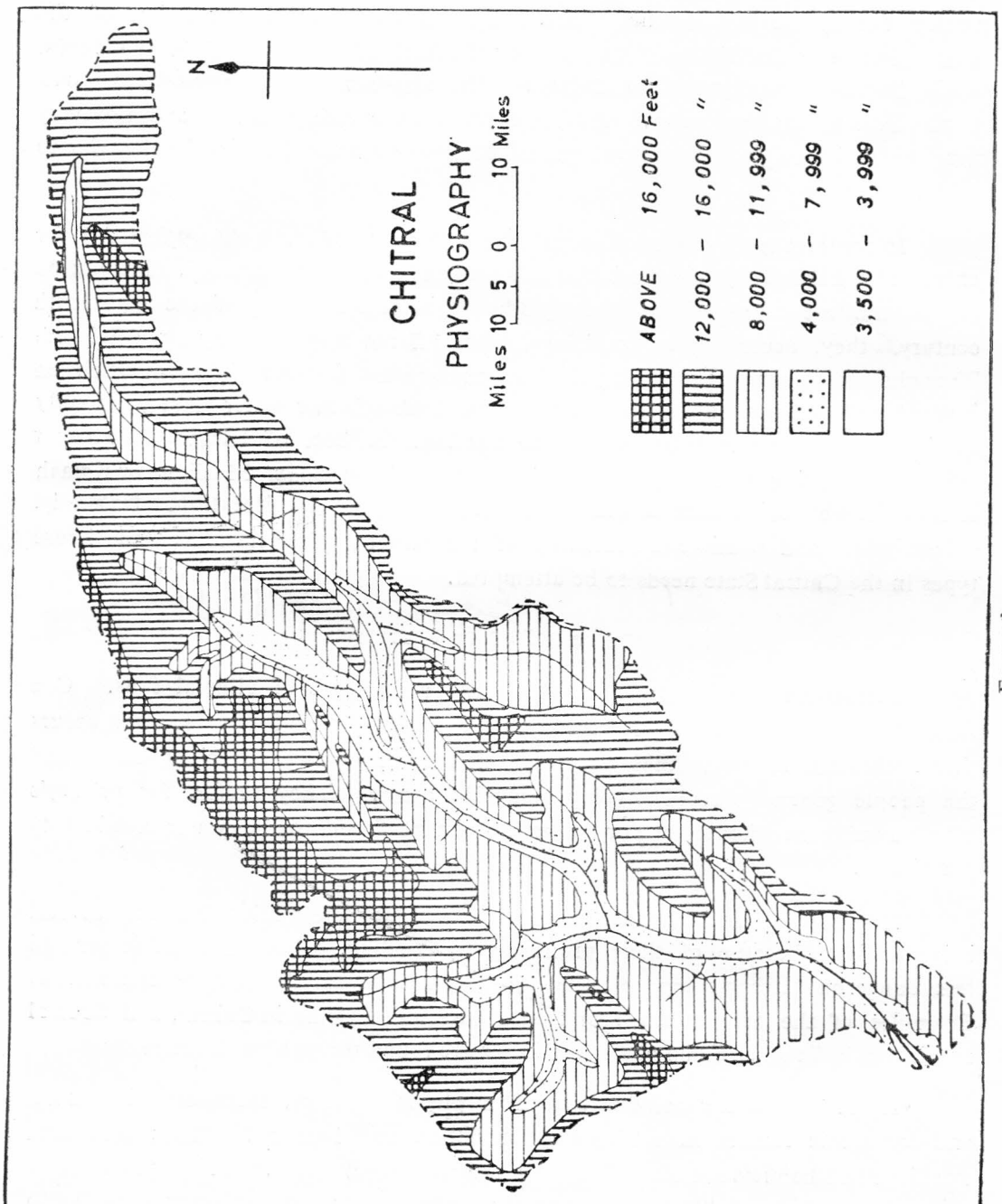

FIGURE 2

of the State), having supreme power, had the authority to seize and grant at will. In this way, his favourites were given tracts of village land, where they settled and

surrounded themselves with a number of agricultural labourers or tenants and their relatives.

The inheritance system prevalent in the country also plays an important role in this respect. Because of this system the holdings of villagers are scattered in fragmented pieces of different sizes. Many who inherit land in distant parts prefer to settle near their holdings.

In Mulikhow *teshil*, fertile terraces and gentle sloping nature of the eastern side of the Mulikhow-Tirich divide have made it possible to locate settlement there. Settlement growth, however, started on the valley floor but the increase in population has impelled the settlers upward alongside the streams arising from springs. The avoidance of landslip is a secondary factor in this movement. In the villages Kosht, Kusham, Sahrt, and Madak this pattern also results from seasonal transhumance, several families having houses at both levels (Fig. 3).

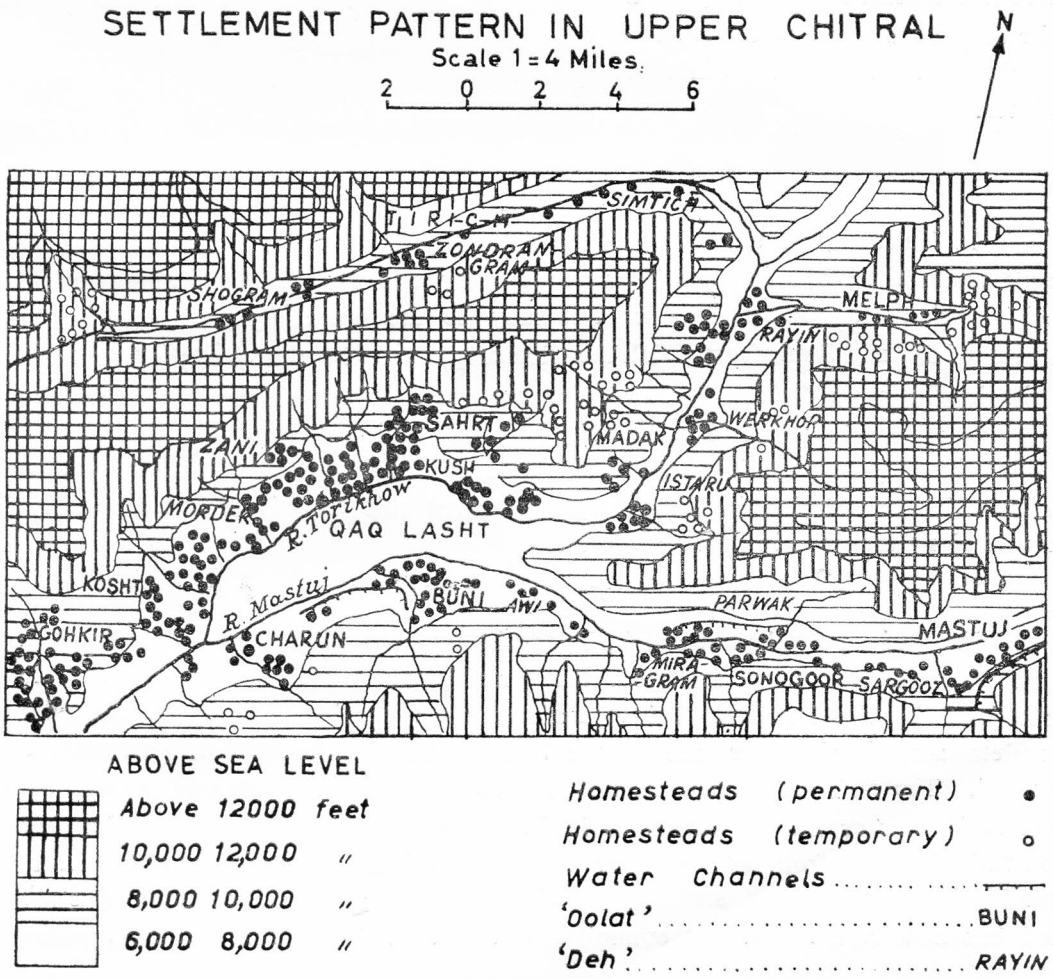

FIGURE 3

The Kalash tribesmen build their houses on hill-sides to gain space for cultivable areas. Defence was probably as important a factor in the past because, until about a hundred years ago, there was a constant threat of attacks on the Kalash valleys from the valleys of Kafristan (now Nuristan in Afghanistan) by the Red Kafirs (Fig. 4).

The Wokhi of the Baroghil area live in scattered dwellings and site their houses with a view to shelter from the cold northern winds of winter.

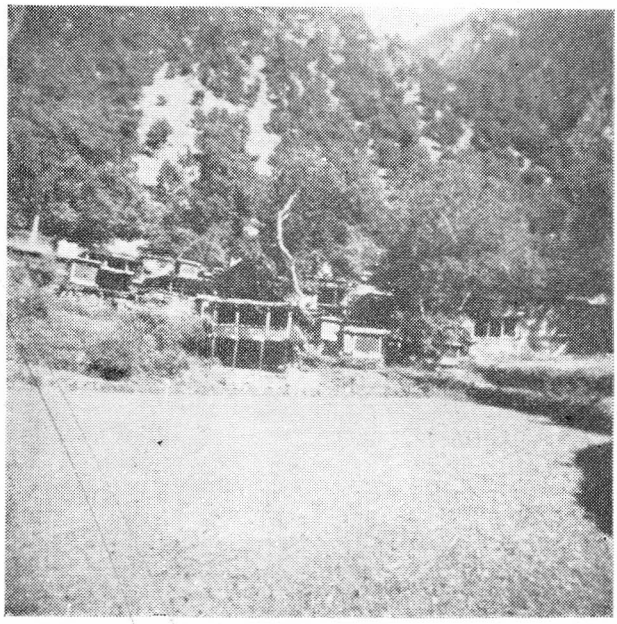

FIGURE 4 : Kalash Houses in Bumborat

In Hairan Kot, the only wholly Pathan area in Chitral town, houses are built along the slope in such a way that every one has his door almost on his neighbour's roof. One reason for this may be the prevailing traditions in the States of Dir and Swat, from which the tribe originates, where most of the houses are built in the same fashion for defence purposes. Inter-village feuds between different tribes, in tribal line, is quite frequent and lead to producing the compact settlements which are special features of most of the Pathan lands. The Pathan tribe which has settled in Chitral has preserved this traditional idea of building houses along the slope in nucleated form.

SETTLEMENT PATTERN

Except in the valleys of Damil, Upper Ashrat, and Melph, and the Baroghil area where dwellings are scattered, the general pattern of settlement in the whole state is of dispersed hamlets. This type of settlement consists of a main site with hamlets spread all over the village lands. Thus three distinct patterns are created. The main settlement unit is the *oolat* or village. *Oolats* are situated on alluvial fans or on hill slopes as in Mulikhow *tehsil* (see Fig. 3). They are generally isolated from one another by such physical boundaries as water-sheds, interlocking spurs, ridges and rivers. An *oolat* possesses a common pasture and has a village *Kamati* or committee to regulate affairs. This unit is also often assessed for collecting *ushar* (taxes).

The *oolat* is divided into *deh* or *gram* and *tseq deh* (subdeh) or *dur*. *Dur*, which means homestead, is the primary unit of a settlement. It is inhabited, with a few exceptions, by the families of the same descent. In certain cases, various *durs*, are named after the families who live in them. For instance, Salan-dur and in Rach, Kuloom-dur and Batulan-dur in Kushum, Sharan-dur in Shirt, Kotalan-dur and Shikaran-dur in Zani.

A number of *tseq deh* or *dur* which form one part of the *oolat* make a *gram* or *deh*. The communal or social and economic interdependence of the people *grambeshi* or neighbourliness, as it is locally termed, is limited to this unit of the *oolat*. A mosque, in the case of *Sunni* Muslims, or a *Jamat Khana* in the case of Ismailia Muslims, is also associated with the *deh*. It is built in a central position for all the *tseq deh* and is used both for offering prayers and as a meeting place. This unit has played a remarkable role in forming the khow tribe which is an assimilation of families and clans numbering more than a hundred, and who came from "ethnologically and historically different background"[5].

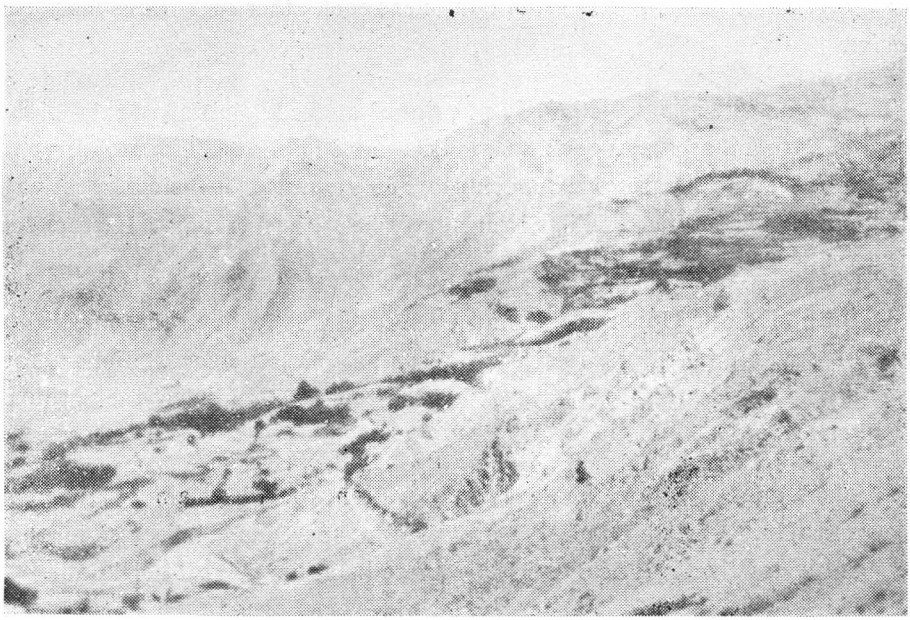

FIGURE 5 : A '*deh*' in Tirich Valley

[4]These exceptions are created by the land tenure system in the past and the inheritance system prevalent in the country. It has already been mentioned that the favourites of the rulers were granted lands in a village "where they settled and surrounded themselves with a number of agricultural labourers." But there were also many of them who preferred to settle in one of the *tseq-dehs*. Thus many *tseq-dehs* contain families more than one.

The scattered holdings are a common feature in the whole country, which is the result of the inheritance system. Many who inherit land in distant parts prefer to settle near their holdings. Then others who have holdings in the same area begin to settle and thus a considerable size of *tseq deh* grows up, inhabited by different families.

[5]G. Morgenstierns "Names, Languages and Tribes of Chitral", *Encyclopaedia of Islam*, Vol. 2 (London : New ed. 1963), p. 31.

Certain *tseq dehs* have grown into *deh* due to the increase of population in the family itself and through immigration. Many such *dehs* are named after the families who were the original inhabitants. For example Mustajapan-deh, and Qazian-deh in Chitral, Darkhanan-deh and Torian-deh in Ayun, Amirbegan-deh in Buni, Beganan-deh in Baranis, Bahrian-deh in Sahrt. The tribe Kalash used the word *ḍam* for a *deh*. Hence the *deh* of Azur-dam, Kal-dam, and Chik-dam in Drosh are of Kalash origin.

The villages in tributary valleys and on small alluvial fans differ in respect of their social and territorial organization. The whole valley is considered as a single *oolat*. Pastures are common to the whole valley and the *Kamati* is also appointed for the whole valley. Each alluvial fan or group of settlements on one piece of land is treated as *deh* and these form together a unit of *grambeshi*. *Tseq dehs* are constituted in the same way as on the larger fans, for examples Bumborat, Birir, Rumboor and Shishi Kuh valleys.

In the settlements on the smaller alluvial fans in the main valley, every fan is taken as a *gram* or *deh*. A few *gram* lying near each other on various fans are taken as an *oolat*.

The dispersed settlements briefly mentioned at the beginning of this discussion, occur in the Baroghil area and on the Damil, Upper Melph, and Upper Ashrat valleys. Here the houses stand separate from each other in the midst of their respective fields. The distance between the dwellings is most significant in this type. Factors controlling this are :

1) In the Domil, Upper Melph and Upper Ashrat valleys the marked slopes of spurs and ridges restrict the spread of settlement. Forests found in abundance in the Domil and Ashrat valleys, also hinder the grouping of settlements.

2) The scanty areas available for cultivation, in the Damil, Upper Ashrat and Upper Melph valleys, are so far apart and inaccessible that each cultivator lives on his own land, remote from his nearest neighbour.

3) Dispersed settlement in the Baroghil area, a region of recent immigration as mentioned earlier, results from the pastoral nature of the economy (Fig. 6).

House-Types and Plans

In an area where human needs are so limited that one cannot conceive of any other considerations except a shelter to house oneself and one's animal and to treasure whatever odd belongings one has, one can hardly expect great

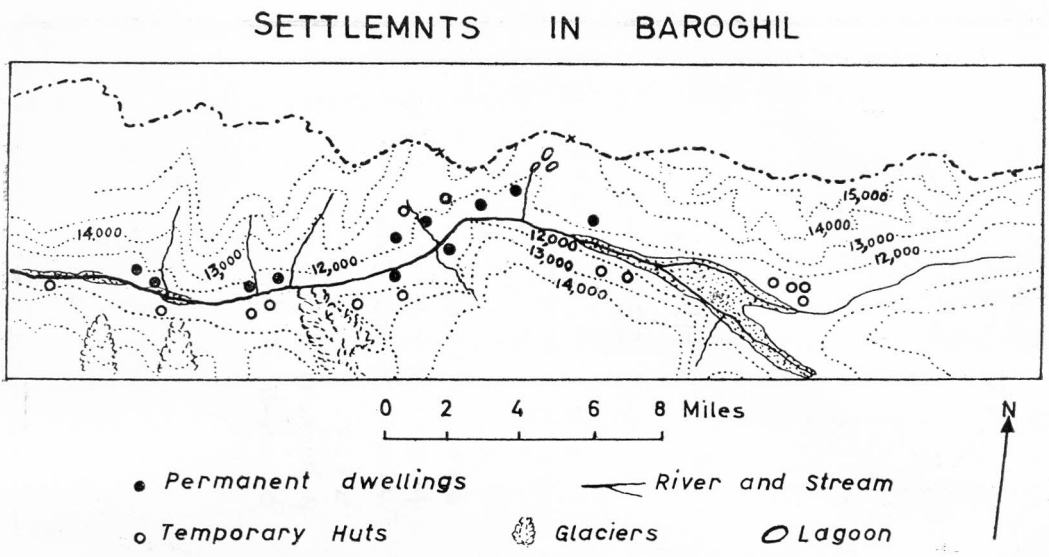

FIGURE 6

architectural style. So instead of looking for sophisticated features, one must see such houses in their natural context. These houses, which are in the real sense of the word the product of their surroundings, are moulded according to the local needs and requirements. It is this "representative type of a region" which interests a geographer most of all.[6]

In Chitral all houses are built on the same principle. They are square, with flat and overhanging roofs which have smoke-holes called *Koomal*. However, because of local needs for social and traditional reasons and because of economic and physical conditions, more than one type of house is to be found in Chitral. The main types are : 1) The 'Khowar Khattan' type, 2) The Kalash or Half-timbered type, 3) The Bashgali type (Fig. 7), and 4) The 'Doogoor or bothie' type.

Khowar Khattan or 'Baipash'

This type has its origin among the Khow tribe which forms the majority of the population throughout the country. At present it is not only common among the Khow but also in various other tribes. The special characteristics of this house is that a low bulge is created in the roof by building up beams of the roof crosswise to form an octagon shape. An orifice or *Koomal*, about two feet in diameter, is left open in the type of this bulge as a sky-light which serves the

[6]J. Brumhes, *Human Geography*, trans. E.F. Row (London : George G. Harrap, 1952), p. 48.

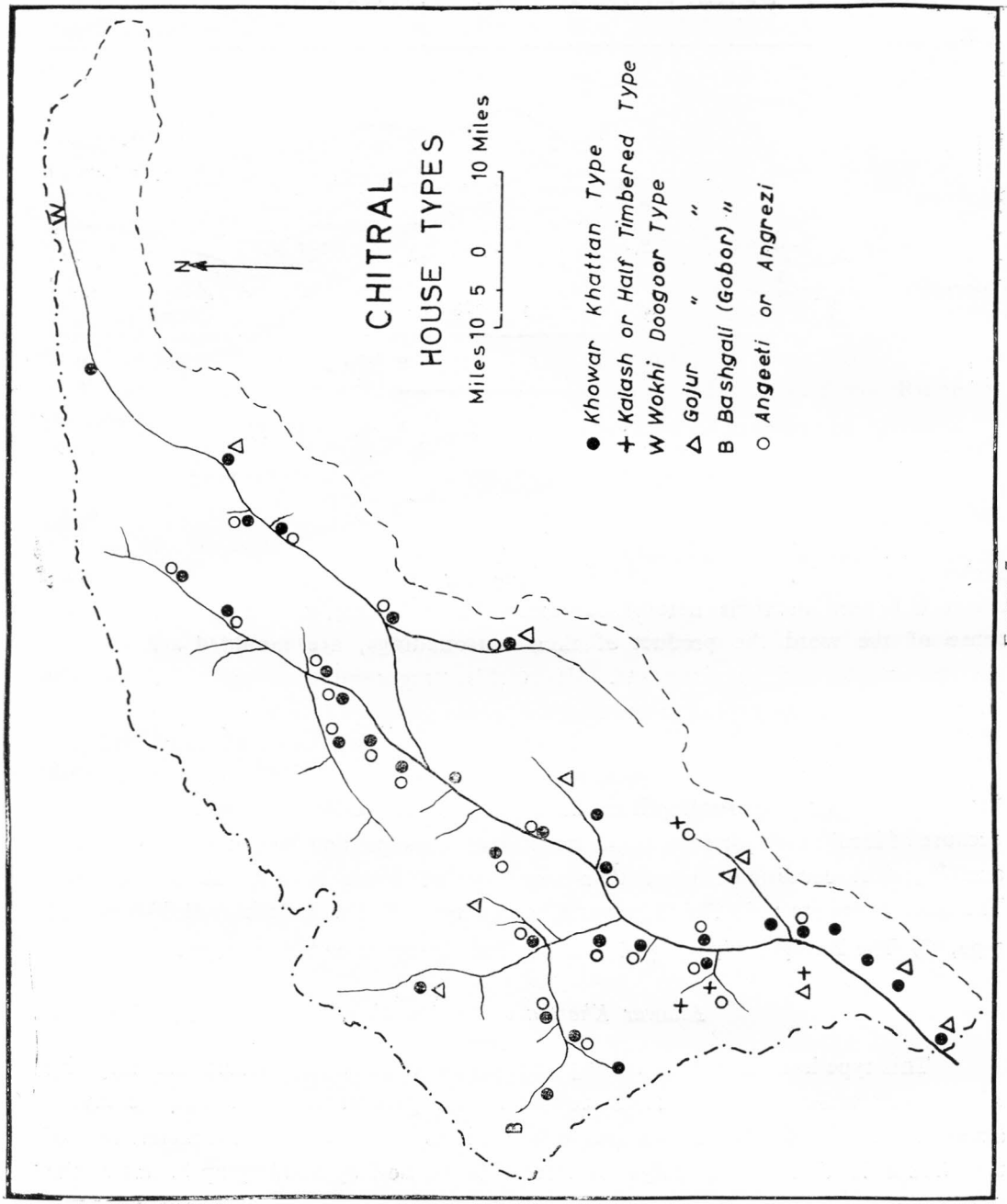

FIGURE 7

purposes of a window, ventilator and also a chimney (Fig. 8). The hearth is made immediately underneath the *Koomal.* The Gowari tribe make the *Koomal* only six or seven inches in diameter for security reasons.

Except for this bulge, the roof is almost flat and overhangs the walls to protect them from rain and melted snow. The roof plastering is done in such a manner as the rain water easily drains towards gutters, which are fixed at the edge of the roof. Wood shortage is an acute problem in most parts of the country, which forbids the use of wood for building the roof. Roofs which are, therefore, built with mud plaster, are made flat to avoid the danger of being washed away by the rain or melted snow if it is made steep.

The roofs are also used for drying maize and storing fodder. In some cases they are also used as threshing floors. This is probably the most satisfactory explanation for the building of flat roofs even in areas with abundant wood.

The hieght of a *Khowar Khattan* is normally twelve feet and the floor area is 25×20 square feet. The walls are $1\frac{1}{2}$ to 2 feet in thickness and are constructed in stone in all parts of Chitral with the exception of an area of about forty square miles in Upper Chitral (from Shogram village in Torikhow *tehsil* to Baranis village of Chitral *tehsil* where they use mainly adobe with stone foundations). The wood used in the country also varies according to its availability. In Upper Chitral and Lotkuh *tehsil* poplar is generally used as there is no other suitable wood. In other parts of Lower Chitral pine wood is used for building purposes (Fig. 9).

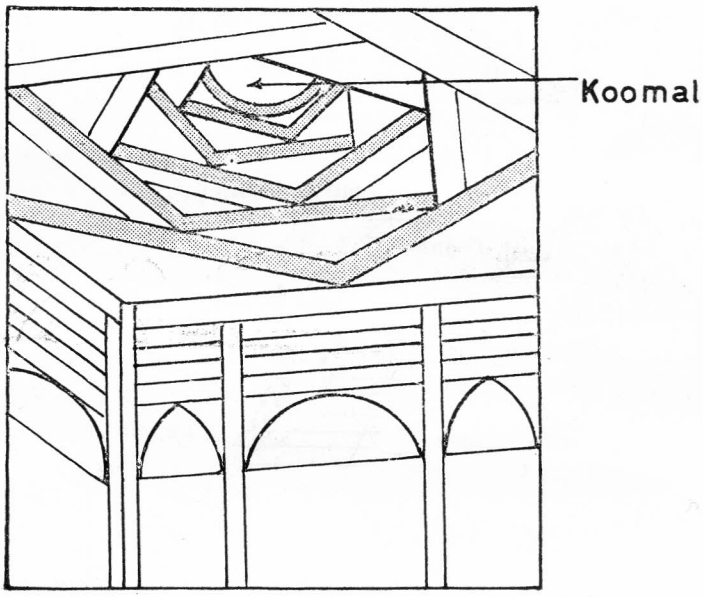

FIGURE 8

The walls and roofs are thickly plastered with straw, mixed mortar, which keeps the houses warm during the cold winter months. As during the summer months the people live outside the house in most parts of the country, so only the cold months are kept in mind while constructing this and other types of houses in the country.

Khowar Khattan is said to have originated in Upper Chitral where strong and durable wood is scarce. This problem of unavailability of strong beams has been solved by erecting four pillars in the middle of the house on which an octagon

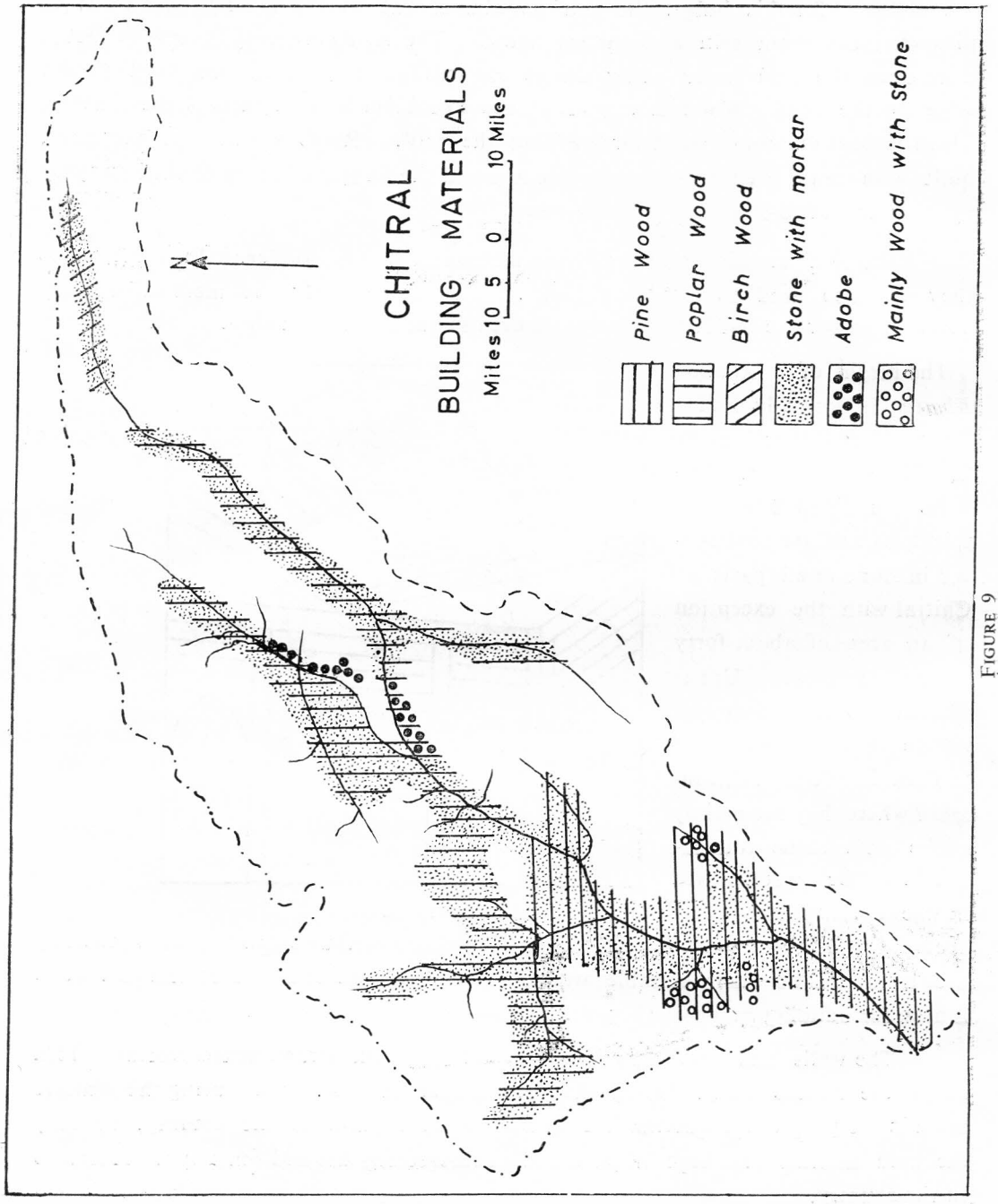

FIGURE 9

is built. This octagon, however, seems to be a later innovation and in its place it appears, from the existing primitive *Doogoor* type of houses, that the roof was built flat by placing the beams straight. This present shape proves successful

in many ways. For instance, it provides space in the house without elevating the walls or using extra material. It helps, most of all, to drain away the water to the gutter.

The spread of this house to the southern and other parts of Chitral is the result of Khow expansion in these areas after the thirteenth century.[7] Although in southern Chitral there is abundant wood, but that has not affected its structure. Moreover, the use of adobe in some parts and of stone in others also plays no part in altering its external appearance. Thus variation in building materials has not succeeded in altering a well-established house type, preserved by social and traditional factors.

The Kalash or Half-timbered type.

This type of house belongs to the Kalash tribe who live in the valleys of Bumborat, Birir and Rumboor. It is double-storeyed and is mainly made of wood. The foundation is built in stone and the remaining part of the walls is constructed in stone, with a wooden framework jointed at the corners.

Roof adjustment and plastering of roof and walls are made with the same climatic elements and social factors in mind as in the *Khowar Khattan*. No bulge in the roof is created as in the former case. Wood planks or branches with one or two beams are used for roofing and covered with small pieces of wood and grass, and plastered with mud. A balcony is also built at the level of the first storey, which is made by laying wooden planks.

The height of the whole house from the ground is about fifteen feet, out of which the upper storey, which is the living part, is ten feet high and is reached from the ground by a ladder.

The explanation of the double-storeyed nature of this type is an interesting combination of social and climatic factors. The Kalash people do not use beds but sleep on the floor. During the winter, snow and in other rainy seasons the soil gets damp and so to protect themselves from the dampness this method has been adopted.

The Bashgali type (Gobor)

This type is found in Gobor area and belongs to the Bashgali tribe living there. It is made of stone and mortar and birch or poplar wood, which is brought from other villages nearby. The roof is flat, and overhangs the walls. The distinguishing feature of these houses is that they have square or, less often,

[7] M.G. Martaza, *Nai Tarikh -i- Chitral*, Urdu (Peshawar: 1963), pp. 28-30; G. Morganstierne, *Report on a Linguistic Mission to North West India* (Oslo : 1932), p. 48.

round wicker receptacles covered with mud, called '*chakki*' or *guzzuli* used to store grain. These strange receptacles look like a jumble of chimney-pots in the top of the houses.

No other reason, except a traditional one, can be put forward as to the origin of these receptacles and their situation on the roof. The people are recent immigrants from Bashgali [8] and still continue this old practice which they followed there.

The 'Doogoor' or Bothie Type

This type can be further divided into two *a*) The Wokhi type and *b*) the Gujri type.

The Wokhi Type

This type is found in the Baroghil area which is covered with snow for more than seven months of the year. The houses are built about seven or eight feet high. Their roofs are made flat with a *koomal* or chimney-hole of nine inches in diameter. There is no other arrangement for light. The door is built only thirty inches high. The materials used are mainly stone, and birch-wood for roofing. The roof covering is done with stone-slabs and grass and manure-mixed mortar is used for plastering. The walls are also covered with manure-mixed plaster and every precaution is taken to leave no gap anywhere. Thus a Wokhi house, if seen from a distance, looks like a pile of mud.

In Susoom village of lower Chitral houses are also made in the same way because the climatic conditions are the same. Plastering, however, is done with straw-mixed mortar only. It is also used in other parts for plastering the '*Khowar Khattan*'.

Gujri type

The Gojurs are a seminomadic tribe and so in spite of inhabiting some of the well wooded valleys they live in wretched huts no better than those of their animals. The *doogoors* or *bothies* are built by piling up flat stones to make the walls, which are without any regular height or breadth. The roof, which is flat, is built by placing dried grass and pieces of wood on one or two beams and a few branches and then covered with mud. The chimney-hole in the roof is also left open. This type is found mainly in the areas where Gojur tribe lives, but occasionally seen among the Khow as well.

[8] Israrud Din; *op. cit.*, footnote 2, pp. 90-92.

Besides the types discussed above, there is the *Angeeti* type. It is also called *Angrazi* or English type of house because it was introduced in the country after the coming of the British. In this type the fireplace is placed in the wall. The roof is made flat without any *Koomal* in it and instead ventilators and windows are adjusted.

The adoption of this type is the result of the people's greater contact with the Indian sub-continent, which has increased during the last fifty years. It is now often combined with the *khowar khattan* type and is frequently selected as a guest room.

House-Plan

As may be seen from the above discussion, the problem of providing shelter has produced a varying pattern resulting from the social, ethnic and economic factors as well as from the physical and climatic conditions. But a Chitrali house is not only a shelter. It is also a workshop wherein are planned and produced several tools connected with the owner's various agricultural activities. Simultaneously, it serves as a storage-place for grains and houses both the implements and stock. A house is, says la Balache, "a pretty fair index of the mentality of its occupant."[9] Similarly, the plan and lay-out of a house is, hence, often an indication of the economic status of the occupant and of the nature of his society.

Houses are generally divided into two parts, 1) *Dur* or human section, and 2) *Shal Mudi* or animal section. These two sections are often attached to each other, though, in some cases because of certain local factors, to be described, the *Shal* or goat-houses are built separately.

The *Dur* or dwelling section in well-to-do families is divided into two parts called *andran* or interior and *beri* or exterior. The former is used by the family and the latter by guests. The two parts are enclosed by high walls which provide separate courtyards or *havailis* for each. By this not only is privacy preserved, but security from theft is also assured. These *havailis* are also made into small gardens.

The number of rooms depends on the social status and total number of the family members. On the average there are six rooms for family use, two guest rooms and four rooms for servants.

An ordinary *dur* consists of two rooms, except for the Gojur, Wokhi and Kalash tribes who have only one room and a store. The Khow are generally

[9]La Balache, *op. cit.*, footnote I, p. 270.

fond of attaching a small garden to their houses, so even with the ordinary *dur* one often finds small garden attached.

The house is entered through a verandah, but in the colder areas a *dahlenz* or closed corridor is built instead. The *Wokhi* type of houses mentioned earlier are always attached to a *dahlenz* because of the high altitude at which they are situated. The Kalash use only a verandah or a balcony. The Gojur who live mainly in the warmer southern parts of the country, use neither a verandah nor a *dahlenz*.

The *mudis* or *byres* are, except in the Kalash valleys where the whole animal section is separated, always attached to the human section of the dwelling. But the '*shal*' or goat-house in most parts of lower Chitral are built separately. A *shal* or goat-house normally includes a shed, two rooms for goats, one barn and a hut for the shepherd. A *byre* has one shed, three rooms (separately for oxen, cows and calves), and a barn. The number of rooms increases according to climate, and the economic conditions of the people. For instance, in the colder area where a long spell of cold weather and snow necessitates much storage accommodation, we find more than one barn. Those who possess large flocks have to provide more rooms.

In view of what is said above, we can distinguish two principal types of house-plans in the state. These are single houses and multiple dwellings. The former have human and animal accommodation on the same site attached to one another and the latter have either the '*Shal*' or the whole animal section on separate site.

Distribution of Single House-type.

This type of house is found in Upper Chitral. But the villages of Goboor, Siah Arkari in Lotkuh *tehsil* (Fig. 10) and Arandu villages in Drosh *tehsil*, have also the same type of houses. In Upper Chitral mainly sheep are reared and stock are accommodated in an attached animal section. Because of the long severe winters animals are fed indoors and it becomes necessary to keep them as near the house as possible so that they can be looked after properly.

The houses of Gobor and Siah Arkari villages are without separate accommodation for stock because of the long winters and for security reasons, particularly as they lie close to the border.

In Shishi Kuh the pastoralist belongs mainly to the Gojur tribe. In most cases, they live with the animals under the same roof.

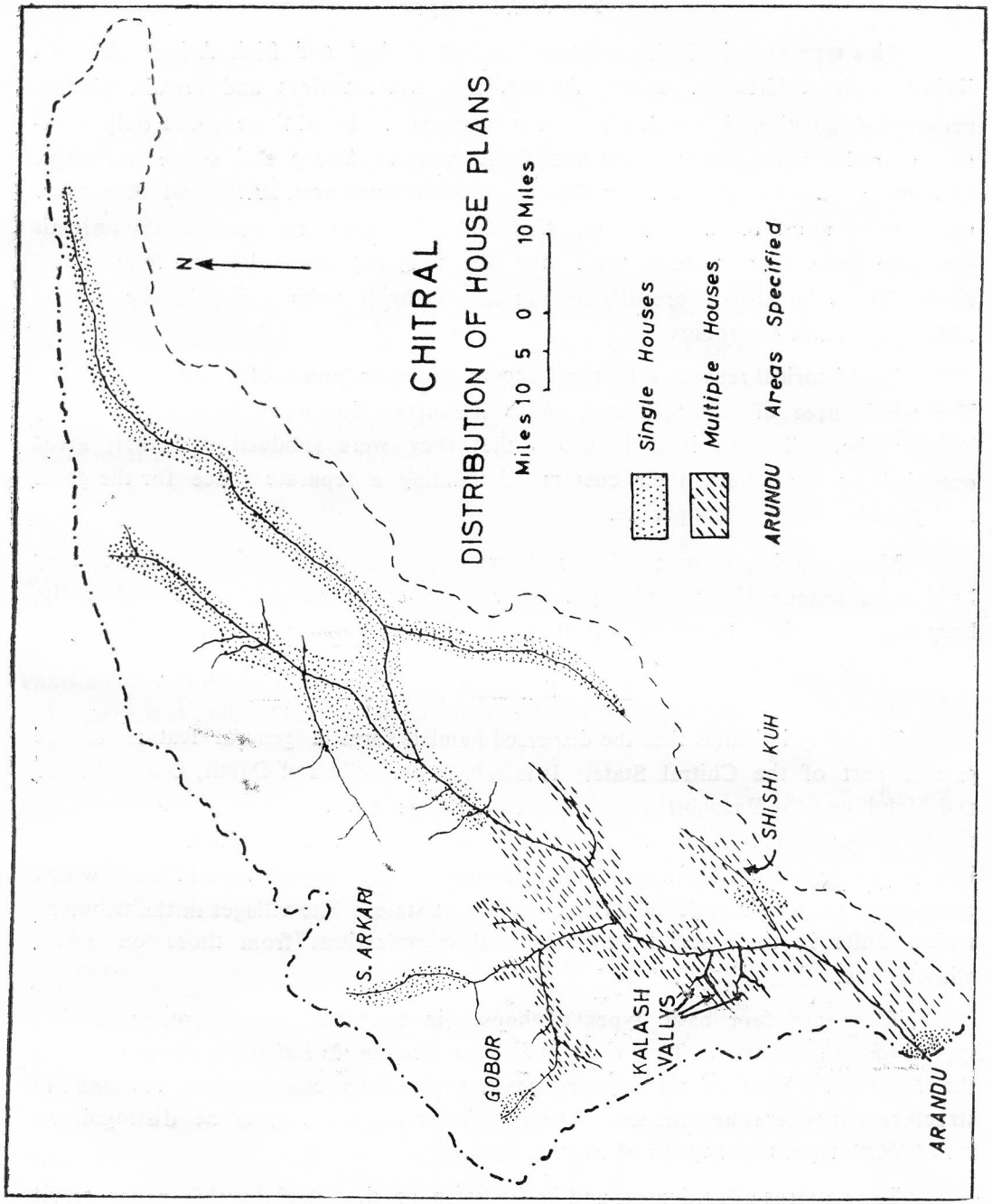

FIGURE 10

In Arandu village on the border of Afghanistan there arises the problem of theft, both from inside the village and from across the border. A number of Gojur, also live there possessing most of the livestock. Thus the social and security factors coincide here.

The Multiple Type

This type prevails in Lotkuh *tehsil* (except Gobor and Siah Arkari villages), Kalash valleys, Urtsoon, Damil, Ashrat, and Beori valleys and certain villages between Kogoozi and Drosh where they keep goats. In all these areas only goat-houses are built separate from the rest of the house. Sheep and cattle are kept, however, attached to the *dur*. In Kalash valleys of Bumborat, Birir and Rumboor, the women are forbidden to look after flocks, especially the goats, so the animals are kept away from women "lest they (the animals) would become impure and die". The same custom prevails among the Bashgali tribe living in the valleys of Bumborat and Rumboor.

For historical reasons this type occurs in other areas of southern Chitral. The whole area of lower Chitral up to Baranis or Kari was once occupied by the Kalash tribe. Though it is long ago that they were subdued and their areas occupied by the Khow, their custom of building a separate place for the goats still prevails among many people.

Many people are superstitious and are afraid of loosing their goats if they kept them among the 'people' because of 'evil-eye'. Others, more realistically, keep them away from the fields because they damage the crops.

Summary

The study indicates that the dispersed hamlets form a general feature of the greater part of the Chitral State. It is only in the valleys of Damil, Upper Ashrat and Melph and the Baroghil areas where dwellings are found to be scattered as single houses in the fields. The main settlement unit is an *oolat* which is subdivided into two hierarchal units of *deh* and *dur*. A *deh* is made up of several *durs* which constitutes the basic unit of occupance in the state. The villages in the tributary valleys differ in their social and territorial organizations from those on small alluvial fans.

There are four basic types of houses in the State which are, normally, typical of various tribes. They are : 1) *Khowar Khattan*, 2) *Kalash*, 3) *Barghali* and 4) the *Doogoor*. Each of these types possesses its own characteristic features in structure and general appearance. The *doogoor* type can further be distinguished into *Wokhi* type, *Gujri* type and *Angeeti* type.

The patterns of settlement and house types as described in this paper result from man's interaction with nature as reflected by the differences in relief, altitude, slopes scantiness of cultivable areas, inaccessibility and the pastoral nature of the economy.

THE FUTURE RELATIONSHIP BETWEEN RURAL POPULATION AND AGRICULTURE IN EAST PAKISTAN

M. AMINUL ISLAM

EAST PAKISTAN is predominantly agricultural in character and perhaps is more intensively cultivated than any other country in Monsoon Asia. The overall man and land relationship is, however, extremely significant, as East Pakistan has a total land area of 55,126 square miles and a population of 50.8 millions with a corresponding density of 922 persons per square mile according to 1961 census of population.[1] By any standard this is large population for the area, and makes East Pakistan one of the most densely populated regions of the world.

Among many other factors, high population density is a major factor in the economic development of East Pakistan. The per capita distribution of cultivated land in East Pakistan is only about 0.45 acres. The density of rural population per square mile for the whole of East Pakistan is 874; but if the rural population density per square mile of crops is taken into consideration, the corresponding figure for East Pakistan as a whole will be over 1800, which is one of the highest in the world, probably exceeded only by parts of Java, Madura and parts of South China, and the Nile Valley.

The distribution pattern of rural population is closely correlated with the uses of the land or farming types. Defining and interpreting the nature of the uneven and varied rural population densities in this part of the world presents an interesting geographical problem. Besides, there has been a phenomenal rise in the density of population over the last few decades in East Pakistan which has greatly increased the demand on the land in the predominantly rural economy of the area.

It is the purpose of this paper to study the geographical relationship that exists between the rural population and cultivated area and also to provide an understanding of the future relationship between the rural population and agriculture in East Pakistan. A knowledge of the present and projected density of rural population in relation to agriculture is desirable so that the possibility of bringing about the desired improvement in the relationship may be visualised.

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[1]Pakistan, Ministry of Home Affairs, *Population Census of Pakistan, 1961,* Vol. 2, East Pakistan; P II-11.

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Only three districts have densities above 1,200 persons per square mile (Dacca, Comilla and Noakhali) and contain about twenty-five per cent of East Pakistan's population. About half of East Pakistan's population is concentrated in seven districts which have a density from 1,000 to 1,200 persons per square mile (Fig. 1). These districts are Rangpur, Bogra, Pabna, Barisal, Mymensingh, Faridpur and Chittagong.

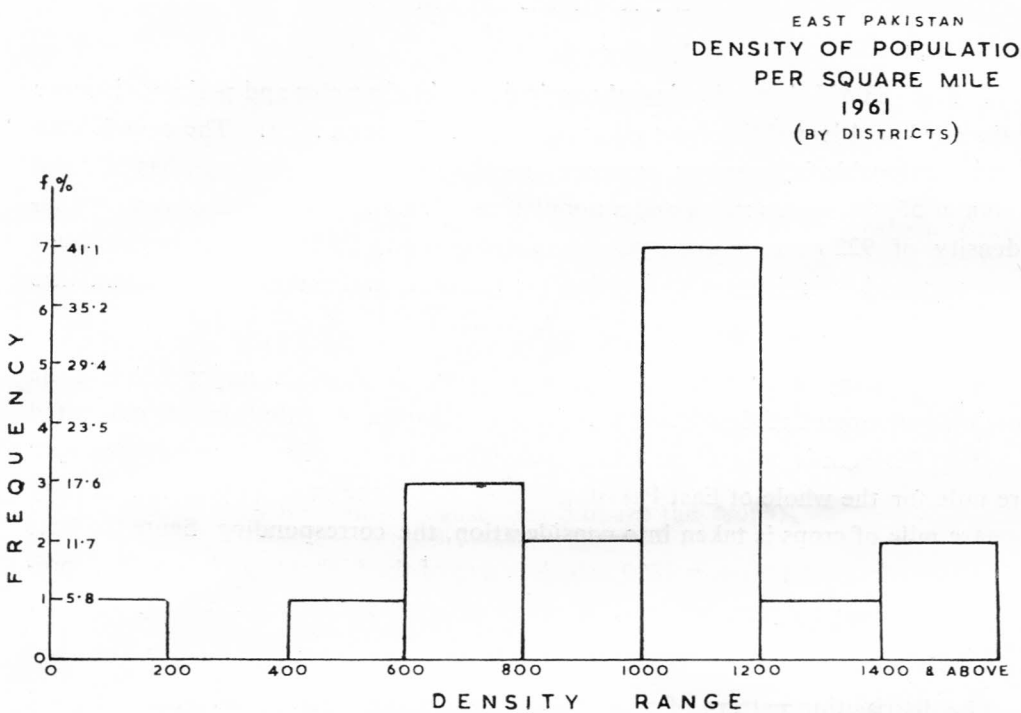

FIGURE 1

Medium densities of 800 to 1,000 persons per square mile, from East Pakistan's point of view, occur in Kushtia and Jessore districts situated in the Moribund delta region, Whereas low densities, 600-800 persons per square mile, occur in Dinajpur, Rajshahi and Sylhet districts. Khulna, with about half of its area covered with forest, has a population density of only 526 per square mile. The lowest density (76 persons per square mile) is found in the district of Chittagong Hill Tracts, a hilly forested area where migratory shifting cultivation is practiced. Indiscriminate settlement into the tribal areas is not allowed.

DISTRIBUTION OF RURAL POPULATION

Still more revealing is the concentration of rural population by *thana*[2] level. Thus, when smaller areas in East Pakistan are taken into consideration, pressure on the land is more discernible.

[2]A *thana* is a police station or a revenue unit. There are over 410 thanas in East Pakistan. The areas of thanas, for the most part, vary between 60 to 250 square miles.

In the rural population density map (Fig. 2) it is noticeable that high densities of over 1,200 persons per square mile are found in a belt between the Jamuna and the Meghna rivers, and along the main streams and their spill areas. This high population belt starting from Mymensingh and Dacca continues southward into Noakhali and Barisal districts and extends up to the northern part of the Chittagong district. Within this belt concentrations of over 1,800 persons per square mile are noticeable in addition to the urban areas where densities exceed 3,000 persons per square mile. This is a region of well inundation, intensive cropping, rice and jute farming, and has further advantage of easy cheap water transport by boats and steamers.

The area lying in between the northern bank of the Ganges and west of the Jamuna is a region of moderate to low density, especially in the further west where sandier soils and lower precipitation hinders intensive cultivation and consequently the rural population density is low. Only in the eastern parts of Rangpur, Bogra and Pabna along the Jamuna river are there densities of over 1,200 persons per square mile.

In the southwestern part along the Madhumati river in the districts of Faridpur, Kushtia and Jessore medium densities of about 1,000 persons per square mile are noticeable. In central Sylhet along the Surma and the Kushiyara rivers also medium density is noticeable.

Rural densities below the provincial average (874) are found in a number of areas here and there. These are : 1) the Madhupur Tract lying in parts of Dacca and Mymensingh districts ; this is an area of poor oxidized soils, 2) the Barind Tract, an area of old alluvium and poor soils, in the districts of Rajshahi, Dinajpur and parts of Bogra, 3) Western Kushtia and Jessore districts, an area of river decay and agricultural decadence, and 4) the heart of the Meghna Basin (eastern Mymensingh and western Sylhet) where water-logging and large depression areas are unsuitable for human habitation.

The least populated areas are found in the Chittagong Hill Tracts and in parts of reclaimed (saline) Sunderban forest areas in the Khulna district. The Sunderban forest area is not open to settlement and hence there are no permanent settlements and habitation.

The Rural Population and Cultivated Area

In East Pakistan, with limited industrial development, and only about five per cent urban population[3] the vast majority of the population is directly dependent upon the land for its livelihood.

[3] Pakistan, Ministry of Home Affairs, *op. cit.*; footnote 1, p. II-16.

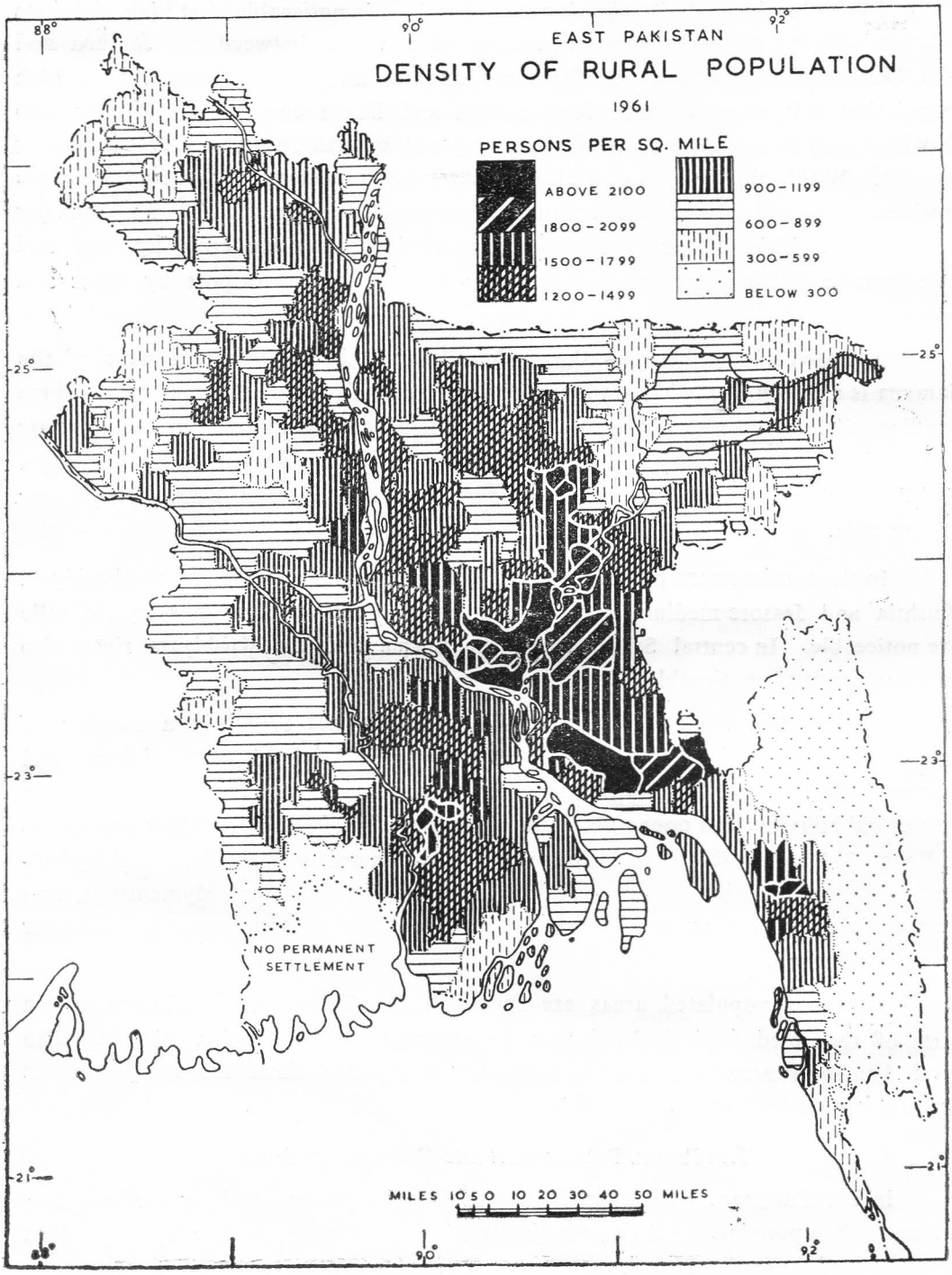
EAST PAKISTAN
DENSITY OF RURAL POPULATION
1961
PERSONS PER SQ. MILE
ABOVE 2100
1800 - 2099
1500 - 1799
1200 - 1499
900 - 1199
600 - 899
300 - 599
BELOW 300
NO PERMANENT SETTLEMENT
MILES 10 5 0 10 20 30 40 50 MILES
88°
90°
92°
25°
23°
21°

FIGURE 2

The density of rural population varies with the distribution of cultivated area. Thus, there is a close correspondence between the density of rural population per square mile of crops and rural population density in general. Figure 3 shows the relationship between the rural population density per square mile of crops and rural population density by districts. With the exception of the districts of Khulna and Chittagong and Sylhet to a certain extent, this relationship is very close. Khulna and Chittagong have forested areas in East Pakistan, whereas in Sylhet, partly because of the forested areas in the south and the depressed areas with water-logging for at least six months of the year in the west along the border of the Mymensingh district, the relationship between the rural population density per square mile of crops and rural population density in general is not so close.

In brief, it might be said that the population distribution in East Pakistan is extremely uneven. At least eleven districts out of seventeen have densities above the provincial average. The rural population density closely follows the general population density, since only five per cent of East Pakistan's population is urban. In addition, the relationship between rural population density per square mile and the rural population density per square mile of crops is very close. The variation of this pattern is found only in those areas which are either forested or devoid of habitation. Thus, it may be assumed that the rural population distribution in East Pakistan is closely related with the distribution of cropland.

Population Projections For Future

According to the estimates of the United Nations, by 1985 East Pakistan will have between 85 and 100 million people with an average density of 1500 to 1750 persons per square mile[4]. By 1971, according to most conservative assumption[5], East Pakistan will have 65.3 million people, an increase of fifteen million in ten years (Table 1).

Table 1—Population Projections For Future, East Pakistan

(in millions)

Year	Conservative Assumptions	Rapid Mortality Decline	
		Constant Fertility	Declining Fertility
1961	51.4	53.2	53.2
1966	57.7	61.3	60.2
1971	65.3	71.4	67.8
1976	74.5	83.6	75.5
1981	85.6	98.4	83.3

Source : United Nations, *The Population of Asia and the Far East 1950-1980*, Report IV (New York : 1959) P. 14.

[4] United Nations, *The Population of Asia and the Far East, 1950-1980, Report IV, (New York: 1959), P. 14.*

[5] Constant fertility and moderate decline in mortality.

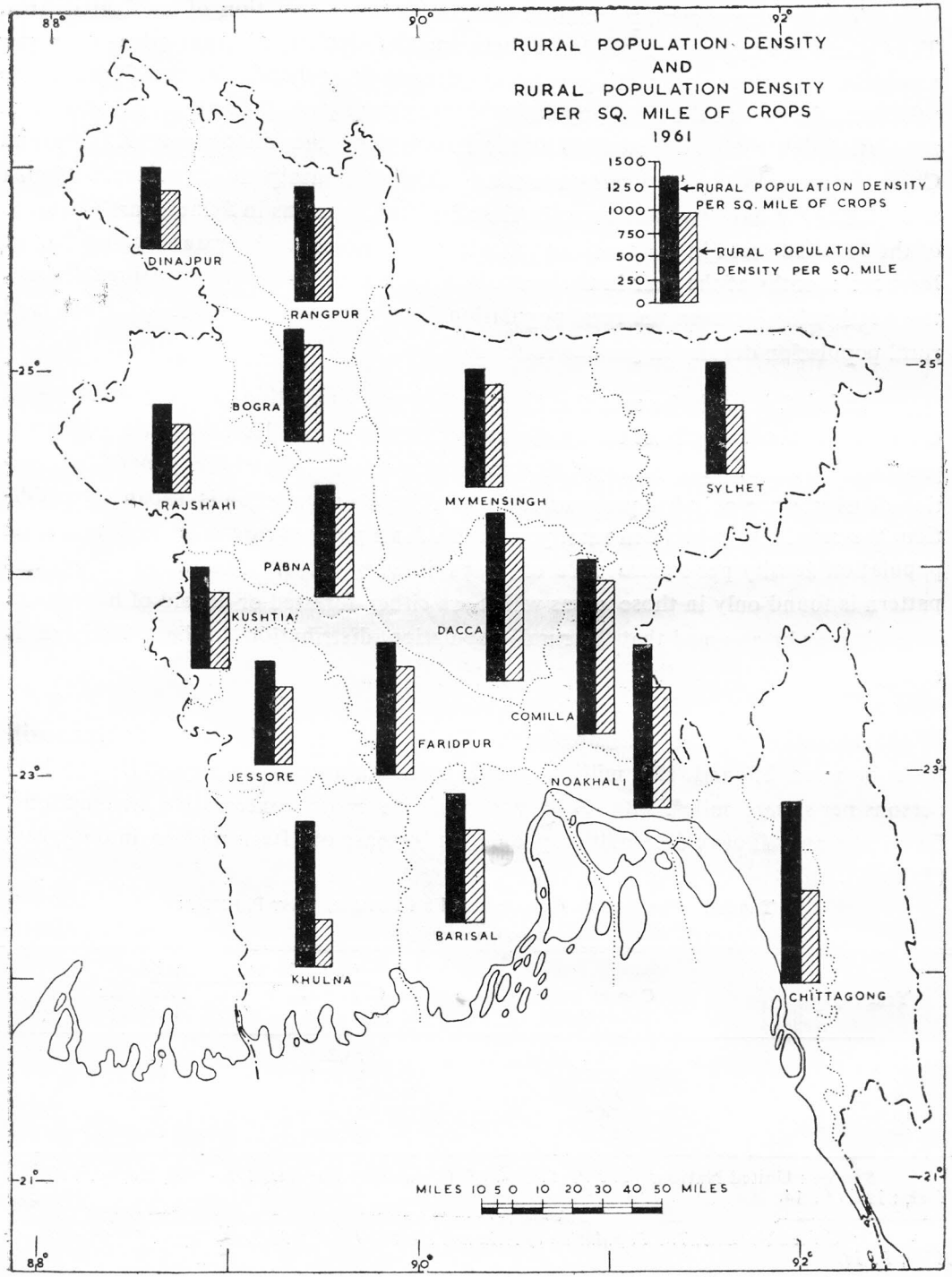
RURAL POPULATION DENSITY
AND
RURAL POPULATION DENSITY
PER SQ. MILE OF CROPS
1961
1500
1250
1000
750
500
250
0
RURAL POPULATION DENSITY PER SQ. MILE OF CROPS
RURAL POPULATION DENSITY PER SQ. MILE
DINAJPUR
RANGPUR
BOGRA
RAJSHAHI
PABNA
KUSHTIA
JESSORE
KHULNA
MYMENSINGH
SYLHET
DACCA
COMILLA
FARIDPUR
NOAKHALI
BARISAL
CHITTAGONG
88°
90°
92°
25°
23°
21°
MILES 10 5 0 10 20 30 40 50 MILES

FIGURE 3

According to the projections above, however, the population would increase from 51.4 million in 1961 to between 85 and 98 million by 1981, depending on the rapidity of the decline in mortality.

The projected future rural population by sub-division for 1971 is shown in figure 4. It is based on the following assumptions. Using the more conservative United Nations' assumption of constant fertility and a moderate decline in mortality, the increase would be twenty-seven per cent in 1961-71, and thirty-one per cent in 1971-81[6]. This assumption has been followed as far as possible in this study. Besides, consideration has been given also to the rate of annual growth which was about 1.1 per cent between 1921-51 and 1.3 per cent between 1931-51. The variation of population between 1951-61 has been 21.2 per cent. It seems unlikely that the rate of annual growth will fall below two per cent in future.

Assuming that on the basis of a conservative estimate population increase would be twenty-seven per cent during 1961-71, the problem then would be to work out the percentage increase for the various sub-divisions. In order to arrive at a meaningful rural population density for all the sub-divisions in 1971, a study was made of the percentage change in population for 1951-61. It was found that in various districts there was no such abrupt and wide fluctuation in the rate of increase.

The real increase was, however, within a much closer range. Ten out of seventeen districts in East Pakistan showed an increase ranging between fifteen and twenty-five per cent, two between twenty-six and thirty and three between thirty-one and thirty-four per cent (including the Chittagong Hill Tracts district). When these increases were compared with the farming practices in East Pakistan, it was revealed that the subsistence or the near subsistence areas with only rice as the main crop showed the greatest increases. On the other hand, where commercial crops figure prominently in the economy, such as in Dacca division, the average increase was twenty-one per cent, same as the average for the province as a whole. It can be concluded, therefore, that subsistence areas tend to have higher average increases in population than those areas where commercial crops are important in the economy. This may be due to a lower level of education, but may also be due to another sociological factor. Throughout the country as a whole there is a tradition that children are considered assets instead of liabilities. This tradition appears to be more prevalent in the subsistence areas than in the commercial areas. At any rate, it was assumed that for the period 1961-71 that the increases would range from thirty-two per cent in the subsistence areas to twenty per cent in the commercially cropped areas. The mixed peasant farming areas with rice and cash crops would have the average for the province as a whole, *i.e.*, twenty-seven per cent.

[6] *Ibid*, p. 13.

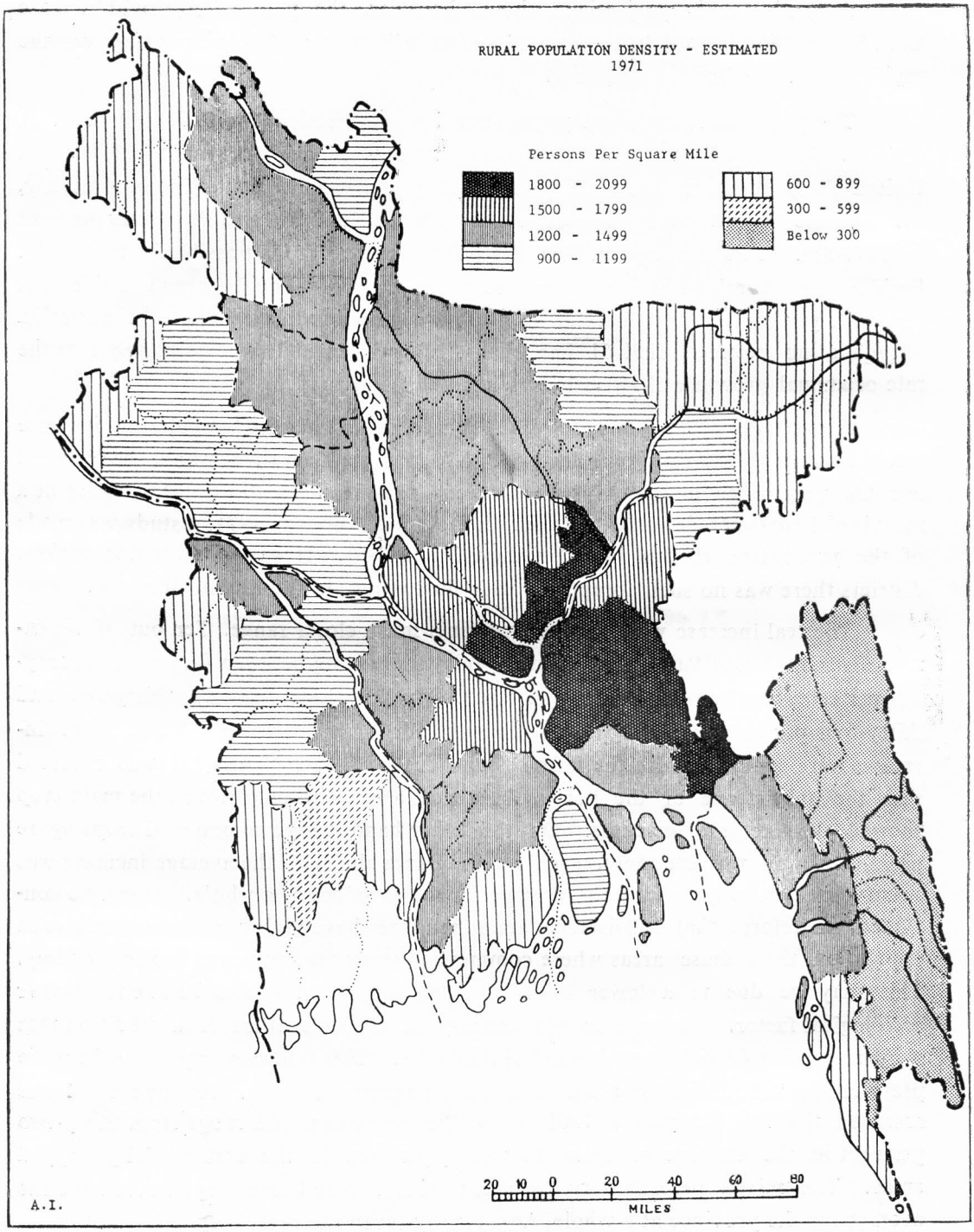

FIGURE 4. This map of rural population density as estimated for 1971 has been compiled with the help of data on sub-division basis.

This trend is also manifested in the density of rural population. During 1951-61, the percentage variation was lower than the average for the country in the high density areas, while the low density areas had the higher percentage variation than the average for the country. It might be mentioned here that in the high density areas, excepting the coastal districts, jute is important in the economy.

Estimated Density of Rural Population, 1971

The estimated density of the rural population (Fig. 4) for 1971 shows a continuation of the basic trend of the previous years. The average density of rural population has risen from 874 persons per square mile in 1961 to 1,085 persons per square mile, with a total population of nearly 60 millions. The density variation among the sub-divisions has increased by hundreds (compare Figs. 4 and 5), in some cases it is even more. Jute farming areas show considerable rises in terms of absolute increase.

It still remains to be seen as to what extent the future increase in the rural population will affect the agriculture of East Pakistan, and future of the equilibrium between land and man. The burning question of the day is East Pakistan's food situation. The following table shows the supply position of rice in the province onward from 1955-56 :

Table 2—Supply Position of Rice in East Pakistan (1955-56 to 1963-64)
(in million tons)

Year	Total requirement of rice in the province (*a*)	Provincial production	Supply of rice available for domestic consumption (*b*)
1955-56	7.57	6.38	5.79
1956-57	7.72	8.19	7.73
1957-58	7.86	7.60	7.08
1958-59	8.01	6.92	6.05
1959-60	8.15	8.48	8.11
1960-61	8.30	9.52	8.81
1961-62	8.45	9.47	8.72
1962-63	8.50	8.72	7.50 (*c*)
1963-64	8.83	10.16	9.24

Source : East Pakistan, Finance Department, *Economic Survey of East Pakistan 1963-64*, Table 17, p. 19.

Note : (*a*) Estimated at the rate of 18 oz. per day per capita for effective adult population which is estimated at 89 per cent of the total population.

(*b*) Total supply equals production minus seed, feed and waste estimated at 1/9th of the production (according to the Planning Commission) minus internal procurement plus Government distribution. Variation in private stocks, being unknown, are ignored.

(*c*) Approximately.

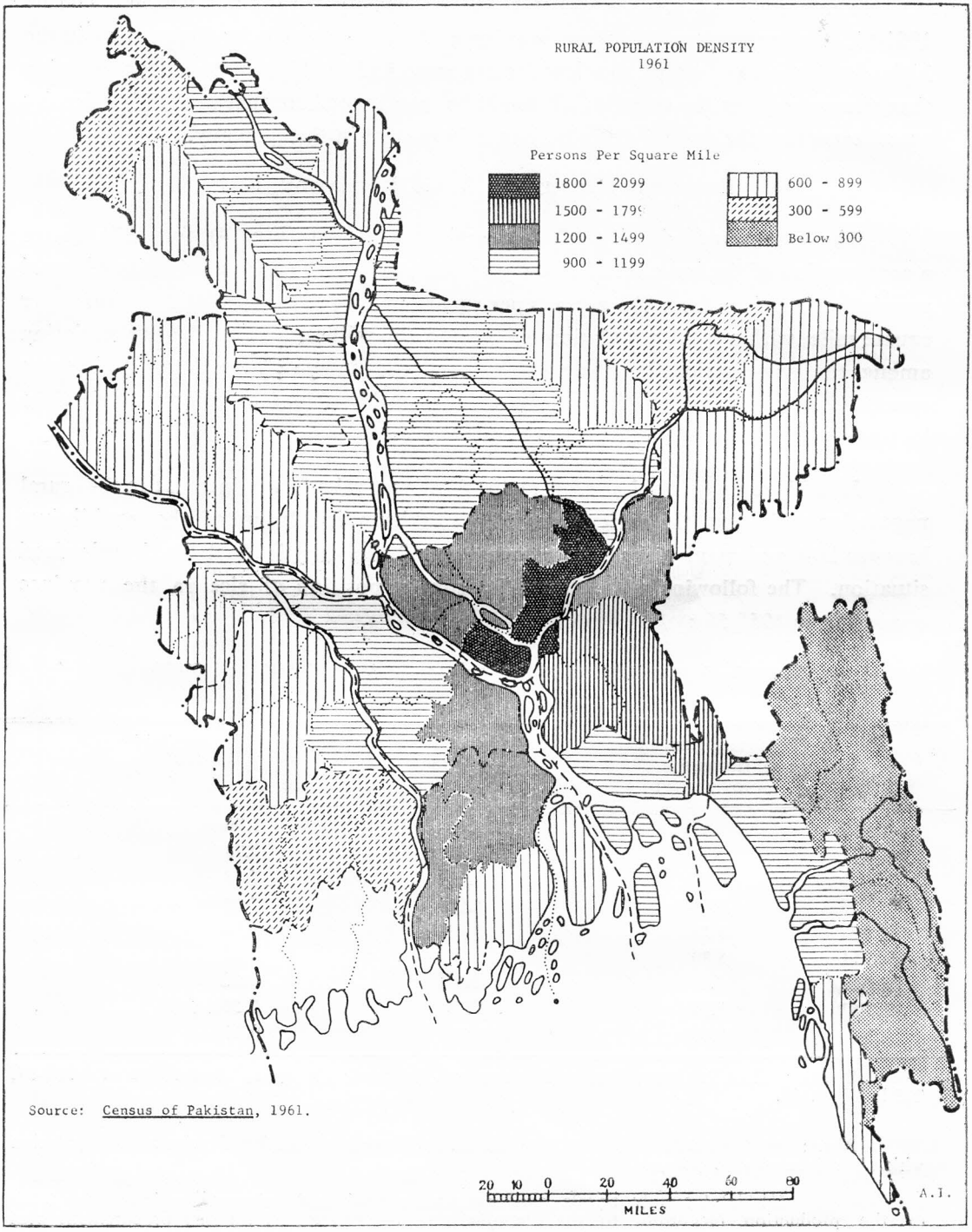

FIGURE 5. This map has also been compiled on sub-division basis for comparison.

It is evident from the table above that the rice production as well as the supply of rice available for domestic consumption in East Pakistan varies widely from year to year, whereas the total requirement of rice in the province is increasing every year. It is also evident from the table above that the small surplus which has been maintained recently is actually insufficient to provide the reserves necessary in case of crop failure or natural calamities, like devastating floods or cyclones. There is generally a deficit of about half a million tons annually. In addition, if wheat, which is getting popular with the people of East Pakistan, especially in the urban areas, is taken into consideration, the total import of food grains in East Pakistan would be over half a million tons approximately every year (Table 3).

TABLE 3—IMPORT OF FOODGRAINS IN EAST PAKISTAN FROM ABROAD AND WEST PAKISTAN FROM 1956 TO 1963 IN TONS

Year	Rice	Wheat	Year	Rice	Wheat
1956	533,256	49,599	1960	401,702	162,980
1957	432.132	70,544	1961	356,825	176,441
1958	465,864	127,943	1962	270,592	512,359
1959	422,712	148,762	1963	565,009	918,780
			1964 (upto April)	100,691	217,107

Source : East Pakistan, Finance Department, *Economic Survey of East Pakistan, 1963-64*, Table 18, p.20.

Thus, about half of the total deficit each year is made good by importing rice and wheat from abroad and spending the hard-earned foreign exchange.

The problem is somewhat more complicated since the population in East Pakistan is increasing at the rate of more than two per cent per annum, while the rice position fluctuates, and is uncertain, from year to year. The situation, as seen from Table 2, however, might well deteriorate with an increase in population. Population increase has not only been phenomenal in the past, but is expected to double within the next fifty years. The question is to find out whether East Pakistan's economy would be self-sufficient in future in terms of its available resources, and to what extent is the land capable of supporting rural population under existing conditions.

Future Trends in Agriculture

The future trend of agriculture can be gauged from the Fig. 6 which shows trends in total area under crops, area under rice, and the yield and production of rice from 1950-51 to 1959-60, and table 4. It is obvious from figure 6 that the trend as regards the total area under crops, and land in rice particularly, has remained almost constant. If the rice acreage remains more or less the same (Table 4), it is unlikely that the area under other crops will increase. Besides, the total area under the crops is not likely to increase. Perhaps, the total production of rice might increase to a certain extent in the future since some signs of increasing yields are already there.

Table 4—Acreage and Production of Rice in East Pakistan
1960-61 to 1963-64

Year	Acreage (in Million acres)	Production (in Million tons)
1960-61	21.17	9.00
1961-62	20.80	9.59
1962-63	21.29	8.72
1963-64	22.08	10.45

Source : Data obtained from Agricultural Directorate, Dacca, East Pakistan.

At present, almost all the available lands have been brought under cultivation. The possibilities for bringing additional land under the plough are remote unless some lands are double-cropped. About twenty per cent of the cultivated area is now sown more than once a year. In addition, land in current fallow for the present is almost insignificant.

It may now be asked whether by itself an increase in population without a corresponding increase in the total cropped area presents any problem? The fact that not all the people live off the land makes little difference in an area where industrial development is not too significant and urban population amounts to only five per cent of the total population. There is a lack of alternative employment for rural population. Thus, it is subsistence farming which largely supports the bulk of the population.

Size of Holdings

The impact of increased rural population on the size of holdings in East Pakistan will also be a major problem for the future agricultural development. The already existing small size of the holdings is a basic cause of many of the agricultural problems in East Pakistan.

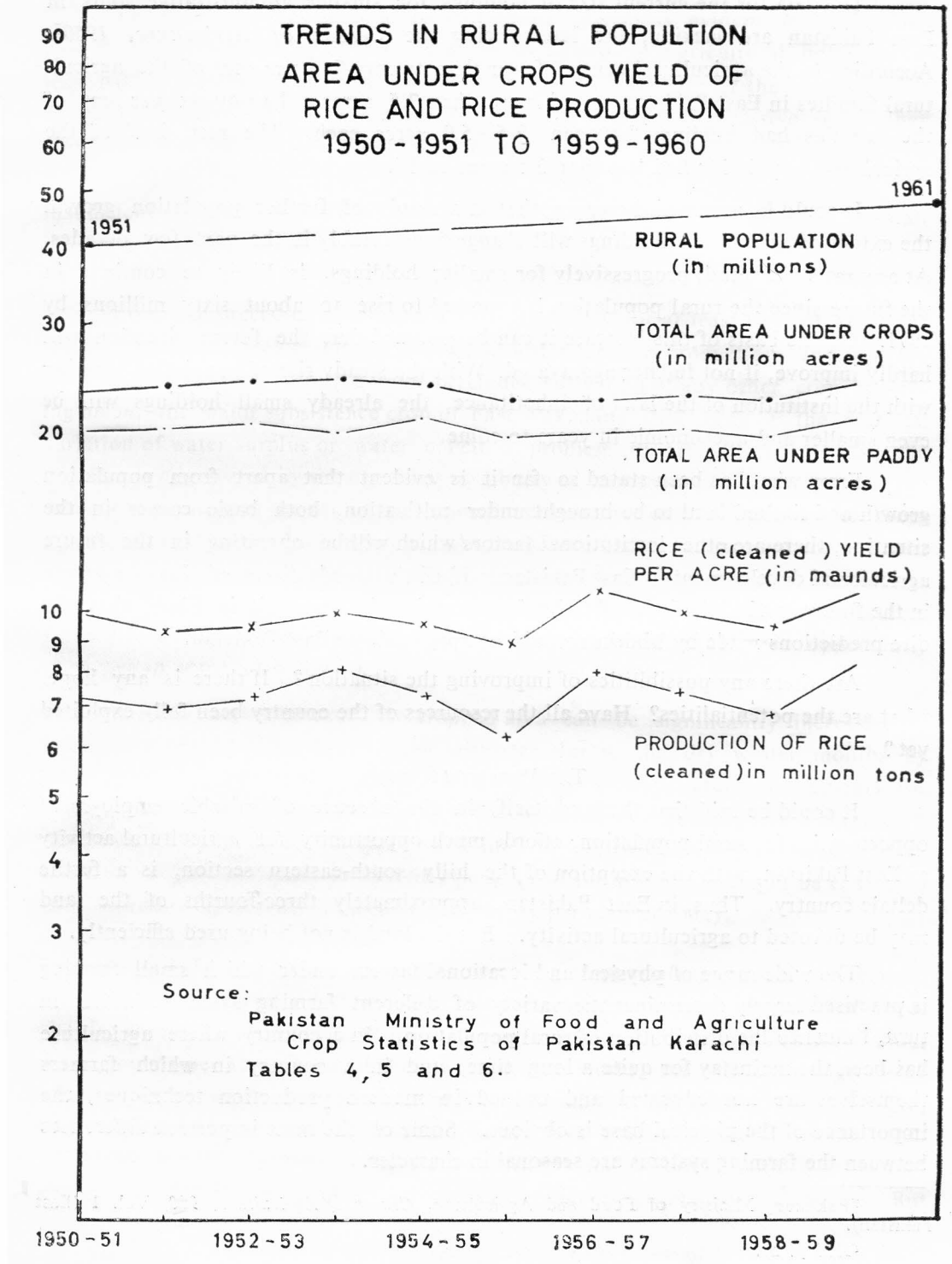
TRENDS IN RURAL POPULTION
AREA UNDER CROPS YIELD OF
RICE AND RICE PRODUCTION
1950-1951 TO 1959-1960
1951
1961
RURAL POPULATION
(in millions)
TOTAL AREA UNDER CROPS
(in million acres)
TOTAL AREA UNDER PADDY
(in million acres)
RICE (cleaned) YIELD
PER ACRE (in maunds)
PRODUCTION OF RICE
(cleaned) in million tons
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1950-51
1952-53
1954-55
1956-57
1958-59
Source:
Pakistan Ministry of Food and Agriculture
Crop Statistics of Pakistan Karachi
Tables 4, 5 and 6.

FIGURE 6

The data for the current size of holdings for smaller administrative units in East Pakistan are lacking, the latest being the *Census of Agriculture, 1960*[7]. According to the agricultural census, fewer than twenty-five per cent of the agricultural families in East Pakistan owned more than 7.5 acres. Twenty-six per cent of the families had holdings between 2.5 – 5.0 acres each. The rest, half of the agricultural population had less than 2.5 acres each[8].

It could be assumed, however, that as a result of further population growth the extent of agricultural holdings will change considerably in the next few decades. At any rate, the trend, progressively for smaller holdings, is likely to continue in the future since the rural population is expected to rise to about sixty millions by 1971. On the basis of this increase it can be assumed that the future situation will hardly improve, if not further aggravated. With the steady rise of population together with the institution of the laws of inheritance, the already small holdings will be even smaller and uneconomic in years to come.

From what has been stated so far it is evident that apart from population growth and limited land to be brought under cultivation, both basic causes in the situation, there are other institutional factors which will be operating in the future agricultural development in East Pakistan. If all the trends discussed here continue in the future, and if the level of technology remains the same, it is likely that the dire predictions made by Malthus would be applicable to East Pakistan.

Are there any possibilities of improving the situation? If there is any hope, what are the potentialities? Have all the resources of the country been fully exploited yet?

The Potentialities

It could be said that the land itself, in the absence of suitable employment opportunities for rural population, affords much opportunity for agricultural activity as East Pakistan, with the exception of the hilly south-eastern section, is a fertile deltaic country. Thus, in East Pakistan, approximately three-fourths of the land may be devoted to agricultural activity. But the land is not being used efficiently.

The wide range of physical and locational factors under which small farming is practised largely determines the variety of different farming systems, which in turn, influence the distribution of rural population. In a country where agriculture has been the mainstay for quite a long time, and in a country in which farmers themselves are not educated and trained in modern production techniques, the importance of the physical base is obvious. Some of the most important differences between the farming systems are seasonal in character.

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[7]Pakistan, Ministry of Food and Agriculture, *Census of Agriculture, 1960,* Vol. 1 (East Pakistan).

[8]*Ibid,* p. 29.

The problem of the seasonality of farming system is evident from the fact that in spite of the scarcity of food and the smallness of agricultural holdings, at least half of the year arable lands remain almost idle. The fact of the matter is that the rainfall is deficient in one season (November-March) and excessive in another (June-October). Therefore, different problems of water supply in agriculture arise in two different season : 1) the pre-monsoon period, which is dry when there is insufficient ground moisture for vegetation, and 2) the period of excessive rainfall during the monsoon season.

From the preceding discussion it is apparent that for at least half of the year soil moisture deficiency results in insufficient water for crop production, and for the other half of the year excessive water precludes cultivation of any other crop excepting *aman*, the major subsistence crop of East Pakistan. Not only is the seasonal variation of water surplus or water deficit a problem to agriculture, but also the problem is aggravated by the excessive variability of monsoon rainfall. This is the most crucial factor in the use of land since the only source of precipitation for crop-production is the southwest monsoon. As mentioned earlier, at present only about five per cent of the total cultivated area is irrigated. Thus, there is a mono-cultural period in East Pakistan for at least half of the year. Besides agriculture, considerable amount of human labour is wasted which during this period, has limited opportunity to engage in some form of work.

If proper action is taken, the cropped area can be significantly increased by multiple-cropping. More land can be cultivated during the dry winter months by providing an adequate water supply. An estimate of the water requirements for crops which can be grown during the dry season is needed. Thus, at least there is a possibility to increase the cropped area and to increase food production. With adequate irrigation systems at least fifty per cent of the arable land might be converted into double-cropped areas, as against the twenty per cent of today.

Although there are possibilities of increasing cropped areas yet mere addition of land under plough may not be sufficient to meet the increasing demand for food, that is, unless the yield of rice crops is increased. Rice yield in East Pakistan, about 1,000 pounds per acre, is one of the lowest in the world, the world average being about 1,700 pounds[9]. But the problem is how to increase the yield of crops per acre? At present farmers in East Pakistan can hardly give proper attention to the land. There is a deficiency as regards the use of fertilizers and manures, both organic and inorganic. The income from a small farm precludes the purchase of fertilizers. But

[9]Pakistan, Ministry of Commerce, *Report of Jute Enquiry Commission*, 1960, p. 37.

if these deficiencies can be made good by supplying adequate fertilizers and manures to the farmers, there is no reason why the production should not increase. Furthermore, the improvement in technique of cultivation, seed selection, pest control and use of adequate improved implements and equipment can raise the efficiency of agriculture.

On government farms, experiments have been made that increased rice yields by adopting better seeds and other improved methods of cultivation including the Japanese method of rice cultivation. If on the government farms in East Pakistan much better results can be achieved, there is every hope that rice yields in East Pakistani farms can be increased.

There is still another direction in which attention can be given. East Pakistan has great potential for water development, besides power development, the bulk of which has remained untapped so far. In fact few areas in the world are passed over by more water signifying vast water resource potential.

Soon after the establishment of the East Pakistan Water and Power Development Authority in 1959, activities started on a modest scale. Already a number of projects have been completed and others are in the process of execution and preparation. It might be hoped that with the successful completion of the projects the food production of the country would also gradually increase. On this basis, one can conclude by saying that potentialities for increasing food production are vast.

Improved Level of Technology

But the question remaining is whether increasing population pressure on the land can be offset by the increase in agricultural production. In other words, assuming the level of improved technology, what would be the potential rural population density for East Pakistan? Only then will it be possible to assess the magnitude of the potentials that exist within the next thirty or more years. It may be assumed, however, that thirty years is the least possible time during which the implementation of land and water development in a region can be envisaged. Also the changes in techniques and patterns of production may be vastly improved in terms of the resources and present knowledge over the next few decades.

In addition, since nearly every aspect of the proposed pattern of agricultural land use will be new, implementation of a programme of agrarian reform will necessitate agronomic research, educational farmer-training programmes and an expanded agricultural extension crops. Thus, there are factors of encouragement and, as seen in this study, great potentialities exist for improving the relationship between land and man in East Pakistan.

Conclusion

Despite the potentialities, outlined before, it is hardly possible under the existing condition that agricultural production will be so rapidly increased as to be able to meet the growing demand, even at a subsistence level. Nor can it be expected that the overall economy of the country will be quickly expanded so as to provide cash for purchasing food from other countries. Thus, any improvement that may be envisaged either for agriculture or for the economy will have to be gradual and should be based on sound agricultural and water development policy.

If the potentialities that exist in the country are taken into consideration along with prospective changes in the level of technology and other improved agricultural practices there is hope of a better future. A study of the pattern of resources and the future needs is necessary pre-requisite for visualising a self-sufficiency in agriculture and in improving the equilibrium of man and land relationship in East Pakistan.

In sum, what is the prospect for the future relation between man and land in its most elemental definition, namely the sufficiency of food production in the country ? The answer cannot be given merely by analyzing the present pattern. The question is to what extent is the land capable of supporting rural population under the present level of technology as well as under an improved level of technology ? There is a need, on the one hand, for a detailed factual, objective study of the present use of the land — to be more precise, agricultural land use study in East Pakistan — and for an evaluation of the actual and potential resources of the country on the other hand. The results that may be obtained by such an analysis might lead to the proper understanding of the future relationship between rural population and agriculture in East Pakistan.

A LIST OF THESES ON PAKISTAN

The compilation presents a list of M.A. and Ph.D. theses on Pakistan problems or on those relevant to her, accepted by various universities at home and abroad. The information has been collected from several sources. The list of theses accepted by the University of the Panjab was taken from the *Bibliography of Thesis, Dissertations and Research Reports* published by the Bureau of Education. Information on theses accepted by Sind and Karachi Universities was compiled from different sources. Partial information was available in some issues of the now defunct *Bulletin of the Karachi Geographical Society*, and in the Appendix of M.B. Pithawala's *A Physical and Economic Geography of Sind*. For information about the department of Geography, University of Karachi theses, the author had to do the spade work in the University of Karachi library. As for Dacca, Nazrul Islam's note, 'Post-Graduate Research at the Department of Geography, Dacca University' (*Oriental Geographer*, Vol. 8, No.1, January 1964, pp. 88-89) was of considerable help.

Various issues of *Professional Geographer* gave information regarding the theses and dissertations completed at various universities of the United States of America. The *Aslib Index to Theses* and *Union list of theses of British Universities* provided information for the British Universities. Professor Dr. H. Blume of Tubingen University was kind enough to send the list of theses written in German Universities. The original titles in German language have been translated into English for this list. The theses have been arranged by subjects. The last name of the author appears first, followed by his first name, title of the thesis, degree, the year and the university where it was accepted.*

CLIMATOLOGY

Charan Singh, Satwant, *The Climate of the Panjab* (M.A., 1947, University of the Panjab, Pakistan).

Ghori, Mohamad Ibrahim Khan, *A Study of Structure, Behaviour and Effects of Tropical Cyclones in West Pakistan* (M.A., 1957, University of Karachi, Pakistan)

Hasan, Inamul, *Electrical Phenomena of the Atmosphere* (M.A., 1959, University of Karachi, Pakistan)

Hussain Azra Afzal, *The Climate of Quetta and its Effects on Plant, Animal and Human Life* (M.A., 1951, University of Sind, Pakistan)

Khan, Azra Ihsanur Rehman, *Contribution to the study of Climate of Panjab, and North West Frontier Province (Pakistan)* (Ph.D., 1954, Clark University, U.S.A.)

Khan, M.F.A., *The Arid Zone of West Pakistan* (Ph.D., 1961, University of Durban, U.K.)

Khan, Mubashir L., *Arid Zone of West Pakistan* (M.A., 1956, University of the Panjab, Pakistan)

Qureshi, Khalil-ur-Rehman, *Climatological Atlas of West Pakistan* (M.A., 1956, University of Karachi, Pakistan)

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Choudhry, M.I., *The Morphological Basis of the Bengal Basin* (M.Sc., 1961, Cambridge University, U.K.)

Rizvi, A.I.H., *Comparison Between the Lower Mississippi and Ganges-Brahamputra Valley* (Ph.D., 1948, Louisiana State University, U.S.A.)

*The list as originally prepared presented a classification on the basis of universities. It was on the suggestion of Dr. I.H. Zaidi that the listing was redone on subject basis for which the author is indebted to Mr. Aziz-ur-Rehman Mian who reorganized the entire listing.

Siddiqi, Jamil Ahmad *Geomorphology of Northern and Southern Chittagong Coast* (M.A., 1963, University of Dacca, Pakistan)

Snead, Rodman E., *Physical Geography of Lasbela Coastal Plains*, W. Pakistan (Ph. D., 1963, Louisiana State University, U.S.A.)

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Ahsanullah, *Arab Navigation in the Indian Ocean* (M.A., 1957, University of Karachi, Pakistan)

Mian, Aziz-ur-Rahman, *Evolution of District Montgomery as an Administrative Area—A Geographical Study of Historical Processes and Administrative Problems* (M.A., 1965, University of the Panjab, Pakistan)

Shafiq Bano, *A Historical Geography of Karachi with Special Reference to Problem of Refugees* (M.A., 1949, University of Sind, Pakistan)

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Ahmad, Kazi S., *Agricultural Geography of the Panjab* (Ph. D., 1939, University of London, U.K.)

Arshad, Ali, *Environment and Distribution of Jute* (M.A., 1947, University of the Panjab, Pakistan)

Bhatty, M.A., *An Agricultral Geography of Certain Semi-Arid Parts of the Mediterranean in relation to the Problems of West Panjab* (Ph. D., 1950, Edinburgh University, U.K.)

Bhutani, Durga Parashad, *Cattle Breeding and Dairy Farming in the Panjab* (M.A., 1947, University of the Panjab, Pakistan)

Edmonds, L.S., *Some Problems of Agriculture in the Vale of Peshawar* (M. Sc., 1960, University of London, U.K.)

Haq, Mahbubul, *Market Gardening in and around Dacca City* (M A., 1959, University of Dacca, Pakistan)

Johnson, B.L.C., *Agricultural Geography of East Pakistan* (Ph. D., 1960, University of London, U.K.)

Jafri, Afzal Hussain, *Improvement of Agriculture* (M.A., 1953, University of the Panjab, Pakistan)

Khan, Fazle Karim, *Comparative Agricultural Geography of East Pakistan and Louisiana* (Ph. D., 1958, Louisiana State University, U.S.A.)

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Latif, Abdul, *Agricultural Atlas of W. Pakistan* (M.A., 1958, University of Karachi, Pakistan)

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Matin, Abdul, *Pakistan and the Problems of Agricultural Development* (Ph.D., 1956, University of Bonn, Federal Republic of Germany)

Mian, Nurul Islam, *Problems of Economic Policy in Pakistan, with Special Reference to Agricultural Economy* (Ph. D., 1960, University of Bonn, Federal Republic of Germany)

Mohammad, Fakhar Bahadur, *Distribution of Cotton in West Pakistan* (M.A., 1950, University of the Panjab, Pakistan)

Rehman, Aziz-ur, *A Distribution of Food in the Panjab* (M.A., 1949, University of the Panjab, Pakistan)

Shahi, Raghunath, *Desert Plantation Agriculture in India* (M.A., 1947, University of the Panjab, Pakistan)

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Khanum, Atifa, *Industrial Development of West Pakistan* (M.A., 1964, University of the Panjab, Pakistan)

Malik, Riaz A., *Industrial Development in West Pakistan* (M.A., 1950, University of the Panjab, Pakistan)

Nahar, Nurun, *Small Scale and Cottage Industries in Dacca Urban Area* (M.A., 1962, University of Dacca, Pakistan)

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Rehman, Lutfur, *Large Scale Industry of Dacca Area : A Study in Distributional Pattern* (M.A., 1959, University of Dacca, Pakistan)

Sharif, Mohamed, *Large Scale Textile Industry in Lyallpur* (M.A., 1950, University of the Panjab, Pakistan)

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Siddiqi, A.H., *The Geographical Background for the Industrialization of the Lower Indus Basin, Sind* (M.A., 1953, University of London, U.K.)

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Fautz, B., *Social Structure and Land Utilization in the Rural Swat, North-West Himalayas* (Ph.D,. 1963, Karlsruhe University, Federal Republic of Germany)

Hoffman, Lawrence A., *Population and Economic Development in India and Pakistan* (Ph.D., 1960, John Hopkins University, U.S.A.)

Varma, K.N., *Population Problems in the Ganges Valley* (Ph.D., 1956, Clark University, U.S.A.)

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Firdousi, Ghulam Rasul, *Irrigation in Panjab : A Contribution to Remodelling of Irrigational Schemes in West Pakistan* (Ph.D., 1961, Karlsruhe University, Federal Republic of Germany)

Goyle, Pushpa, *Water-logging in the Rachna Doab* (M.A., 1947, University of the Panjab, Pakistan)

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Husain, S. Ahmed, *A Geographical Survey of Thatta District, Sind* (M.A., 1955, University of Karachi, Pakistan)

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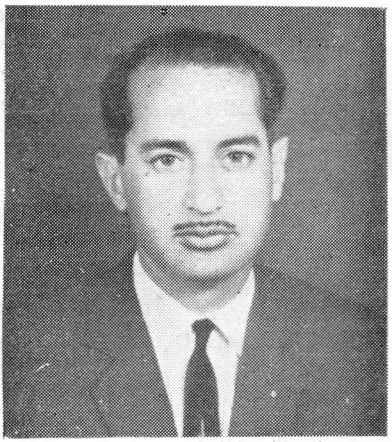
MUSHTAQ-UR-REHMAN

University of Karachi



ABDUL HAQ MALIK, 1935—66

It is with deep seated sorrow that we put on record the untimely death of a young, promising colleague of ours Dr. Abdul Haq Malik who fell a victim to a car accident on June 25, 1966.

Born in Sabhral village of Sargodha district Dr. Malik took his M.A. degree in Geography from the University of the Panjab in 1959 and thereafter served the University of Peshawar for a period of two years as a lecturer in Geography. In 1961 he was awarded a Turkish Government Cultural Exchange Scholarship to pursue higher studies at the University of Istanbul from where he obtained his Ph.D. degree in 1964 with credit. His doctoral thesis was on *Agriculture in Adana Plain* which was submitted in Turkish language. He travelled Europe and South West Asia extensively by car.

Dr. Malik joined the staff of the Department of Geography of the University of the Panjab in September last (1965) as a lecturer. His specialities were Agricultural Geography and South West Asia. He was held in high esteem as a teacher and was well known for his dutifulness and extremely polite and affable nature. May his soul rest in peace and may Almighty Allah grant his bereaved family courage to bear the colossal loss caused by his demise.

BOOK REVIEWS

The Struggle for Pakistan. Ishtiaq Husain Qureshi. University of Karachi, Karachi (1965); 1—394 pp. ; appendices, bibliography, index ; Rs. 20.0, $ 8.0, sh. 45.

Pakistan is a nation state. It represents a culmination of the desire of the Muslims of the Pakindian subcontinent for a separate homeland who by no measure could be regarded as a mere religious minority. Why was it necessary for the Muslims of the subcontinent to create a separate homeland and thus to reject the good old principle of "united we stand and divided we fall"? Why was it not possible to organize a multi-national state of united India like Switzerland or Canada? These are the questions which are generally raised by the students of history, geography, government and world affairs. The questions are considered relevant particularly by those western thinkers who have a superficial understanding of Islam, and the history of Musalmans in India. Dr. Qureshi's book *The Struggle for Pakistan* attempts to answer the questions raised above *par excellence*.

Several general and scholarly books and treatises have been written on Pakistan movement and on Pakistan's politics, religion and cultural heritage, but none provides such a succinct, coherent and well written account of the events and circumstances which led to the creation of Pakistan as the book under review. The author of *The Struggle for Pakistan* has shown great scholarly insight in sifting the relevant materials from a jungle of information available on the subject. As a person closely associated with the Pakistan movement and with the government of Pakistan during the first decade of its existence, the author had had obvious advantage of making a first hand observation and an access to the many official documents which could otherwise be not available. He has interviewed various leaders associated with the Pakistan movement and, as is evident from profuse footnotes and an extensive bibliography, the author has also consulted other works and documents related with the history and the independence movement in the subcontinent. Thus, the bases of Dr. Qureshi's study are well founded.

The theme around which the book under review has been organized revolves around the idea that no event can be understood in isolation from its historical and geographical milieu ; and that has been skilfully demonstrated by the author as a seasoned historian. He has successfully established that the creation of Pakistan is a cumulative result of the cultural, political and economic processes operating in the subcontinent for several centuries. The book has been divided into fourteen chapters, viz., 1) Introductory, 2) The Formulation of Attitudes, 3) Towards Responsible Government : 1914—1935, 4) The Establishment of Provincial Autonomy, 5) Congress Rule in the Provinces, 6) The Movement for Pakistan, 7) The Impact of the Second World War, 8) The Crips Mission and Congress Revolt, 9) Gandhi-Jinnah Talks, 10) Simla Conference and Elections, 11) The Cabinet Mission. 12) The Interim Government, 13) The Transfer of Power, and 14) Retrospect. What has been said in these chapters may be summarised as below :

Historically the Muslims of British India were a nation rather than a religious minority. With this conviction the Muslims of the subcontinent were not prepared to accept a subordination of Hinduism under the cover of democracy and secularism. From the events which followed the grant of provincial autonomy and the congress rule in the provinces where Muslims were in minority, like the United Province (now Uttar Pradesh), Bihar and others, it became sufficiently clear that India after independence would be a Hindu India, and for the Muslims it would mean only a change of master. Hence for their survival as a nation with full sovereignty over their own affairs, the Muslims of the subcontinent made positive efforts to create Pakistan which they achieved in the face of tenacious resistance by Hindu leadership and pro-Congress or pro-united India attitude of the then exponents of the British *raj*.

What remains to be desired is a more elaborate discussion on the way the Boundary Commission messed with the principles of demarcation of boundaries in the provinces of Bengal and the

Panjab. The chapter on 'Retrospect' does question the justification of awarding Gurdaspur district (with the exception of only one *tehsil* named Shakargarh) and the canal headworks at Ferozpur to India. But that may not be considered conclusive. Another question which the reviewer would like to raise is directed to the use of the term "race" as a heading under which Dr. Qureshi has briefly described the ethnic and cultural make up of the Muslim population in the Pakindian subcontinent. While one may find it convenient to use it, the term "race" implies human attributes of purely biological nature and hardly conveys the idea of man as a culture-building social being. But these are minor points. The book on the whole represents a high quality work. The contents of each chapter are well organized, sources of information have been conscientiously evaluated and the inferences are logical. The chapters are well interwoven with each other and exhibit a remarkable degree of coherence.

To sum up, Dr. Qureshi in this volume provides substantial background for understanding the *raison d'etre* of Pakistan which is so essential to a meaningful analysis of her political problems and policies. It is a most welcome addition to a relatively scanty scholarly literature on Pakistan from which the geographers, especially the political geographers can also profit a great deal. The book has been carefully edited and its overall production is impressive.

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The Geography of Modern Africa. William A. Hance. Columbia University Press, New York, London (1964); xiv+653 pp.; maps, photographs, charts, bibliograpy, index. $12.00

Africa can no longer be regarded as cut off from modern civilization. In recent years many independent states have emerged and several others are struggling to achieve similar political status. The importance of Africa in the context of the present world economic and political pattern cannot, therefore, be over-emphasized. Naturally, then the African affairs must provide a vast scope for studies in various fields. However, the studies on Africa so far have concentrated mainly on political aspects. It is for the first time that an exhaustive volume like the one under review has been produced which focusses mainly on economic geography of the area. Professor Hance in this book proceeds with the assumption that the achievement of mere political independence without substantial economic strength should not be considered as enough. African states have to go a long way to develop their economic resources. The author attempts to appraise the present level of economic development as well as to assess the extent to which the exploitation of national resources in future can be helpful in making the African states economically viable. The book is excellently written and amply reflects the author's scholarship, experience and deep insight in African economics. For constructing a geographic framework Hance divides Africa into seven, rather arbitrary, regions; viz.,: 1) North Africa (Spanish Sahara, Morroco, Algeria, Tunisia, Libya, Egypt (U.A.R.) and Sudan); 2) West Africa (Mauritania, Portuguese Guinea, Mali, Niger, Senigal, Sirra Leone, Guinea, Liberia, Upper Volta, Ivory Coast, Ghana, Dahomey, Togo and Nigeria, 3) Equatorial Africa (Chad, Cameroon, Rio Muni, Central African Republic, Gabon, Congo [Brazzaville], Congo [Leopoldville], Rwanda and Burundi; 4) Eastern Africa (Ethiopia, Somalia, French Somaliland, Kenya, Uganda, Tanganyika and Zanzibar [now Tanzania]; 5) South Central Africa (Angola including Cabinda, Mozambique, Zambia, Malawi and South Rhodesia); 6) Southern Africa (Union of South Africa, South West Africa, Bechunaland, Swaziland and Basutuland); and 7) Madagascar (now Malagasi) and Mascarene islands.

The volume is divided into eight parts and twenty-six chapters. Part one of the book, comprising five chapters, is entitled as "Introduction" and has been solely devoted to furnishing the very basic information about the continent as a whole. Part II through VIII deal with various regions as outlined above. Each of these parts is divided into several chapters.

In his treatment of these regions the author does not seem to be consistent, however. Some regions, like West Africa, have been treated systematically whereas in other cases Hance choses to deal regionally (by country). Discussions on subregions begin rather abruptly without any introductory remarks as one would normally expect. The space devoted to various regions, in general, is fairly reasonable ; but what strikes one is the treatment of Somalia (potentially a very important country) which is very sketchy, running into five pages only. Then again a country like U.A.R., with all its economic and political complexities has been afforded only twenty-two pages whereas South Africa and its associated areas have consumed sixty-six pages. U.A.R.'s economic problems are at least as varied and perplexing as those of South Africa. Availability of data, in the case of U.A.R., cannot be considered a serious problem for the scholars as there are various government and non-government, published and unpublished, materials to which one can have an easy access.

Of course the reviewer would not like to press far on the justification of devoting just two pages to the racial problems in the Union of South Africa as that happens to be a political issue and the author does not wish to care much about the political affairs of whatever significance they may be. Nevertheless, it is to be remembered that the politics sometimes plays a dominant role in the development of a nations' economy.

However, the author has done a painstaking job in writing out this most needed outstanding book which provides a fund of intimate knowledge of the economic conditions of Africa. This beautifully produced volume is profusely illustrated with excellent maps, charts and photographs well arranged with the text. The chapter by chapter bibliography and exhaustive index are immense of help to the readers. The book is most welcome.

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