PAKISTAN GEOGRAPHICAL REVIEW

Volume 19 6351 JULY, 1964 Number 2

CONTENTS

The Review is published half-yearly in January and July

SUBSCRIPTION

Annual,	Inland :	Rs. 8.00	Foreign :	$ 2.00 or 15s.
Single Copy,	,,	Rs. 4.00	,,	$ 1.00 or 7s. 6d.

Orders should be addressed to :

The Manager,
Pakistan Geographical Review,
University of the Panjab,
Lahore, West Pakistan.

TO CONTRIBUTORS

1. The Pakistan Geographical Review serves as a medium of publication and dissemination of knowledge mainly on the geography of Pakistan. Only such papers are published as have been written on a specific aspect of the geography of the country and carry original contribution in that field. Regional studies with special reference to Pakistan may also be published.

2. The contributions are classified into the following categories :

(*i*) **Papers** which contain the results of an original investigation mainly on Pakistan, principally on West Pakistan not exceeding 10,000 words.

(*See inside of the back cover.*)

Pakistan Geographical Review

Volume 19 JULY, 1964 Number 2

THE CATOGRAPHIC REQUIREMENTS OF DEVELOPING COUNTRIES

BY

R. G. DAVIES

Department of Geology, University of the Panjab, Lahore.

1. The Nature of the Problem

All over the world, developing countries are facing problems which have become especially acute as a result of man's scientific progress. Indeed, we are in the throes of a scientific revolution which is changing the whole situation which exists between man and his environment.

Developments during the past 40 years or so in the fields of drugs and anti-biotics have led to a situation where diseases, which previously had placed a severe curb on the growth of population, have been controlled or eradicated. Developments in modern insecticides have, at the same time, led to a much greater control over the disease-carrying insects responsible for the spread of pestilence and plague : these substances have also been responsible for increased protection of plant food-stuffs against the ravages of harmful insects. Chemicals have in addition been developed for the purposes of controlling the various diseases by which plants are affected. At the same time, great advances have been made in our knowledge of essential substances in plant, animal and human nutrition, while improvements in agriculture and farming have greatly increased the available food supplies.

As a result of these and similar developments, man's expectation of life, all over the world has increased, as has human fertility and the birth rate. Consequently, a great increase in population, despite the 40 million dead of the two Great World Wars has occured. The greatest increases have been in those countries which had previously been regarded as underdeveloped, while some countries which had been in a state of reasonable economic equilibrium have found their balance disturbed in the direction of under-productivity. The net result has been an enormous increase in the world demand for virtually every kind of food-stuff and a related increase in the consumption of all those industrial raw materials, without which the necessary developments cannot proceed and employment

Presidential address presented at the 15th All Pakistan Science conference, Lyllapur:

cannot be available for all the new people. In some cases, completely new thinking concerning the type of economy needed has to be done and great assistance has been given by the F. A. O. branch of the United Nations.

The extent to which the situation can be controlled and the increase in the population can be matched by an expansion in all the necessary fields of production, in industry, agriculture, in livestock farming and in the winning of the raw materials of production from the earth itself, depends upon the creation of organisations for the correct evaluation of new resources and the planning of their most efficient use. In addition, ways of increasing the availability of raw material must be sought.

It is stating the obvious to say that, for such activities, the preparation of a large number of technical maps of different kinds is absolutely essential. No technical map can be better than the base upon which it is placed, and it seems profitable to survey the possibilities which exist for the rapid provision of such bases.

Ultimately, the solution of the practical problems depends upon education and upon finding some way of controlling the growth of population. Possibly, modern medicine may produce more satisfactory answers than it has done so far.

2. Basic Maps and Topographic Representations for Recording Technical and Scientific Data

Pakistan is somewhat more fortunate than most developing countries in that topographic survey maps at scales of one inch and one quarter inches to the mile had already been prepared over considerable areas before the partition of India. The quality of these maps was, by ground—survey standards, good and considerable improvements have been made to them by using photogrammetric methods based on vertical aerial photography. Now, the " inches to the mile " scales inherited from the British are being replaced by metric scales of 1 : 50,000, and 1 : 250,000 and new photogrammetric maps are being prepared.

The present address is not specially concerned with Pakistan but with a broader field. In many parts of the world, base maps are still virtually non-existent or rudimentary; and we should consider the quickest and most effective means of providing base maps for practical and urgent projects in such places. We may classify developing areas as follows :—

(A) Those for which none but the most general topographic maps exist ; maps of such areas show only the general coast-lines and frontier, the more important human settlements, major rivers and the positions of major hills, and can be regarded as *Rudimentary Base Maps* for which survey has not passed far beyond the exploration stage.

(B) Those at the Preliminary Plot Stage where a network of accurately placed reference points and elevations has been prepared by ground survey, but the finer details and the contours have not been plotted. Scales lying between 1 ; 50,000 and 1 : 250,000 are in use in different countries for such maps.

(C) Those where more or less complete survey, at a reasonable scale, such as 1" to 1 mile or 1 : 50,000 exists and contoured maps at this scale are available. Pakistan is at the present at this stage but, if modern developments proceed to increase at the present rate, larger scale maps will be very much needed for new planning.

(D) Those where large scale maps at scale of 1 : 25,000, 1 : 10,000 and 1 : 2,500 are available. This applies mainly to well-developed countries which need maps at a still larger scale for their detailed planning. The more advanced western European and some American countries are now in this category, as may also be Japan and parts of Russia.

It is clear that, in particularly urgent cases where time is not available for the completion of the details by ground survey, more rapid methods of preparing base maps are necessary. By far the best available methods are those based on aerial survey. The use of such methods will be particularly advantageous in territories of types A and B.

3. Aerial Survey in the Provision of Basic Topographic Representations

In so far as speed is the essential factor, we have the following possible ways of providing bases for the plotting of information which requires urgent evaluation and action :

(*a*) Photographic lays-down are made, over which an over-lay of transparent material can be placed. Topographic details can then be traced out on the overlay and a very useful base map, which is not, however, perfectly scaled at every point, can be produced quickly.

(*b*) A Photographic Mosaic may be made ; the joining of the different photographs to each other is adjusted by careful cutting and stretching of the paper to obtain a good fit. Some areas of photographic distortion may be reduced or excluded and individual prints can be reproduced at larger or smaller scales and perhaps tilted to obtain a better fit. There are two kinds of such mosaics : *uncontrolled mosaics*, where no ground control is available, and *controlled mosaics* where certain fixed points can be recognized in the photographs and their relative distances apart can be preserved at the average scale of the mosaic. Good mosaic making is a very skilled business.

(*c*) By making *topographic maps without contours* by use of the *radial line principle*, either by *graphical plotting* or by the *slotted template method*. The equipment required for such work is relatively inexpensive and a method of radial triangulation is used which ensures that the scale of the map produced is consistent. For obtaining the true scale of the map, two accurately known control points on the ground are required. Topographic details which it is desirable to plot are drawn on transparent overlays to the photographs during their stereoscopic examination and are then transferred onto the map. For such work, photographs are required which are as truly vertical as possible, within 2° or so of tilt.

In practice it is impossible to guarantee that every photograph is as free from tilt as this and rectifying enlargers are used to compensate for excessive tilt in suitable photographs.

(*d*) By use of *plotting instruments*, of different kinds and degrees of complexity, which allow the details of the stereoscopic models produced from pairs of aerial photographs to be plotted with lesser or greater accuracy. Some of these instruments are termed "*optical*" while others are of the "*mechanical*" type. The most accurate of these plotters are very expensive to buy but, if they can be guaranteed sufficient work, rapidly pay for themselves. All details seen in the stereoscopic models can be transferred to the map and contours can be plotted. The amount of accuracy available depends upon the inherent possibilities of the machine and its operator and upon the ground control available.

In general, the choice of method depends upon the nature of the problem for which a base map is required and upon the time and money available for the work. The use of the more expensive machines is naturally costly. However, as will now be shown, if multiple surveys are carried out, where photographically interpreted details other than those of topography are plotted in addition to the topography, the expense becomes very much less and can certainly be much lower than that of orthodox ground surveys. In all cases, however, the interpretation is vastly improved by using ground control to verify the interpretation and to allow it to be extended.

4. Superposition of Technical Information

The accuracy of a technical map can never be greater than that of the base on which it is placed. From the writer's own experience in geological survey operations, the extent to which this ultimate accuracy is achieved by individuals varies greatly, whether the work is being done on paper base maps or directly on to the aerial photographs with subsequent transfer to the paper. Ultimately, it is a question of individual ability, practice and experience and the intensity of interest which the individual brings to bear on the problem of relating his field observations to the maps or to the aerial photographs. In certain cases, defects of vision in the individual are limiting in this respect. Nevertheless, given an individual worker of good ability and free from certain visual defects, it is a matter of experience that the use of aerial photography in the interpretation and plotting of technical data and results leads to a great saving of time and an increase in the overall relative accuracy. This is naturally most true in areas where highly accurate topographic maps are not available. Even in areas where very good maps have already been prepared, the use of the three dimensional views, given by pairs of aerial photographs, in the field greatly assists the plotting and understanding of the technical information being studied.

The type of information which is normally plotted on to the topographic base can be divided into two ; the relatively *static information* such as the geological structure and bed-rock lithology, which in the stable areas rarely changes appreciably during the life time of a man, contrasts with those features, associated with land use, forestry, agriculture and soil use, which are *constantly* changing. There are, however, certain areas of the world where erosional changes occur so quickly that even geological maps have to be revised in order to obtain reasonably complete agreement with the actual ground under the new situation. In one area in which the writer has worked, appreciable changes in the detailed topography had occurred by comparison with aerial photographs taken ten years previously. These changes in some cases also affected the geology as shown on the maps.

It may be deduced, therefore, that if one accepts the idea that aerial survey is an acceptable means of working quickly and economically, one really needs to provide a service whereby *new* aerial photography can be provided as and when it is needed. (In considering the cost, one must not only consider the actual price in money of such work but also the total time involved which, in some projects, may be critical). This is especially so with the constantly changing but mappable features previously referred to and allow an impartial check to be made on the ways in which these features are changing, since a given area can be covered in a relatively short time. In such cases, pure ground work is so slow that appreciable changes occur even while the work is going on, so that the actual position becomes more or less a matter of opinion. It is sometimes possible to obtain such photographic coverage by close co-operation between the military aviation authorities and those who are interested in the scientific and development aspects. Such co-operation is, however, rarely all that could be desired and it may be important that the organization which is responsible for the photography should have an independent brief for carrying out its work.

The writer may perhaps be permitted to give a few examples of the sort of work that is possible by carefully controlled use of aerial photography in the field followed by laboratory interpretation of the photographs and the plotting of the data from them :—

(*i*) Pasture improvement surveys.

(*ii*) Soil and agricultural studies of major irrigation projects.

(*iii*) Studies of engineering projects from the point of view of topography and geology, *e.g.* dam sites, location of roads, control of land slips, etc.

(*iv*) Estimates and classification of forest reserves.

(*v*) Rapid reconnaissance geological mapping, especially in desert or once glaciated areas.

(*vi*) Geological mapping as a basis for mineral exploration.

(*vii*) Detailed geological mapping, using photographs in the field for the plotting of geological observations.

(*viii*) The preparation of large scale maps for the replanning of old towns and the mapping of sites for new towns.

It should be noted that if the best results are to be obtained in plotting information obtained from photographs on to previously existing topographic maps prepared by ground survey, the scale of the aerial photography should be larger than that of the maps used as the topographic base. In cases where the reverse is true, plotting errors may become substantial ; this situation is to be avoided except where no other alternative is available.

5. Conclusion

On the basis of practical experience, it is concluded that a vast need for base materials, for use as topographic maps and for the plotting of various kinds of scientific and technical data, exists. This need will become greater as the world population expands and the further development of natural resources becomes imperative.

By far the best hope of fulfilling this need at a responsible speed is by the carefully planned use of aerial photography, using different methods of producing the base materials and of plotting the superimposed technical information according to the needs of the situation and the money available. Where possible, the same photographs should be used for obtaining different kinds of technical interpretation as well as for producing the base materials, so reducing the average cost of each kind of map.

In some cases, there is a need for repeating the photography of certain areas every few years in order to keep in touch with the changes which have occured. It is, therefore, important that aircraft and facilities for repeating photographic surveys, at a given scale, whenever required, should be on hand.

It must seriously be considered whether a developing country can afford to be without some organization for the co-ordination of all aspects of work which can be based on the correct use of aerial photographs in the planning of the use of that country's natural resources. When the creation of such an organization is possible it must have full control of all the stages in the production of the necessary maps, from the initial flying and photography to the final printing.

In addition, all the photography, maps and reports produced by such an organization must be made rapidly and generally available to all organizations, whether public or private, who can make use of them in the development of new projects. Furthermore, such material provides an excellent way of furthering education in the Earth Sciences in schools, colleges and Universities. The advantage of having such maps and information available greatly outweighs any considerations of military secrecy which are, these days, largely illusory. The value of such work lies in the quickness with which it can be made available and brought into use ; otherwise, the advantages, although not entirely lost, are greatly diminished.

I would, therefore, end with a plea that the availability of all basic maps, air photographs and scientific reports should be increased all over the world and that far more attention should be paid to the possibilities so opened up. The barriers to such free use of basic mapping materials should be pulled down, whatever their causes, so increasing the speed of development in all manner of modern enterprises.

There should, in fact, be freedom in the development of natural resources for all those who have the necessary knowledge to make proper use of aerial photography and maps. The consequent increased activity would be certain to lead to advances and to the discovery of new possibilities in the planning of development, both on the private and in the public sectors.

—————

CAVERNOUS ROCK SURFACES (TAFONI) IN SEMIARID AND ARID CLIMATES

BY

HERBERT WILHELMY,

Department of Geography University of Tubingen, Germany,

Each one of the different climates has its specific type of disintegration. In the humid tropics chemical weathering predominates; in the arid climates physical or mechanical decomposition is the most important way of destruction of solid rocks. That is what we read in most of our text-books. But in free nature physical and chemical disintegration are not separated as strongly as it seems to be. There is in reality an interplay between both and locally, regionally or seasonally the one may predominate over the other. In

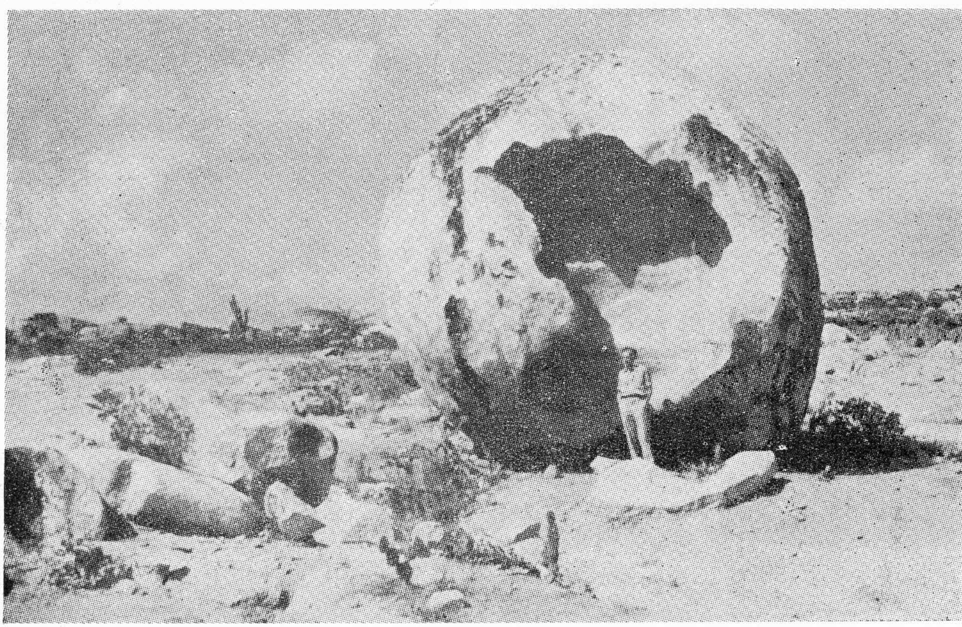


Fig. 1
Tafoni in a well rounded "Woolsack" of Dioxite, Island of Aruba, Netherl. West-Indie.

some areas winter-time is characterized by physical weathering, which perhaps in summer-time is not of any importance. These different kinds of disintegration and their interplay may be reflected in soil profiles or landforms—may be, but must not be always, because sometimes co-operation between physical and chemical weathering is so complete, that no differentiation is possible. Hydration, for example, which produces an enlargement of volume, is the result of chemical and physical processes and both cannot be separated. Independent of the usually used terminology it is perhaps better to speak of " surface-weathering " or phanerogenic weathering (with a greek word) on the one hand—and of " deep-weathering " or cryptogenic weathering on the other hand.

Arid and semiarid climates, of special interest to us, in Pakistan are characterized by surface-weathering, brought about by the interplay of insolation, hydration, oxydation and in mountainous regions also by frost riving. The general effects of these forces are well known : decomposition of rocks by differences in tension, dividing in pieces by fissures (Kernsprunge), granular disintegration, exfoliation, forming of well rounded woolsacks with bull-scale-like rounded slabs, spalling off a relatively fresh core, forming of domes, inselbergs (*i.e.* bornhardts) or sugar-loaf-like mountains. These forms have often been described, and we do not need now to occupy ourselves with them.

I wish to turn your attention to a special problem of rockweathering in the arid and semiarid climate, and that of the cavernous rock surfaces, the so-called tefoni. "Tafonare"

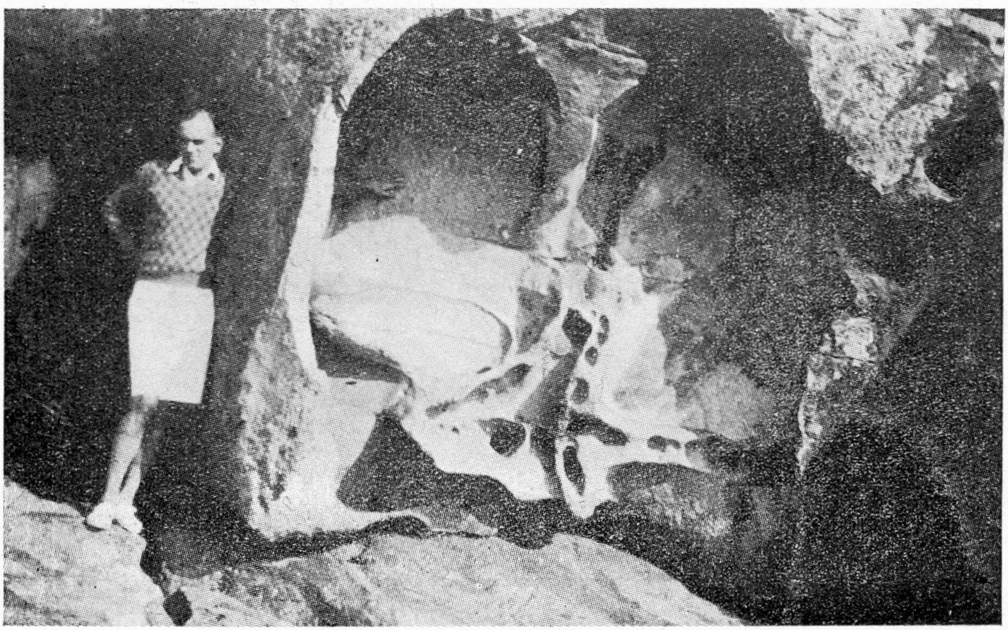


Fig. 2

Cavernous rock, Island of Hong Kong, opend by a "Window" on the left side.

is a corsic word, an expression of the island of Corsica in the Mediterranean and it means : to perforate. It is a good expression because the tafoni are really perforating the rocks and often the rocks are nothing more than ruins, skeletons of fantastic forms. People have called them "head of the dog", "sea lion", "elephant" etc. You may find them in the Mediterranean islands of Corsica and Elba, in the West India (Island of Aruba), in the coast desert of Peru, in the Sierra Mahoma of Uruguay, in the dry Southwest of North America, in the rocky desert of Peshan in Central Asia, on Mount Abu of the Aravalli Mts. of NW-India, in East Africa and even in arctic and antarctic regions.

Always we find these hollows, these tafoni, in rocks, covered by so-called "protecting barks". These are hard surface-crusts, mostly of iron-hydroxyde and are the result of evaporation of salt-bearing solutions. Moisture of occasional rains or nightly thaw penetrates the rock and comes back to surface with dissolved minerals in consequence of the daily heating of the rock. Minerals are secreted on the surface, changing the surface into a hard crust, whereas the core of the rock will be weakened by the loss of dissolved

Fig. 3

Small tafoni in Granite, Island of Elba.

minerals. On that side of the rock where precipitation is quickly followed by drying off the rock surfaces are intensively fastened. The shadowsides of the rocks on the contrary are not covered with such a hard crust. There is no protecting bark and from this side weathering penetrates the interior, crumbles core of the rock and makes the tafoni, opened to the shadowside, the wettest side of the rock. This process is called "Shadow-weathering".

All samples of a real hollow block formation will have in common their origin from either a periodical damp, frequently breezed coast-climate where the rock surface will be exposed to constant changes of humidifying and dehumidifying that is temporarily due to a microclimate or edaphic aridity, as in coastal areas of the Mediterranean and the Caribbean Sea, or they originate from a macroclimate aridity where long dry seasons with high temperatures cause strong evaporation as in the deserts.

Those areas are noted for their low annual precipitations which occur periodically during short intervals. Thus the climate in those areas must be ranged between seasonally arid and all-year-arid climate. That means: the best conditions for tafoni-forming are in the border areas of the deserts, not in central deserts where precipitation is too low.

In this rather small transition-zone, as well as in areas with a change of nightly humidifying and daily dehumidifying of the rock surface caused by high temperature, the specific core disintegration (Kernverwitterung) dominates. Core-disintegration is the

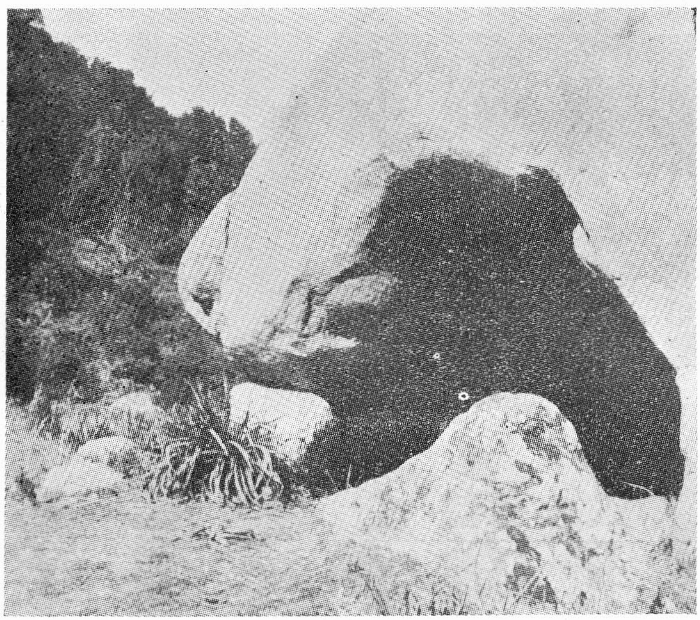


Fig. 4

Big hollow (tafoni) at the base of a Granite rock, Island of Corsica.

exact opposite of surface-disintegration dominant in humid and periodcally humid climates with mainly rainy periods. Instead of a disintegration from surface to core, there appears the capillary increase of mineral solutions from core to surface.

Crumbled surface rocks with solid cores of durable conservation originate in humid and semihumid climate, whereas in transitional zones to arid climate solid surface rocks and crumbled cores will be found. Disintegration zones with detritus formation of red soils between solid cored ellipsoides, following the fissures, develop in humid and semihumid climate as far as tropical climates are concerned. But in the above mentioned transition zones hard iron-hydroxyde surface crusts cover crumbled cores (Zersatzdrusen).

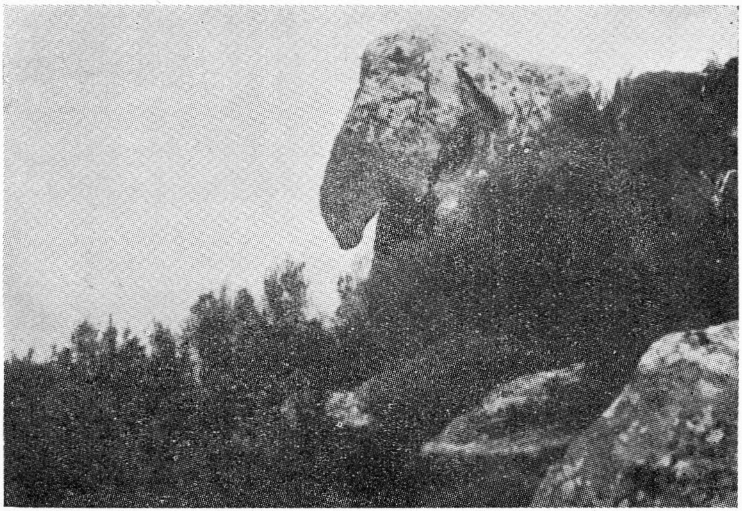


Fig. 5
Skeleton of a granite rock, called the "Elephant," Island.

In the boundary area, an entire relief-inversion develops in block disintegration between seasonal and all-year arid climate contrary to all other climates. Transferring to extreme arid desert areas, we shall again meet block disintegration from surface to core and as a result rock grusing, shell formation and solid core.

——————

WOOLLEN TEXTILE INDUSTRY IN PAKISTAN

BY

K. S. AHMAD AND (MISS) M. K. ELAHI

Production of hand woven woollen cloth, blankets and shawls has been known to be a common art in the highland areas of Pakistan since long. Today in the highlands of Dir, Swat, Chitral, Gilgit, Hunza and Baluchistan one comes across fine quality woollen cloth rugs and carpets, which fetch high prices when marketed to the cities.

In Pakistan, generally speaking, the use of woollen cloth, blankts and other articles is very limited. In East Pakistan climate remains mild even during winter months. In West Pakistan except in the highland areas winters are of short duration and not so severe, so that most of the rural population feels warm enough in thick coarse cotton clothes. With the growth of urban population and rise in the standards of living, the demand for woollen textiles also rose. In the absence of any woollen manufacturing industry in the country, the demand was mostly met by imports of woollen and worsted textiles from foreign countries and partly by cottage industry.

Growth of the Woollen Textile Industry since Independence :

There were no woollen textile mills in West Pakistan at the time of independence. There was only one woollen textile establishment in East Pakistan at Dacca, employing about 141[1] workers only. Most of the indigenous wool was exported in raw form. In order to lessen the drain on our foreign exchange, the growth of woollen textile industry was considered essential for the country's economy. Plans were drawn for the development of this industry in West Pakistan, which had the advantages of raw material and market. Indigenous wool from West Pakistan is quite suited for tweeds, rugs, carpets and rough blankets. In 1949, one spinnery was established with 2,000 spindles and there were plans to set up more spinneries with a total capacity of 31,000 spindles, 13,000 for former Panjab, 16,000 for former Sind and 2,000 for former Baluchistan.

In 1952, P. I. D. C.[2] planned to set up three woollen mills in wool producing areas, at Harnai, Bannu and at Qaidabad (Shahpur District). The Mills at Harnai and Bannu went into production in November, 1953. Each of these mills is capable of producing 40,000 barrack blankets, 40,000 of carpet yarn dyed in various colours for distribution to the

1. Statistical Digest of Pakistan 1960.
2. Pakistan Industrial Corporation established in Jan. 1952.

cottage industry and 270,000 lbs. of fine tweeds. The Third woollen mill with 1,000 sanctioned spindles was set up in Qaidabad in association with the Thal Development Authority and started production in May, 1956. The production capacity of this mill is 1-2 million lbs. of yarn per double shift. It is to specialize in the production of blankets.

First Five Year Plan

A survey of the position of the industry was made in 1955 for the purpose of the first five year plan. The actual production of woollen and worsted yarn in millions of lbs. was as follows :

1948	1949	1950	1951	1952	1953	1954
Nill	*Nill*	*Nill*	1·141	1·54	8·7	7·5

The value of goods produced was 34·1 million rupees. The plan increased the investment in the industry from 50m to 71m. rupees during the plan period 1955—60, with an addition of 53 % in the spindlage capacity (30,790 to 47,040). An appraisal of the country's needs for woollen and worsted yarn for various purposes was also made. According to it about 10m. lbs. of woollen and only 3·4m. lbs. of worsted yarn were needed. Details of the requirements are

Woolen Yarn ..	Tweed overcoating	35	Thousand lbs.
	Civilian Blankets	1,200	,,
	Military overcoating and Blankets ..	450	,,
	Barrack Blankets	2,100	,,
	Hand looms	1,300	,,
	Carpet yarn	4,590	,,
	Total ..	10,035	
Worsted Yarn		3,400	

As compared to other industries, this industry was given less importance in the plan, on account of the limited demand for indigenous production and the need for imports of fine wool and woollen and worsted yarn from abroad for better quality cloth as indigenous wool is too short stapled for the purpose.

Second Phase 1955—1960

Table I shows that by 1956 there were in Pakistan 13 woollen worsted mills, one in East Pakistan and 12 in West Pakistan, comprising an aggregate of 22,760 woollen and 21,832 worsted spindles, employing about 3,631[1] workers daily and producing goods worth

1. Statistical Bulletin Vol. X 1962.

about 34 million rupees. During 1956, 1200 woollen and 700 worsted spindles were added, bringing the total strength to 22,762 woollen and 21,732 worsted spindles. The productive capacity by 1957 was 5·2 million lbs. of woollen and 4 million lbs. of worsted yarn.

The last census of manufacturing industries in 1959-60 showed 24 woollen textile manufacturing establishments in Pakistan, 23 in West Pakistan and only one in East Pakistan. The number of daily workers had almost doubled between 1956—60. (Table I).

As an individal industry of Pakistan it occupies eighth position as regards number of persons employed. The value of all the products and by products of the woollen manufactures was placed at 55·8 m. rupees in 1959-60. The total installed equipment in woollen textile in 1959-60 was 25,700 spindles, providing a capacity of 3.5 million lbs. of woollen yarn on single shift basis. These spindles can meet the internal demand (about 5.2 million lbs.)[1] by operating on multi-shift basis. Installed worsted spindlage in 1959-60 was 22,700 with a capacity of 3·5 million lbs. of worsted yarn. According to the statistics made available by one department of industries, the total installed spindlaged in 1961 was 57,986, (woollen and worsted) with a total of 359 hand looms and 418 power looms.

Size and classification of the woollen textile mills

A detailed analysis of the existing data of the woollen mills shows that in 1959-60, out of a total of 24, ten woollen manufacturing establishments were medium sized factories employing between 20—100 workers each. Four mills employed between 100—250 workers. All the rest were large sized mills which employed more than 250 workers each out of which only two employ more than 1,000 workers, one at Karachi the other at Lawrencepur. Only two mills employed less than 20 workers each. Location of large sized mills at places mentioned above is easily accountable. At Harnai, Bannu, Lawrencepur and Multan nearness to indigneous raw materials and cheap labour were the most important common factor; while in Karachi facilities of cheap power, plenty of cheap labour and imported yarn for worsted fabrics have been the chief locational factors. Table II shows the size, classes and nature of the enterprises. The largest number is of partnership firms (10) while private companies own only 4 mills. Individual enterprises are few (2) while these belong to joint stock companies and corporations. Government owned mills are only two in number. Collective enterprise was greatly encouraged after the industry was handed over to P.I.D.C. in 1952. Because of the shyness of capital the individual enterprises are few.

Second Five Year Plan 1960—1965

The industry at present can cater for almost all the requirements of the country with a small surplus of woollen yarn and fabrics for export, and therefore no substantial increase

1. Second five Year Plan of Pakistan 1960-65.

in capacity is proposed during the second plan period. The foreign exchange burden of imported raw materials, including wool and wool tops, dyes and chemicals, is also standing in the way of the faster development of the industry. Under the Second Five Year Plan, it is proposed to set up a carpet wool spinning mill based on indigenous wool and to modernize the existing mills. Out of the total of 10 million rupees allocated to be invested in this industry during the plan period, about 7 million rupees will be spent on modernization and only 3 million rupees is allocated for new installations.

Products

Woollen manufacturing industry turns out various types of products worth 55-8 million rupees. Woollen cloth is the most important in terms of value, accounting for about 40 % of total value of all products (Fig. I) Total quality of woollen cloth produced from Pakistan Mills amounts to 16,07,000 yards worth about 23 million rupees. (This works out to be 1 yard of woollen cloth for about every 60 persons). The production is very low, but in view of its limited use in the rural areas of the country it is sufficient for the requirements of the urban population without any substantial imports from foreign countries. Worsted cloth and mixed cloth (wool silk and cotton) production is relatively small, only 272,000 and 289,000 yards respectively. This is due to the imported raw materials needed for both these types of cloth.

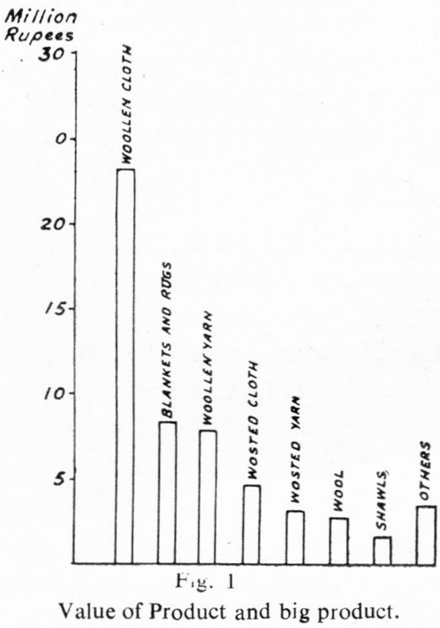


Fig. 1

Value of Product and big product.

Blankets and rugs rank next in importance to woollen cloth in value. Number of blankets and rugs produced in 1959-60 was 372,652 worth 8.5 million rupees. Woollen and worsted yarn was also among the important products. It feeds the hand loom and other cottage industries. Knitting wool produced was worth 2.7 million rupees Knitting wool has an expanding market in our country as it is economical for people to wear hand knitted jerseys, sweaters and shawls.

Shawls, jerseys, carpets and other hosiery goods are among other items of production worth about 4.6 m. rupees.

Fuels consumed

Power for this industry is supplied by various sources. The following figures show the relative importance of the various types of fuels as percentage of total value of all fuels consumed for the industry.

Electricity	53·6%
Coal	14·4%
Natural Gas	10·6%
Oils (Kerosene, petroleum diesel and other)..	11·6%
Lubricants	5·5%
Others	4·8%

More than half the value of fuels is met by electricity, perhaps the most economic fuel in our country (Fig. 2). Coal is next in importance whereas an almost equal amount of money is spent on natural gas and fuel oils. Natural gas is the most imoprtant fuel in Karachi and Multan. The relative importance of these fuels is, to some extent, determined by their availability, but since this industry is not a very large consumer of fuels, its availability is no where the most important locational factor.

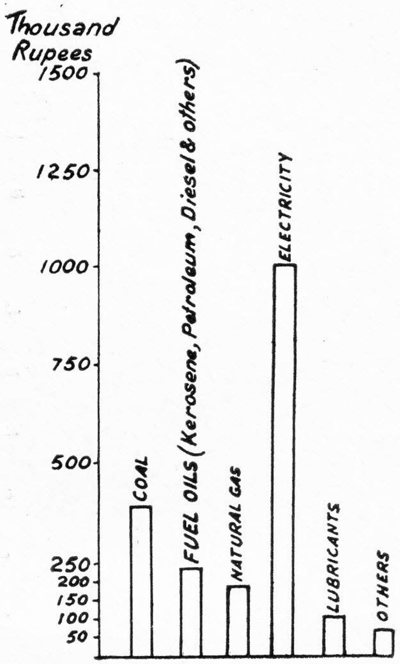


Fig. 2
Fuels and Electricity Consumed

Raw Materials

Woollen textile industry consumes raw materials worth about 31.4 million rupees. The largest amount about 81 % is spent on raw wool and wool tops, which are the basic raw materials (Fig. 3). Pakistan produces about 28—32 miilion lbs. of raw wool, with production in the West Wing where in the highland areas sheep rearing is either a very important supplementary source of income other than agriculture or the only important means of livelihood. At the time of independence almost all the wool produced was exported. Even now it is one of the important items of export, and only a small fraction about 2 million lbs. is consumed in the woollen manufactures mostly for carpets, rugs, and rough blankets. It is too short stapled for worsted and fine quality woollen and tweeds goods. For this reason imported raw wool and wool tops account for 90 % of the value of raw wool and wool tops consumed in the industry.

Woollen and worsted yarn worth 1.7 m. rupees is the second largest item of expenditure among raw materials. Only 1/3rd of the total woollen and worsted yarn consumed in the industry is imported. Most of the mills are capable of producing quality worsted and woollen yarn. Other raw materials consumed are chemicals, dyes, wool shoddy and cotton yarn. Most of the chemicals and dyes are imported.

IMPORTANT CENTRES OF THE INDUSTRY

Some of the important centres of woollen textile industry are Karachi, Lawrencepur (District Campbellpur), Rawalpindi, Harnai, Bannu, Multan, Lahore and Qaidabad. As it appears from fig. 5, the industry shows no particular concentration in any one region. Some centres are based on raw material and others on better marketing facilities. As most of the production is for the country's requirements, a more widespread distribution of the industry has given better access to the regional markets.

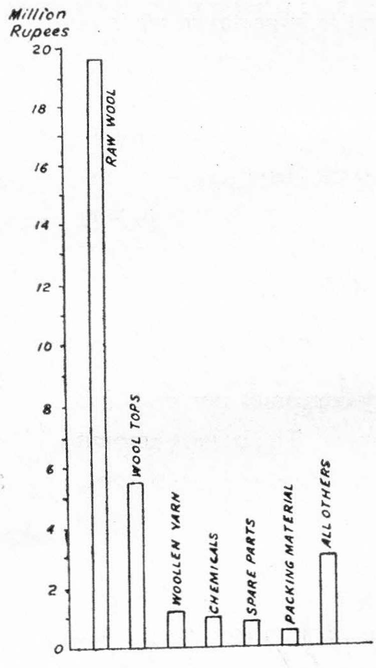


Fig. 3
Raw Materials Consumed and Payments to other Statistics. (Woollen Manufactures).

Karachi

Karachi is the largest centre of woollen textile manufacturing industry (Fig. 5). It has four woollen and worsted mills with a total installed capacity of 16,444 spindles, which is more than one third of the total for Pakistan. The first mill Valika (worsted) was established in 1949 and is the largest mill in Pakistan, producing about 2 million lbs. of yarn and 1·3 million yards of cloth including blankets. Other mills are Allah Jahangir Woollen Mills, Haidari Woollen Mills and Pak. Woollen Mills.

Karachi has many advantages, which has given her first position among industrially developed places in Pakistan. Its coastal location facilitates the import of raw materials needed for woollen textile manufactures. There was no lack of capital in Karachi. Old established businessmen and the businessmen who immigrated from Bombay at the time of independence in 1947 with capital and experience welcomed such industrial enterprises. There was also a great influx of destitute immigrants from India, which provided cheap labourfor the growing industries of Karachi. Being the biggest city and the most important commercial centre of Pakistan, it had all the facilities for the marketing of finished products. Recently the advantage of cheap power supplied by Sui gas is an additional facility. It is expected that this centre would continue to command a dominant position.

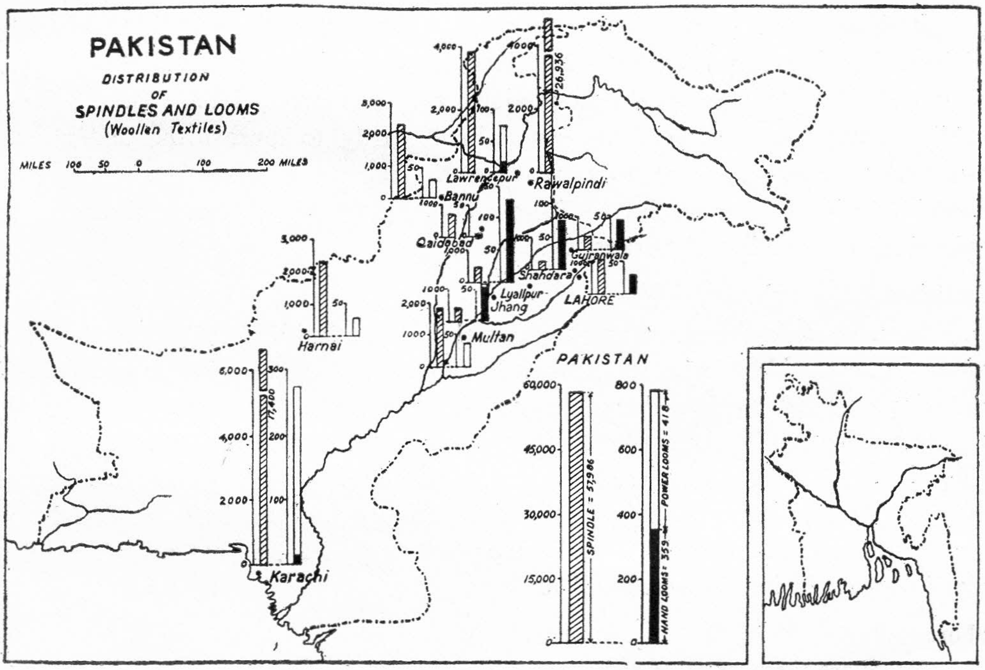


Fig. 5

Lawrencepure (District Campbellpur)

Lawrencepure is the second most important centre of the industry. It has one large woollen and worsted mill which went into production in 1954. It has a sanctioned capacity of 11,000 spindles. The installed capacity however is 6,824 spindles. This mill employs about 1,300 workers daily and produces about 1 million lbs. of yarn and about 378, 166 yards of cloth including blankets and shawls. Lawrencepur had the advantages of nearness to indigenous raw material, availability of cheap electricity and a large marketing area in the adjoining areas of Peshawar, Mardan and Hazara District. It has also occess to the markets of other urban areas in the Panjab plains.

Rawalpindi

Rawalpindi has also become an important centre of woollen textile industry. It has two mills, Wattan Woollen mills Ltd. and Rahat Woollen mills, having a combined installed capacity of 5,246 spindles and employing about 539 workers daily. These mills produce woollen yarn of all types and woollen cloth and hosiery goods. Rawalpindi mills have the advantage of cheap power (fuel oil), cheap labour and efficient means of transport providing a direct link with the large urban centres of the Panjab Plains. With the new capital of Islamabad being constructed near Rawalpindi it is likely to grow in relative importance in future.

Bannu and Harnai (Sibi)

Both centres are of equal importance with an installed capacity of 2,340 spindles each and 30 and 28 looms respectively. Mills at both these places were established under the guidance of P. I. D. C. and went into production in November, 1953. These mills were established partly on the basis of raw material and partly to improve the underdeveloped area. The production of woollen yarn and cloth from these centres amounts to 812,000 lbs. and 425,000 yards respectively. Bannu is a slightly bigger centre than Harnai in production and number of workers employed.

Ismailabad (Multan)

Ismailabad is also one of the important centres of this industry. It has one large Colony Woollen Mills with an installed capacity of 1,920 spindles and 40 looms, employing over 500 workers daily. It produces about 668,000 lbs of yarn and 434,720 yards of woollen cloth worth more than 3 million rupees. This centre, lying near one of the oldest cities of Pakistan, has a cheap and adequate labour supply. Being located on the main line, it has rail and road links with all other important markets of West Pakistan. It now has an additional advantage of cheap power supplied by Sui Gas and is likely to grow in industrial importance.

Lahore

There are three woollen mills in Lahore, which employ about 185 workers and produce goods worth about one million rupees. Woollen yarn, cloth, blankets and hosiery goods are the chief products of these mills. Inspite of being the second largest city of Pakistan with adequate and cheap labour supply, efficient means of transport and a large market, its industrial development is not encouraging, perhaps on account of the disadvantage of its being a border town.

Qaidabad (Sargodha) has one woollen mill with an installed capacity of 644 spindles. It produces goods worth 918,119 rupees comprising woollen yarn, cloth and blankets. The development of this industry at this centre was in association with the Thal Development Authority. It was for the purpose of regional development that the mill was located in the

Thal area to supply goods to the growing population in the newly settled areas and the old canal colonies of Sargodha near by.

Jhang and Gujranwala are the two relatively less important centres of the woollen manufacturing industry. There is one Government Weaving and Spinning Development and Training Centre at Jhang. The number of installed spindles and looms is 420 and 58 respectively. It employs persons for training in the art of spinning and weaving for the future development of the industry.

Gujranwala, though otherwise industrially well developed, has only one woollen mill with a total capacity of 400 spindles and 42 looms. It produces woollen yarn, cloth shawls and blankets.

Imports and Exports (Raw Wool, Yarn, Woollen fabrics)

There have been some interesting changes in the imports and exports of raw wool and woollen cloth and yarn and fabrics since independence.

Imports

At the time of independence in 1947, woolleny yarn and manufactures were one of the important items of imports of Pakistan. As is shown by Fig. VI, in 1951-52, the value of all imported woollen manufactures was 23.8 million rupees after which there has been a rapid decline upto 1954-55 when the value of imported yarn and fabrics was about 1/8th of that in 1951-52. After 1954-55, the downward trend though not rapid continued and by 1961-62 the total value of imported woollen fabrics and yarn was only Rs. 292,000. This is explained by the corresponding growth of woollen manufacturing industry during these years.

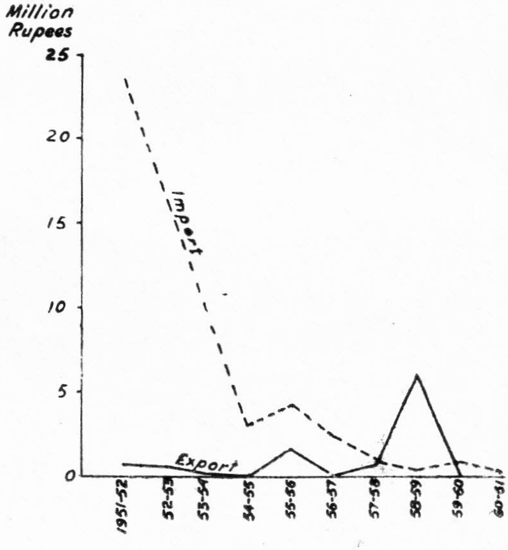


Fig.
Exports and imports of woollen yarn and woolen manfacture

On the other hand, with the growth of the woollen textile industry in the country, imports of raw wool and waste have increased steadily to more than five times between 51-52

61-62. Pakistan imported raw wool and wool tops worth 5.0 million rupees in 1951-52 and by 61-62 the value of these imports had risen by five times to 25.4 million rupees. This is partly accounted for by the greater demand of such imported material for the worsted goods and partly by a general rise in prices.

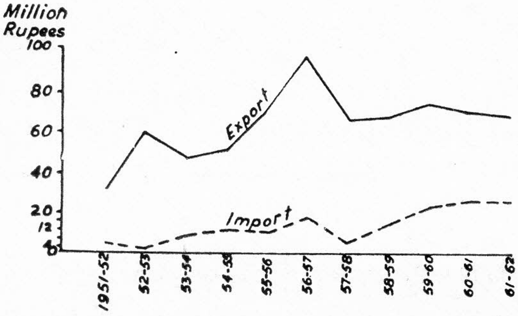


Fig.

Export and Imports of raw wool and Waste

Exports

As has been stated before, Pakistan has been a large exporter of raw wool. The growth of woollen textile industry seems to have apparently no effect on the export of raw wool as only a small fraction of the local produce is consumed by the industry. In 1951-52, the value of exports of raw wool was 81.1 million rupees which had fallen to 65.4 million rupees in 1961-62. Exports of woollen yarn and fabrics on the other hand continues to be negligible.

SALINITY IN IRRIGATED SOILS OF LOWER SIND

BY

MUSHTAQ-UR-RAHMAN*

Irrigated soils in lower Sind are mostly salt-affected. Salt accumulations differ from one place to another in general, depending on the topographic positions, water table, and irrigation practices. Irrigation water contains dissolved salts, which become concentrated in areas where the water table is high. Excessive loss of irrigation water from perennial canals constructed in permeable soils is the major cause of a high water table. Too much perennial irrigation without a proper understanding of physical milieu may further aggravate the situation. A comprehensive understanding needs a scientific appraisal of facts based on the local geography and calls for an immediate solution. This paper is an attempt to present the problem of salinity in Lower Sind with a geographical background supported by the recent empirical data.

Lower Sind designates an area south of Hyderabad within the boundaries of the former province of Sind. Perennial irrigation is practised along the Fulailee canal and as far as the boundary of Thar desert in the east and Kirthar ranges in the west (Map 1).

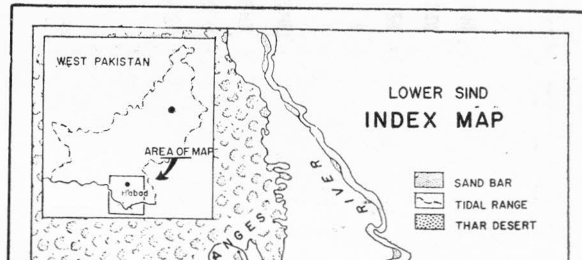


Fig. 1

Type of Salt-affected Soils

According to the classification of United States Department of Agriculture (Bulletin 190, p. 6), the salt-affected soils are classified into three different groups: saline soils, sodic soils, and saline-sodic soils. Saline soils contain too much soluble salts. These soils are generally flocculated—that is, the soil particles are grouped together ; water and air moves freely between them. Sodic soils have appreciable amounts of sodium absorbed on their

*Dr. Mushtaq-ur-Rahman, is Senior Lecturer, Department of Geography, University of Sind Hyderabad.

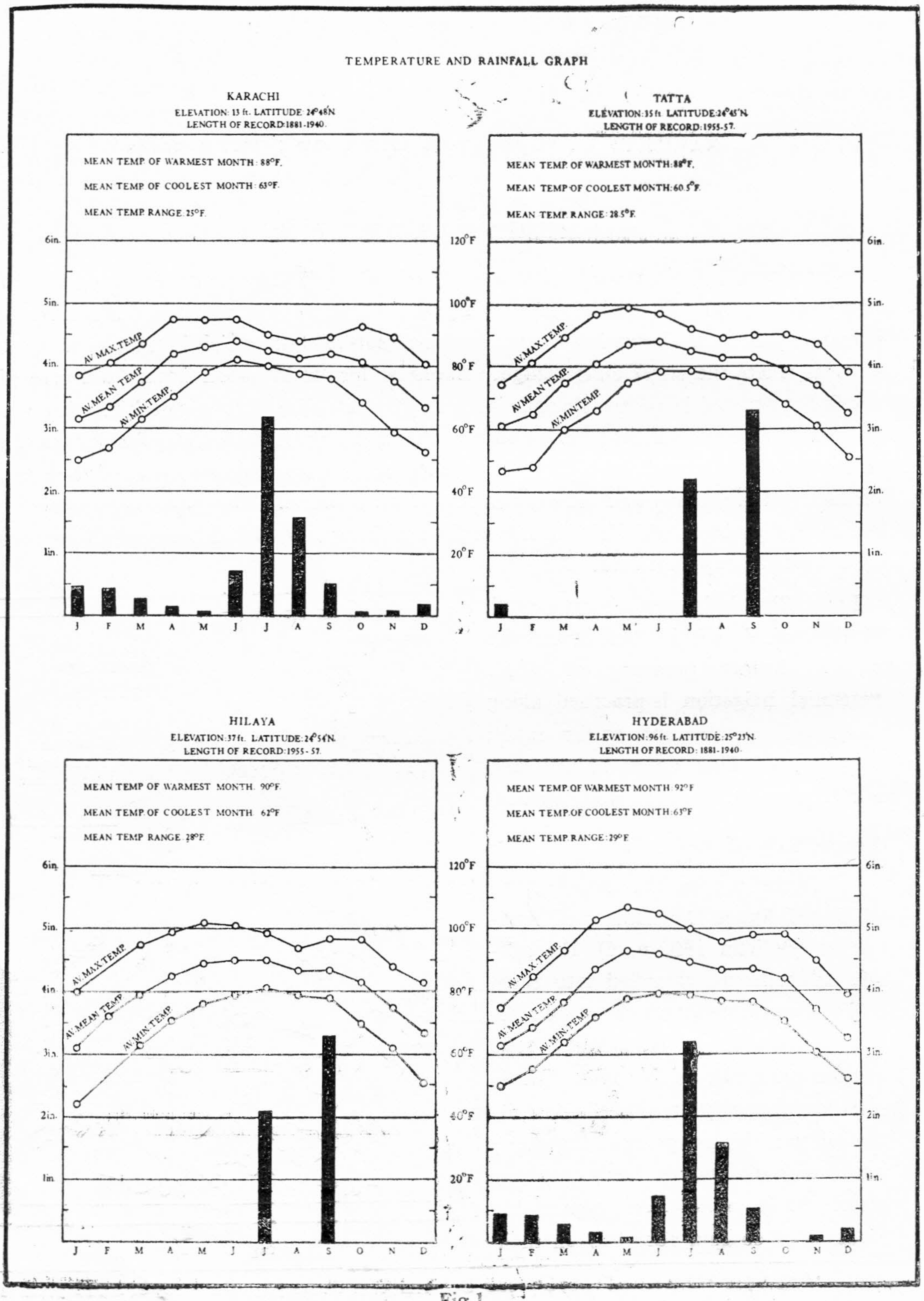

TEMPERATURE AND RAINFALL GRAPH
KARACHI
ELEVATION: 13 ft. LATITUDE: 24°48'N.
LENGTH OF RECORD: 1881-1940.
MEAN TEMP. OF WARMEST MONTH: 88°F.
MEAN TEMP. OF COOLEST MONTH: 63°F.
MEAN TEMP. RANGE: 25°F.
TATTA
ELEVATION: 35 ft. LATITUDE: 24°45'N.
LENGTH OF RECORD: 1955-57.
MEAN TEMP. OF WARMEST MONTH: 88°F.
MEAN TEMP. OF COOLEST MONTH: 60.5°F.
MEAN TEMP. RANGE: 28.5°F.
HILAYA
ELEVATION: 37 ft. LATITUDE: 24°54'N.
LENGTH OF RECORD: 1955-57.
MEAN TEMP. OF WARMEST MONTH: 90°F.
MEAN TEMP. OF COOLEST MONTH: 62°F.
MEAN TEMP. RANGE: 28°F.
HYDERABAD
ELEVATION: 96 ft. LATITUDE: 25°23'N.
LENGTH OF RECORD: 1881-1940.
MEAN TEMP. OF WARMEST MONTH: 92°F.
MEAN TEMP. OF COOLEST MONTH: 63°F.
MEAN TEMP. RANGE: 29°F.
AV. MAX. TEMP.
AV. MEAN TEMP.
AV. MIN. TEMP.
6in.
5in.
4in.
3in.
2in.
1in.
120°F
100°F
80°F
60°F
40°F
20°F
J F M A M J J A S O N D

Fig. 1

individual particles. They are not flocculated because the soil particles on which the sodium is absorbed separate from the flocculated clumps. This separation causes the openings between the clumps to become smaller. Water and air cannot move through the soil freely even though there may be more openings. Saline-sodic soils occur when salinity and adsorbed sodium affect the soil at the same time.

Salt-affected soils in Lower Sind generally belong to the group of saline soils. These can be improved by leaching and other means, which in turn is difficult due to climate, type of soils, and high water table.

Climate

The climate of Lower Sind embodies most of the characteristics of a semi-arid climate except in the south where maritime influence becomes more conspicuous. The most striking feature is the variability in amount and time of rainfall. Rains occur mostly in the summer season but the amount and time vary to such an extent that during some years the rainfall doubles the average, while in others it drops considerably.

The average monthly temperature is 80 F ; average monthly maxima passes 91.9 F, and average monthly minima goes below 68.7 F (Fig. 1.). The hottest area corresponds to the northern limit of the area, where stations record an annual mean of over 92.3 F. The days are hot and the nights cool with average diurnal range as high as 22 F for most stations.

The temperature begins to rise in March and remains high until October, which is regarded as the summer season. The beginning of the summer season is marked by an abrupt change in temperature from February to March, but the temperature remains fairly constant during the summer months (Table 1), with May and June the hottest months. The temperature falls rapidly in November, which marks the beginning of the winter season. Winter prevails from November until February, with January as the coolest month.

Low precipitation with a high variability is the chief characteristic, which in terms of amount averages about eight inches annually. According to the available data pertaining to Karachi, the co-efficient of variability of annual rainfall is around 13 per cent, and that of individual months varies from 137 per cent in January to 567 per cent in April and October, with intermediate values in intervening months (Naqvi, p. 1).

Soils

Like other areas with arid climate (Simouson, p. 31) and recent alluvial deposition, there are practically no profile developments in soils. The effect of pedogenic evolution is obliterated by climatic aridity and yearly additions of silt, leaving the mineral constituents predominant in the soil (Hodges, p. 67). Basically the soils of the area are made up of sands, silts, and clays. In terms of texture, the areas of higher relief are characterized by medium textured soils while areas of comparatively lower relief have moderately heavy textured soils. The finer materials are carried by river into the tidal area (Map 1), where they are either deposited as mud flats or carried to the sea.

There is preponderance of medium and moderately fine materials in most places, and heavy textured materials are also common on that part of the cover flood-plain forming the eastern half of the region. Large tracts of puddled soils, with low permeability are found in the southern part (Colombo, p. 357). Both medium and heavy textured soils are thick with no appreciable difference in material down to depth of 25 feet or more from the surface (LeVee, p. 9).

Broadly, the same soil patterns ranging from sand to silty loam and clay exist north of Hyderabad (Youngs, p. 17). The seepage of water from the river and canals results in the rise of water table carryin g with it salts that become concentrated at the surface.

Origin and Accumulation of Salt

Salts dissolved in the irrigation water and a high water table are the two chief causes of salt accumulation in the area. Lenk-Chevith (p. 123) tested a sample from the Indus River at Tatta in December, 1954 ; according to which the water has 8.1 pH and 9.6 a.ca.inity. More recent investigations show that salt content varies from 276 parts per million near Hyderabad to 299 parts per million near Tatta.

This indicates that the river water is the major source of salt found in the soils. Salt remains when water evaporates at the surface, or accumulates in the root zone below the surface. By capillary action this salt comes to the surface in solution with the water rising from a high water table. The rapidity with which salt builds up in the root zone is determined by the quality of the irrigation, the method of irrigation, the type of field drainage and some other conditions.

Accumulation of salt varies from place to place depending on the water table, surface topography and irrigation practices (Map 2). Salt concentrations are maximum at the low lying areas where the water table comes within 10 feet of the surface or at places where surface soils prevent leaching. In terms of statistics, about 1,820,000 acres are severely saline and 1,030,000 acres have saline patches (WAPDA, p. 6). The concentration is usually highest in the surface eight inches although sufficient accumulation exists throughout the soil.

In general terms LeVee (pp. 10—12) has classified the soil near Tatta into three categories of salinity : slightly to moderately affected, severely affected, and very severely affected.

*Information obtained from M/s. Sir Macdonald and Partnerss, Consultants to WAPDA.

In slightly to moderately affected areas, the salt content is evenly distributed throughout the soil profile and ranges from 0.2 per cent to about 0.6 per cent. In severely affected soils, salt content may exceed I per cent in the surface 8—10 inches, but rises again in the lower subsoil. In very severely affected soil, the salts show a high concentration throughout the

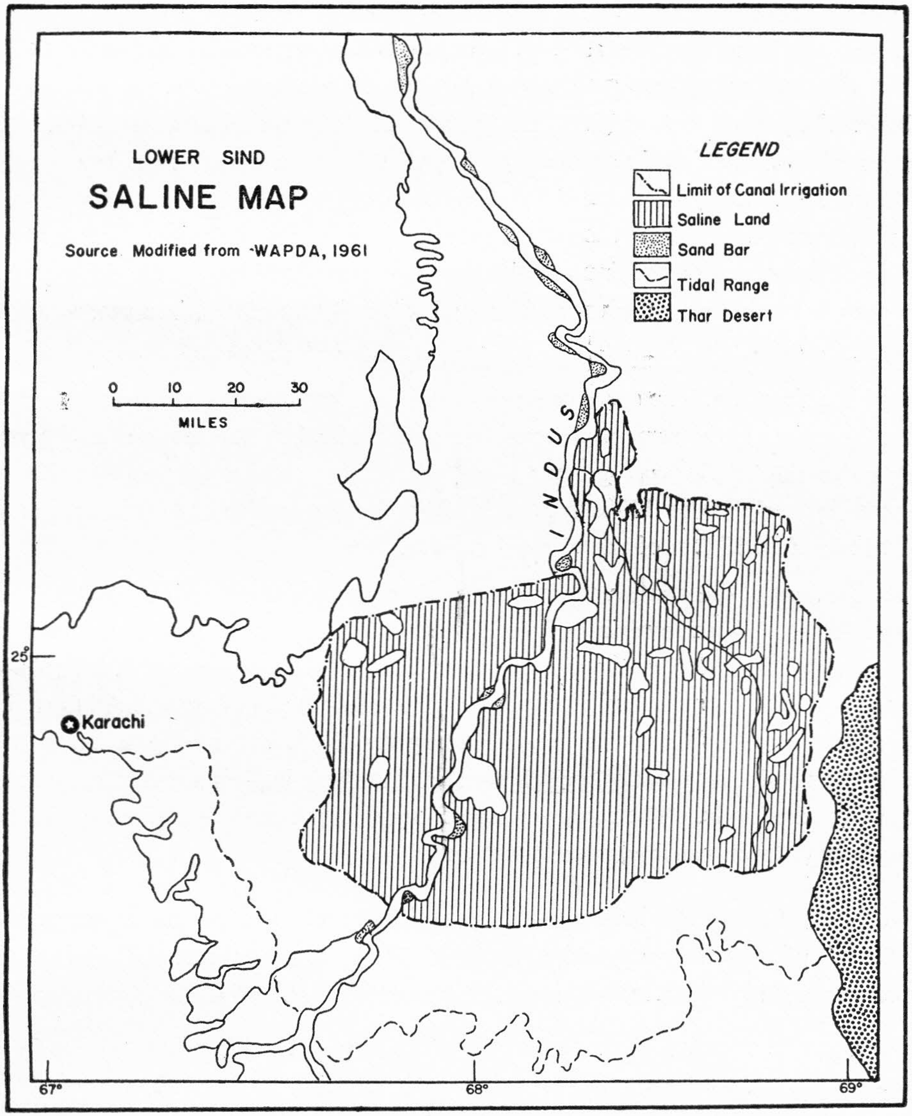


Fig. 2

profile. Concentrations often exceed 3 per cent depending upon the topographic positions and irrigation practices.

The problem of salinity was perhaps not so intense before perennial irrigation was introduced into the area. Prior to this system, irrigation was practiced by the innundation canals in summer and by lifting water from subsurface sources during the winter season. Near the river the water table always tended to approach the surface, but the configuration of the saturated zone of the alluvium, which over much of the region has a depth of several hundred feet, was by and large stable. The depth to the water table increased with the distance from the river, and over a greater part the ground water table was at a considerable depth below the ground surface (WAPDA, p. 5). The infiltration of water from the river and the percolation of rainfall and the water supplied in the seasonal innundation irrigation within the area were in equilibrium with the discharge of ground water by evapotranspiration and the movement out of the area towards the sea. Any possible disbalance was supposedly checked by the practice of continuous lifting of water from the wells through *nars* all through the winter, keeping the water table and salt build up at its minimum.

Perennial irrigation and the accompanying availability of water all year round has aggravated the situation. The seepage from canals and percolation of water applied for irrigation formed a new increment of recharge, which added to the normal recharge from the river and precipitation, was greater than the normal discharge from aquifer. As a consequence, as early as the 1930s and early 1940s the water table had risen over much of the area within 10 to 15 feet of the ground surface.

As a result of the continued rise of the water table, more and more land became adversely affected. With lowering of the drainage capacity of the soils the upward evaporation of water from the water table resulted in a steadily increasing accumulation of salt from the soil and from the irrigation water in the root zones of crops. All the irrigation water applied was absorbed by the crops leaving very little water to pass below the root zone, with the result that most of the salt contained in the irrigation water remained in the uppermost strata of soils. The canal seepage continued and maintained the water table at dangerously high levels causing severe problems which call for an immediate solution.

Various attempts are being made by national and international agencies to solve this problem. There are two principal aspects of the problem ; one, the improvement of salt affected soils and the other to lower the high water table.

Salts can be removed from the soils by leaching. Leaching is a process in which fresh water is added to a field and allowed to soak through the soil and drain away underground. The amount of water required to leach saline soils depends on the initial salinity level of the soil and the final salinity level desired. On an average, about 50 per cent of the salt in root zone can be removed by leaching with 6 inches of water for each foot of root zone (Bower and Firman, p. 285). About 80 per cent can be removed with 1 foot of water per foot of soil.

Unless the soil is well drained, the application of water for leaching can be detrimental from the standpoint of salinity. In Lower Sind the high water table presents a problem; otherwise soils favour such an operation. Medium and heavy textured soils ordinarily present no problem for the salinity control as they have good structure and are usually underlain by a sand aquifier which facilitates the removal of drainage water. In such cases installations of artificial drains or tube wells helps to lower the water table and may also prove effective in the area.

Botanists suggest growing of salt resistant crops to economically use the salt-affected soils. A number of crops like barley, cotton, tomatoes, and others adapt to the saline soils, and are being tried in many countries. In Lower Sind these crops are grown to a sizeable extent and a further emphasis may help to minimise the problem.

Some botanists are trying to develop another species of grass adaptive to saline soils (Shah, et., al., p. 1). Partial success has been reported with bright chances of further progress. However, biotic treatment may be helpful so far as the sait content is concerned, but does not answer for the high water table. Salinity and high water table are twin problems and have to be dealt with jointly, with emphasis on the later.

The problem of salt build up and high water table is becoming severe in areas where perennial irrigation has been introduced. In fact, it is beginning to challenge human ingenuity and may result in unprecedented changes in land-man adjustments. The mass starvation or migration that accompanied simiiar occurences in other once-great irrigated area in historic times cannot be permitted to occur here. Lined channels to prevent seepage, artificial drains to maintain a low water table, and leaching seem to be the most possible solutions.

TABLE I

Monthly Temperature Means

(Figures in Fehrenheit)

Months	KARACHI			TATTA			HILAYA			HYDERABAD		
	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Means	Max.	Min.	Mean
January ..	7711	5017	6919	74	47	61	80	44	62	7512	4919	6215
February ..	8015	5417	6719	81	48	65	..	..	72	8215	5418	6816
March ..	8719	6311	7515	89	60	75	95	63	79	9316	6319	7818
April ..	9417	7019	8418	97	66	81	99	71	85	10310	7212	8716
May ..	9513	7812	8612	99	75	87	102	76	89	10718	7815	9311
June ..	9514	8211	8817	97	79	88	101	79	90	10510	7917	9213
July ..	9018	8018	8518	92	79	85	99	81	90	9918	7910	8914
August ..	8812	7818	8315	89	77	83	94	79	87	9518	7712	8615
September ..	8918	7618	8318	90	75	83	97	78	87	9719	7710	8714
October ..	9319	6917	8118	90	68	79	97	70	83	9810	7716	8413
November ..	8919	5918	7418	87	61	74	88	62	75	8915	6017	4617
December ..	8019	5310	6619	78	51	65	83	51	67	7816	5217	6516

Source: Karachi and Hyderabad data from the files of Pakistan Meteorological Department. Thatta and Hilaya data from *Climatological Means for West Pakistan*, Doxiadis Associates, Karachi, 1959.

REFERENCES CITED

Bower, C. A., and Fireman, M., " Saline and Alkali Soils," *Soil* 1957 *Yearbook of Agriculture*, Washington : U. S. D. A. (1957), pp. 28—290.

Colombo Plan Co-operative Project. *Report on a Reconnaissance Survey of the Landforms. Soils and Present Land use of the Indus Plains*, West Pakistan, 1958.

Hodges, R. C., " The Aerial Resources Survey of West Pakistan," *Canadian Geographer*, No. 8 (1956), pp. 63—69.

Lenk-Chevitch, P., *Hydeological Research in Pakistan in* 1954. New York : United Nations Technical Assistance Administration Report No. TAA PAK 7., 1956.

LeVee, V.M., *Observations on Land Conditions in West Pakistan*. Rome : Food and Agriculture Organization Report No. 88., 1953.

Naqvi, Sibte Nabi, *Desalinization of Sea Water by Using Wind and Solar Energy for Development of Marine Desert Near Karachi*. Karachi : Meterological Department (Mimeographed)., 1958.

Shah, B. H., Malik, I. A., Chaudhri, I. I., *Investigation of Salt Accumulating and Salt Excreting Plants of West Pakistan*. University of Sind (unpublished)., 1962.

U. S. Department of Agriculture, *Salt Proembls in Irrigated Soils* Bulletingn No. 190, Washington.

WAPDA, *Programme for Waterlogging and Salinity Control in the Irrigated Areas of West Pakistan*, Lahore : 1962.

Youngs, F. O., *Report to the Government of Pakistan on Soils and Agriculture*. Report No. 158. F. A. O.

Simoouson, R. W., " What Soils Are," *Soil* 1957 *Yearbook of Agriculture*. Washington : U. S. D. A., (1957), pp. 17—31.

GEOMORPHOLOGY OF THE NORTHERN CHITTAGONG COAST

BY

JAMIL AHMAD SIDDIQI

The Northern Chittagong Coast is a part of the East Pakistan coast which extends for a distance of nearly fifty miles from the mouth of the Feni river in the north to the Karnafuli river in the south. It lies within the North latitudes of 22°15′ and 22°45′ and the East merdians of 92° and 91°15′. A major part of the Northern Chittagong Coast lies within the district of Chittagong, while a small part, in the north, is within Noakhali district. To the west of the coastal plain is the Bay of Bengal with its numerous islands and dwips, the largest of which is Sandwip Island, located within a distance of 15 miles from the coast. The eastern limit of the coastal plain is marked by a range of Tertiary hills extending northwards from Chittagong town. The width of the coastal plain varies from less than one mile to more than eight miles. The hill range comes closest to the coast line in the south near Foujdarhat, and its distance increases gradually towards the north. These hills are made of slightly consolidated rocks and are subjected to considerable erosion, especially during the rainy season despite their coverage by luxuriant vegetation. A considerable amount of fine sediment is washed down the hills by coastal streams and deposited in the foreshore zone.

The Northern Chittagong Coast is characterized chiefly by its depositional land forms. Erosional reatures are not very important. In parts of the coast where erosion has been locally effective, erosional features assume significance.

EROSIONAL FEATURES

Cliffs :

As the hills stand several miles behind the shoreline, a typical cliffy coast has not developed. During the pleistocene time when the sea rose several times to a level at least one hundred feet higher than the present level,[1] the shoreline must have followed the 100-foot contour along the hills forming erosional features such as notches, cliffs, abrasional platforms and others. The anticlinal Chittagong hills have their seaward limb of the anticline wholly or partially eroded by the action of the waves, producing steep sided cliffs. All along the hills the marks of ancient high stands of sea are present, but these become particulary distinct in and near Sitakund where steep and high cliffs, notches and

1. R. J. Russel "Recent Recession or Tropical Cliffy Coast" Science, 1963, Vol. 139, No. 3549, pp. 9-14.

caves, and wave-built depositional terrace provide evidence for the reconstruction of the story of wave action in the past.

The only cliffy like feature, which at places assumes a height of six or eight feet, occurs along the coastline separating the coast from the backshore. A sudden break of slope clearly demarcating the shore from the coast is a conspicuous feature throughout; but wherever it is steep sided, as in Uttar Ḳatali, it presents a cliffy aspect on a small scale. Here we can clearly see the recession of tehss weah, unconsolidated "back cliffs" under the impact of wave erosion.

Even a kind of *abrasional platform* can be distinguished in the backshore area. It is considerably different from the muddy beaches in its firmness, degree of oxidation, and type of material. These *Platforms* represent the coastal material on the backshore level.

Tidal Creeks :

Tidal creeks are essentially an erosional feature. They are formed by up and down movement of tidal water in the lower section of coastal streams. In areas of heavy deposition of sediments, such as Bagachator, Baghkhali and Saiyidpur, a net work of highly meandering tidal creeks has developed in the fore-shore. These creeks are associated with the coastal streams originating from the back-hills but are essentially the product of tidal currents which move back and forth with considerable velocity on the foreshore area. The landward extension of these creeks is proportional to the erosive capacity of tidal currents. The delta-like break up of coastal streams in numerous channels is partly a function of their own load and partly of the wave-deposited sediments.

These "distributaries" become the tidal creeks when the action of the tidal currents give them their typical form and character.

DEPOSITIONAL FEATURES

Beaches :

The beach, a zone between low and high water marks, receives its material generally from the waste that results from marine erosion, together with that brought down to the sea by rivers. The waves are, then, responsible for its movement into different directions. Finer materials are usually carried to considerable distances by waves and tides towards the land, while the coarser, heavier material is directly subjected by the undertow of the bottom water towards the sea. So a mechanism exists on the beach to sift the material, placing coarser material on the slope under the sea and finer material towards the land on the beaches. Thus the slope of the beach, which is often called platform, is flanked seaward by a bank of sediments. These sediments may increase in accumulation if the wave action remains vigorious, causing the offshore-slope to become more and more gentle. In course of time, it offers a hinderance to the big waves from breaking on the beach space. These waves breaking at the margin of the slope cut into the sea bottom and dislodge the material which in turn is partly used in the formation of sub-marine bars and partly carried landward to be deposited on the beach.

In certain situations, when the big waves are obstructed by the presence of large off-shore islands, as is the case in Northern Coast, the accumulation of sediments is particularly rapid. In Northern Chittagong Coast the shore is not open to big waves of the ocean. The presence of Sandwip Island parallel to the coast has sheltered the coast, and the modifications of shoreline are only slightly influenced by the sea waves. The other important factor controlling the formation of land forms on this shoreline is the presence of the estuary of the Meghna, which carries into the sea millions of tons of sediments annually. These sediments pass through the Sandwip channel all along the coast.

Mud Flats :

Mud is referred to as a material which is finer than sand. This fine material is vulnerable to the attacks of the weekest agents of erosion and transporation. Wind and water generally cause the disapearance of mud from the beach much earlier than other materials. But this generalization is not necessarily true in every case. In places which are sheltered or are favoured by a current a different mechanism takes place.

The deposition of mud flats takes place when there is an abundant supply of mud. Currents and tides also favour the growth of mud beaches. The off-shore water, charged with sediments, is carried into different directions by drift and long shore drift. These sediments are then deposited on the beach in order of their size.

Fine material is, however, kept in suspension longer than the rest. With high tide, turbid water is carried into the inlets and creeks where these sediments get ample time to settle. Moreover, the tidal creeks and adjoining areas of land are less trubulent and less disturbed. Therefore, the sheltered coasts are very good areas for the development of mud beaches and mud flats.

Mud flats on this coastal belt are a dominant feature from north to south. They are of varying width at different places. A good example of a typical mud flat is found at Bagachator, Baghkhali and Saiyidpur villages. Here the deposition of fine sediments is maximum. The width of the mud flats is about 4000 yards at Bagachator and about 5000 yards in Saiyidpur. From Saiyidpur southward these flats decrease gradually. They are interrupted at Foujdarhat and Uttar Katali, then they continue towards Double Moorings and the mouth of Karnafuli. From Bagachator northwards the width of the flats again decreases.

Mud Cracks :

Mud cracks are found chieflly in clayey deposits. Clay shrinks notably on drying but has sufficient cohesion to hold together until cracks form to relieve tension. When wetted again the clay softens and swells and in fairly homogenous mud the cracks may close and disappear; but if a mud cracked surface is covered by a layer of different composition (silt or sand) before the mud has time to swell, the crack will be filled with this new material and cannot close. Alternative deposition of clay and sand or of clay and silt therefore affords the best conditions for the preseravation of mud cracks.

Normally mud cracks are not produced in the tidal zone because the interval between tides is too short to permit thorough desication, and if they ever form under standing water it is under very local conditions that are not understood. In general, mud cracks may be considered one of the best evidence of nonmarine depositions.[1]

On the beaches of Baghkhali and Saiyidpur, mud cracks are found scattered in the middle of the mud flats. These are situated in areas which are covered by water during rainy season but remain exposed in dry weather. They are not found occuring in continuous belts but in patches here and there.

Generally mud cracks are associated, even in the coastal areas such as Baghkhali and Saiyidpur, with stream deposition. With the inflow of tidal water in the coastal streams they overflow their banks and deposit their land derived sediments which, when dried, develop characteristic mud cracks.

Sand Dunes :

The alternative shifting of material with swash and back swash of breaking waves results in the movement of rock fragments in seaward and landward directions on the beach. The material itself comes from the *Saw* like action of wave upon the cliff. Clified head-lands contribute the material to the beaches. Usually finer sediments are carried away in large number by wind and waves, leaving the coarser sediments on the beach.

1. Carl O. Dunbar and John Rodger, Principles of Stratigraphy. New York : John Wiley and Sons, 1957, pp. 98-99.

W. H. Twen Horel, Principles of Sedimentation. New York: MoGraw-Hill Book Company, 1950, pp. 590.

The presence of sand on the beach is, however, subject to drifting. Onshorewinds on the coast blow the fragments of sand towards the land where the back clifts of Chittagong coast offer obstacles, and the drifted beach sand accumulates at the base of these cliffs and gradually grow in size. Any mound or ridge of sand with a crest or definite summit is called a dune. These sand dunes may develop on any irregularity of the surface, including grass scrub.

Sand dunes do not occur in every part of the Northern Chittagong Coast. Generally in the northern section of the coast, where the deposition of enormous amount of finer sediments in recent years has completely covered the former sand deposit, the coastal dunes are either totally absent or are low, flat and distinctly deteriorated.

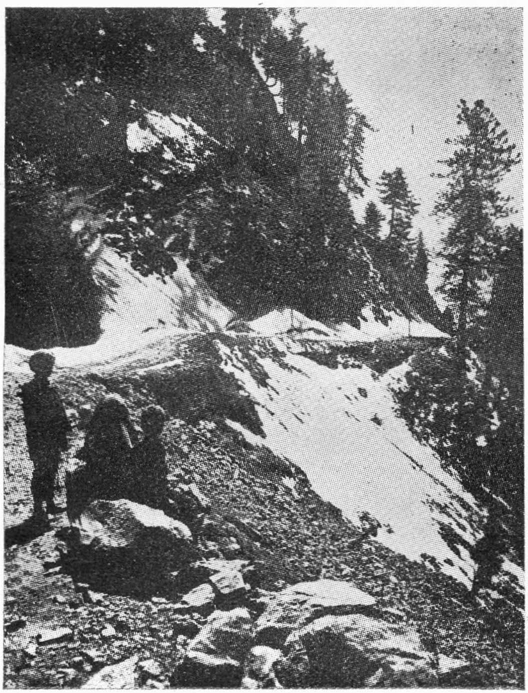
Southward from Foujdarhat there is almost a continuous line of dunes which are well formed and appear recently deposited. They attain a height of 6 to 8 feet south of Foujdarhat, but in Uttar Katali they are a little lower. The colour of the beach sand, where ever it occurs in small patches, is invariably grey indicating the presence of considerable quantity of fine material mixed with it. As a contrast, the sand-dunes are lighter in colour and represent comparatively cleaner fine to mdeium sand. The sifting of material has, apparently, taken place during its drift by the wind.

Acknowledgment :

The author wishes to extend his thank to Dr. A. I. H. Rizvi, Reader in Geography at the University of Dacca, for his supervision and direction of research, to Asia Foundation for financial assistance and numerous others for helping the author in different ways.

AYUBIA

A visit to the hill station during summer has now become a habit of nearly all West Pakistanis whose economic status and employment affiliation will permit a vacation in a cool and comfortable resort. Throughout most of West Pakistan the summer lasts for about seven months, and the heat of June, July and August becomes unbearable. Schools, colleges and Universities are closed; the social and cultural life of the towns comes to a stand still. In the afternoons the roads look deserted, and business becomes dull. Intense heat and high



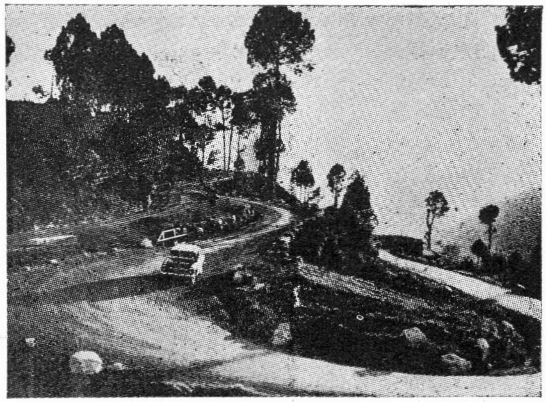
Landscape Ayubia

humidity lowers the efficiency of workers in every walk of life. At the time of partition, Pakistan got only one hill station, namely Murree, which was primarily a developed cantonment for the British troops. During summers, thousands of visitors and tourists from almost all parts of West Pakistan visited the hill station. The cost of living rose very high and became expensive for middle class people.

Quetta could also be considered a hill station, but its climate and lesser accommodation for visitors has made it less attractive. Kaghan and Swat are farther and due to transportation difficulties are over looked.

In the year 1962, the idea of Ayubia was concieved by President Ayub Khan. It envisages the development of the following townships :

1. Khairagali.
2. Chhangla gali.



On way to Ayubia

3. Ghorada Kha.
4. Khanspur.

The later two are treated as one station—Another township between Abbottabad—Sherwan is under consideration.

Khairagali—at a distance of only 8 miles from Murree, is situated at an altitute or 8770 feet with an area of about 37 acres consisting of 97 plots, while eleven other plots are under school, mosques, post and telegraph office constructions.

Changlagali—with a wide independent source of water supply and a distance of 10 miles from Murree-builds up an area of 211 acres 43 acres of which is under development. The height is greater than the former about 8,500 feet. It has 88 plots; nine plots are meant for the construction of shops, hotels, etc.

Ghordakha and Khanspur at a distance of 7 or 9 miles from Dungagali and Nathiagali and 14 miles from Murree, have 13 natural springs which provide a wholesome supply of drinking water. The area is 80 acres, and 96 acres are under development which have been divided into 192 plots. Government Transport buses regularly run between Murree and various hill stations to Nathiagali, and even beyond Abbottabad a wide metalled Road connects Ayubia with Murree.

The entire scheme related to these townships has been approved by the development working party.

Ayubia presents picturesque scenery and shows the real beauty of nature with fir, chif pine, deodar and oak trees—Nature has blessed it with conginial climate for the growth of all plantations.

The imprints of modern civilization can be observed, by the visitors coming from all corners of local backward population of this area. Various fields of the occupation of this area different fields of occupations could procure all avenues and employment to the inhabitants. If new settlement patterns may be introduced in this area, then there are many chances of giving a new life to the settlers.

In short, nature has endowed this area with every possible blessing which gives charm, vigour, zeal to people to work in life.

SUKKUR POWER HOUSE

On the left bank of the Indus river at Sukkur is yet another Pakistan-Canadian project under construction. This is the thermal power house with a designed capacity of 25,000 kilowatts, which will meet the growing power requirements of the Upper Sind.

The first Pakistan-Canadian power project was the hydel plant at Warsak, which has been successfully completed and is generating the much-needed power for the northern and central regions. After the completion of Warsak, the construction machinery was despatched to Sukkur for the power house.

Like Warsak, the Sukkur power house is also a project financed under the Colombo Plan by Canada, which provided Rs. 35 million as a gesture of friendship and goodwill towards Pakistan. This amount will meet the entire foreign exchange component of the project. The total cost of the project is estimated at Rs. 53 million.

The entire Upper Sind area comprising the Khairpur division is power-starved, the existing generating capacity of small diesel units being only about 4000 kilowatts. These stations are at Sukkur, Jacobabad, Larkana, Khairpur, Kot Diji, Dadu, Shahdadkot and Kandkot. The power shortage is the main factor of the backwardness of the area; for no major industrial unit could be set up nor could medium industries flourish which required power. Similarly, power is not available for tubewells, and the plans for eradicating salinity and waterlogging could not make any headway.

It is against this background that Wapda planned for building the power house at Sukkur. The construction of the project was started early last year, and so far 60 per cent of the work has been completed. The power house will be ready in all respects by October this year and the supply of power for commercial purposes will begin early next year.

The main power house building is almost complete. Ninety per cent of the work has been done on switchyard, filteration and circulating water system. The tunnels, intake and outlet, are almost complete. Forty per cent of the construction work on pump houses has been done so far. Similarly, sixty per cent of the work on the erection of boilers is complete.

Like power houses at Multan and Hyderabad, the Sukkur power house will also use the Sui gas as fuel. The gas pipes have reached the site. About one crore cubic feet of gas will be used daily for two turbines of 12,500 kilowatts each.

The Indus river water will be used for producing steam at the power house. A chamber, 400 feet long and 50 feet wide, has been excavated right in the bed of the Indus in a record time of six days only, with the help of about 700 persons working round the clock in knee to waist deep waters. The channel will take the Indus water from the main creek to the intake tunnel during low-flow season in winter. For excavating the channel, Wapda utilized the opportunity of the closure season of the river. The excavation involved about 40,000 cubic feet of earthwork, mostly rock which made the task all the more difficult. About 20,000 cubic feet of rock was excavated for intake and outlet tunnels.

All equipment, with the exception of generators and turbines, has reached the site. The generators are expected by the end of this month. Two turbines of 12,500 kilowatts each will reach from Canada by the middle of next March. The contract for instralling the machinery has been awarded to Messrs Asociated Elec rical industries (Pakistan) Limited. The contractors will start fixing the air-condiitoning plant, switchgears and auxilarly machinery by the end of this month.

The crane for installing the turbines will be set up by the end of February. The first turbine will be erected next April, and the second the following month. The first turbine will be commissioned in August and the second in October.

Simultaneously, work on laying the transmission lines in the area to be fed by the power house has made a considerable progress. By the time the power house is complete, some time in October, the lines would have been laid. These will form the Upper Sind grid which will ultimately be linked with the main grid of West Pakistan on the northern end and with the Lower Sind grid coming from Hyderabad on the other end. The transmission network is being laid within 70 miles of radius of the power house and it will carry power to 28 towns including Shikarpur, Jacobabad, Larkana, Khairpur, Gambat and the Nara Canal. It will consist of 110 miles of single circiut 66 kv lines, 33 miles of double circuit lines and 66 kv sub-stations. Eighty miles of 11 kv lines will be drawn from Rohri to Gotki and the Nara Canal. The contract for laying the 66 kv lines has been awarded to Messrs Imperial Eletric Company Limited. The contractors have completed the most difficult job of laying the lines across the Indus.

The housing colonies have also been provided for the staff engaged on the construction of the power house. The officers' colony situated in the barrage area is almost complete. The workers' colony near the power house site is about 60 per cent complete. It has in all 51 residences—16 D type, 20 E type and 15 F type.

A temporary arrangement for the generation of 1500 kilowatts has been made at the site for providing necessary power facilities for the construction of the power house. The unit also supplies electricity to a part of the city with the approval of the Sukkur municipal committee which is responsible for power distribution.

A scheme for doubling the 25,000 kilowatt capacity of the Sukkur power house has been prepared. This extension scheme will also be implemented with the assistance of Canada under the Colombo Plan. On its completion it will be the country's largest thermal power station, next to the Multan Natural Gas Power Station.

FIRST ALL PAKISTAN GEOGRAPHY CONFERENCE

The first All Pakistan Geography Conference was held at Karachi from 6th to 10th January, 1964, and was inaugurated by Mr. A.T.M. Mustafa, Central Minister of Education. A large number of Geographers and Educationists from Universities, Colleges, other institutions, and government organization all over the country were present. Professor Kazi S. Ahmad of the University of the Panjab was the General President and addressed the inaugural session on Geography Through The Ages. Dr. Ishtiaq Hussain Quraishi, Vice-Chancellor, University of Karachi, as the Chairman of the Reception Committee, presented the welcome address.

The Conference was jointly organized by the Pakistan Geographical Assocation and Karachi Geographer's Association. Two symposia one on Geography in National Planning and the other on Teaching of Geography were held.

The following acted as Sessional Presidents :

1. Dr. Nafis Ahmad, T.I., Head of the Department of Geography, University of Dacca, Dacca.
2. Dr. N.M. Khan, Director General, Geological Survey of Pakistan.
3. Col. Dr. K.U. Kureshy, Director of Studies, P.M.A. Kakul.
4. Dr. Shamsul Islam Siddiqi, Head, of the Department of Geography Karachi University, Karachi.
5. Mr. M.M. Memon, Head of the Department of Geography, University of Sind, Hyderabad.
6. Lt.-Col. Nazir Ahmad, Director General, Central Statistical Office Karachi.

THE EXTERNAL RELATIONS OF CITIES DURING 'INDUSTRIAL REVOLUTION'

BY

ALLAN PRED

IX and 113 *pp., maps, diag. illus, bibliogr. Research Paper No.* 76. *The University of Chicago Press, Chicago* 1962 4, 4×9 *inches.*

The study of cities as centers of change is of relatively recent origin, and it is only during the last three or four centuries that the demographic and economic ramifications of cities have been properly understood. Several works have been completed to show the impact of 'industrial revolution' on population structure and economic complex of cities. These works have been undertaken largely with a view to treating the emergence of industrial cities as a cultural process which brought about significant changes in the social institutions and internal economic structure of the cities under study. However, such studies have evinced little to indicate the impact of industrial revolution on the interregional economy and external relations of cities.

The dissertation by Allan Pred is an attempt to generalize and theorize the observed changes that occurred in the foreign trade of newly emerging industrial cities, with particular reference to the Swedish port of Göteborg. The study analyses, both theoretically and empirically, some of the important adjustments that were made in the external relations of cities following the industrial revolution. Within this context, the study has discussed four groups of hypotheses as they apply to different aspects of external relations of cities.

The first group of hypotheses relates to external relations developing from technological change and the industrial scale-shifts that are associated with such a change. The second group is confined to the understanding of changes in the inter-regional space — economy brought about by the reduced transportation costs and the expansion and intensification of transportation networks. The third group of hypotheses concerns the changes in the agricultural pattern that occurred due to increased demand by the growing urban population. The last group deals with changes that industrial revolution has incurred in the pattern of internal migration from rural areas to urban centres.

The dissertation has, as is frankly admitted by the author himself, a few limitations which are basically the result of over-generalizations involved in such a broad study and the reliability of data presented in this wotk. At any rate, the work is significant in that it is of a pioneer nature and, therefore, provides incentive for better understanding and further development of some of the concepts and hypotheses presented in this study.

RASHID A. MALIK

BOOK REVIEWS

SAMPLE STUDIES: published by the Geographical Association, Sheffileld 1962, price Sh. 4—6.

R. C. Honeylone defines the sample study methods as part of the general trend during this century towards more realism in the fi.ld of Geography. This is to recreate, through various geographical techniques, conditions and regional character of the region to be studied in the class room and to make a picture of the region under study in the minds of the students by stressing the objective facts, thereby giving a detailed and accurate account of peoples and places.

The book under review demonstrates sample study method by giving:

(1) A detailed study of a Californian fruit farm.

(2) The details of the physical basis and human economy of an Alpine valley.

(3) A study of the irrigated cotton farm of Siddiq Ahmed, a peasant of the Gezira.

(4) An account of the geographical factors involved in the development of hydro-electric production sites and the storage and distribution of irrigation water by means of a detailed study of the Snowy River Scheme.

It is suggested in the book that such samples be chosen as have a fairly wide application in a region, and the detailed information should have a direct bearing on the subject studied. The observation and recording of the raw material is considered to be important. The teachers are required to use the previous knowledge of the students in conjunction with the sample study method in order to make the physically realized facts more understandable and meaningful.

This is a very valuable book which must be studied carefully by Geography students.

AZIZ-UR-REHMAN

TABLE 1

CULTIVATED AREA, CLASSIFIED BY TENURE AND BY SIZE OF FARM (EAST PAKISTAN)

Size of Farm (acres)	All Farms Area: Total (acres)	All Farms Area: Cultivated Area (acres)	All Farms Area: Cultivated %of the Total	Owner Farms Area: Total (acres)	Owner Farms Area: Cultivated Area (acres)	Owner Farms Area: Cultivated %of the Total	Owner-*cum*-Tenant Farms Area: Total (acres)	Owner-*cum*-Tenant Farms Area: Cultivated Area (acres)	Owner-*cum*-Tenant Farms Area: Cultivated %of the Total	Tenant Farms Area: Total (acres)	Tenant Farms Area: Cultivated Area (acres)	Tenant Farms Area: Cultivated %of the Total
1	2	3	4	5	6	7	8	9	10	11	12	13
Total Farms ..	**2,17,25,827**	**1,91,38,139**	**88**	**1,16,53,910**	**99,92,384**	**86**	**98,29,813**	**89,14,537**	**91**	**2,42,104**	**2,31,218**	**95**
Under 0.5 ..	2,04,496	1,38,382	68	1,82,357	1,20,446	66	18,462	14,768	80	3,677	3,168	86
0.5 to under 1.0 ..	4,99,144	4,01,680	80	3,85,896	3,03,948	79	1,04,278	89,393	86	8,970	8,339	93
1.0 to under 2.5 ..	28,26,355	24,68,590	87	16,63,854	14,20,222	85	11,06,109	9,94,888	90	56,392	53,480	95
2.5 to under 5.0 ..	57,34,739	51,51,175	90	26,55,778	23,34,909	88	29,82,169	27,23,001	91	96,792	93,265	96
5.0 to under 7.5 ..	41,92,948	37,80,245	90	19,83,266	17,55,212	89	21,65,728	19,82,588	92	43,954	42,445	97
7.5 to under 12.5 ..	41,58,797	37,17,064	89	21,96,919	19,33,445	88	19,39,547	17,62,395	91	22,331	21,331	95
12.5 to under 25.0 ..	30,66,199	26,88,922	88	18,31,890	15,84,642	87	12,25,882	10,96,469	89	8,427	7,811	93
25.0 to under 40.0 ..	6,32,622	5,38,618	85	4,31,672	3,60,521	84	1,99,389	1,76,611	89	1,561	1,486	95
40.0 and over ..	4,10,527	2,53,463	62	3,22,278	1,79,039	56	88,249	74,424	84	..	..	..

Ministry of food and Agriculture, *Agricultural Census of East Pakistan*, 1960.

TABLE 2

CULTIVATED AREA—IRRIGATED AND UNIRRIGATED, CLASSIFIED BY SIZE OF FARM (EAST PAKISTAN)

Size of Farm (acres)	Total Cultivated Area (acres)	Irrigated		Flooded		Unirrigated	
		Area (acres)	Percent of Cultivated	Area (acres)	Percent of Cultivated	Area (acres)	Percent of Cultivated
1	2	3	4	5	6	7	8
Total Farms ..	**1,91,38,139**	**13,23,218**	**7**	**35,44,946**	**18**	**1,42,69,975**	**75**
Under 0.5 ..	1,38,382	8,916	6	19,829	14	1,09,637	79
0.5 to under 1.0 ..	4,01,680	24,207	6	70,998	18	3,06,475	76
1.0 to under 2.5 ..	24,68,590	1,54,462	6	4,70,518	19	18,43,610	75
2.5 to under 5.0 ..	51,51,175	3,27,743	6	9,80,011	19	38,43,421	75
5.0 to under 7.5 ..	37,80,245	2,40,108	6	6,88,712	18	28,51,425	75
7.5 to under 12.5 ..	37,17,064	2,59,203	7	6,76,384	18	27,81,477	75
12.5 to under 25.0 ..	26,88,922	2,25,572	8	5,02,723	19	19,60,627	73
25.0 to under 40.0 ..	5,38,618	51,092	9	99,583	19	3,87,943	72
40.0 and over ..	2,53,463	31,915	13	36,188	14	1,85,360	73

TABLE 3

USE OF MANURES, CLASSIFIED BY SIZE OF FARM (EAST PAKISTAN)

Size of Farm	All Farms	Net Sown Area	All Manures				Chemical Manures		
			Farms Reporting Use		*Area Manured*		*Farms Reporting Use*		Quantity
			Number	Percent of All Farms	Area	Percent of Net Sown	Number	Percent of All Farms	
(acres)		(acres)			(acres)				(maunds)
1	2	3	4	5	6	7	8	9	10
Total Farms ..	**61,39,480**	**1,88,47,649**	**27,44,800**	**45**	**43,27,822**	**23**	**2,64,340**	**4**	**4,35,882**
Under 0.5 ..	8,02,630	1,37,688	2,06,820	26	39,072	28	6,940	1	5,053
0.5 to under 1.0 ..	6,89,840	3,99,175	2,67,310	39	1,19,211	30	19,160	3	16,582
1.0 to under 2.5 ..	16,77,410	24,49,766	7,74,190	46	6,70,537	27	74,540	4	89,001
2.5 to under 5.0 ..	16,15,020	50,98,545	8,04,600	50	12,30,615	24	82,610	5	1,32,088
5.0 to under 7.5 ..	6,98,450	37,26,310	3,57,880	51	8,37,559	22	37,620	5	71,564
7.5 to under 12.5 ..	4,42,360	36,50,877	2,27,610	51	7,79,432	21	27,120	6	61,154
12.5 to under 25.0 ..	1,87,790	26,22,922	94,380	50	4,98,748	19	13,740	7	37,689
25.0 to under 40.0 ..	21,370	5,18,786	9,990	47	91,428	18	2,010	9	6,809
40.0 and over ..	4,610	2,43,580	2,020	43	61,220	25	600	13	15,942

(*ii*) **Shorter Contributions** of research and semi-research type which present a summary of work in progress and results achieved. General accounts of fieldtrips are also included in this category. They should not exceed 1,500 words.

(*iii*) **Correspondence** in which contributors may communicate their views and comments on papers appearing in the journal. A space limit of 1000 words should be observed.

(*iv*) **News and Notes** which contain brief accounts of new discoveries of resources, development projects and other news of geographical interest. They should not exceed 500 words.

3. The manuscripts should be typewritten, double spaced, typed on one side of the paper with wide margins. The diagrams and photographs should be clear. The tables should be consistent with the size of the Review. References should be listed at the end of the paper either in order of citation or alphabetically and indicated in the text by the corresponding number written in parenthesis.

4. The contributions are accepted with the understanding that they have not been published elsewhere.

5. Writers of Papers and Shorter Contributions are supplied with 15 complimentary reprints of their contributions. In case they require more copies they should indicate the number of copies desired at the time of receipt of intimation regarding the acceptance of their contributions.

6. Normally the proofs are seen by the writers but in order to preclude any possibility of delay and maintain the schedule strictly they are not sent to writers outside of Lahore. Additions at this stage should be avoided.

7. The publication of a paper should not be assumed as an approval by the Editors of the statements and opinions expressed by the writers. In fact, the former do not hold any responsibility to that effect. However, the Editors reserve the right of removing such material from the papers as they consider is unnecessary or is lacking in sound theoretical and empirical foundation.

8. The Review is a purely academic and non-commercial publication. As such no payments are made to the contributors.

9. All manuscripts should be sent to :

The Editor,
Pakistan Geographical Review,
University of the Panjab, Lahore, West Pakistan.

Books and Periodicals for review should also be sent on this address.

Printed and Published by Kazi S. Ahmad, Editor, Pakistan Geographical Review, University of the Panjab, at the Panjab University Press, Cutchery Road, Lahore.