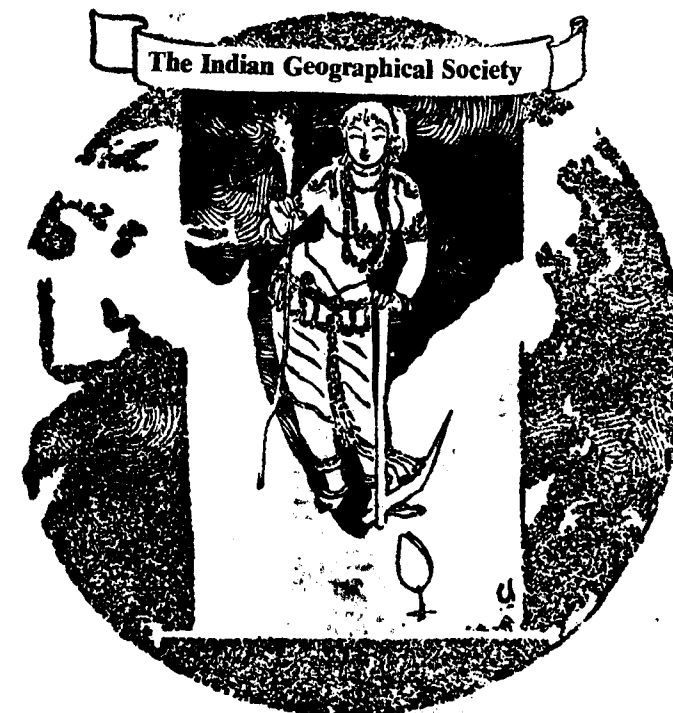


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THE INDIAN GEOGRAPHICAL JOURNAL



Volume XLVI

Jan—March

No. 1 & 2

April—June

1971

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The Indian Geographical Journal is published quarterly in March, June, September & October by the Indian Geographical Society (formerly the Madras Geographical Association), at Madras, India. Address all Communications relating the subscriptions, recent back numbers, proposal for Exchange of Publications etc. to:

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Indian Geographical Society
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THE INDIAN GEOGRAPHICAL JOURNAL

Formerly

THE JOURNAL OF THE MADRAS GEOGRAPHICAL ASSOCIATION

Vol. XLVI

JAN-MARCH and APRIL-JUNE 1971

Nos. 1 & 2

The Editor takes no responsibility for the views expressed in the Journal. Authors alone are responsible for their respective statements.

PURPOSE, SCOPE AND PROGRESS OF MEDICAL GEOGRAPHY: DEC 1971

A REVIEW

BY

Mrs. RAZIA KHAN, M.Sc.

According to world Health Organisation "health is a state of complete physical, mental and social well being and not merely absence of diseases and infirmity". Webster defines diseases as a "discomfort, a condition in which bodily health is seriously attacked, deranged or impaired, a departure from a state of health, an alternation of the human body interrupting the performance of vital functions". When the body is unable to adjust to the natural or man made environment it yields to their pressure and falls prey to their vagaries, with the result, certain changes take place in the body, away from the normal conditions and the person affected is called as a sick person.

It has been observed that diseases are not uniformly distributed over the surface of the earth. There are different patterns of distribution of various diseases. When a systematic study is made about the spatial distribution of diseases in which the diseased person lives in relation to the environment, we approach the field of Medical Geography. Medical geography is, therefore, defined as a study "dealing with the geographic arrangement of diseases and with the

factors relevant to the incidence and spread of diseases"

Despite the fact the diseases have been widely studied by the researchers in medicine, very little is known about their geographical distribution. The curative aspect of disease is well handled by the men of medicine, but when the preventive aspects have to be dealt with the, medical profession has to go beyond its conventionally defined field and venture into sociology and geography. Unfortunately the medical profession has not yet responded readily and sufficiently enough to these pre-requisites, with the result that newer and more complicated diseases emerge before the older ones are eradicated.

There is thus a felt need for research in the field of medical geography all over the world. It is especially so in countries like India where thousands of people die of innumerable disease, the causes of which are still obscure.

This paper is an introductory part of a research project on the spatial distribution of diseases and medical facilities in Mysore State. Its objective is to review the pro-

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1. Encyclopædia Britannica—Vol. 10, 1968, page 159.

gress made in the field of medical geography and to discuss the purpose, scope and methodology of its research.

Medical geography in retrospect

Since ancient times, dating back to 600 B. C. or so, we come across the findings of Susruta and Atrey, those great men of medicine who taught and practised at Banaras and Taxila and whose contributions to medical science are indeed enormous. The period between 600 B. C. to 400 A. D. was the creative period of Indian Medicine. During this period various monographs and text books were published on Indian Medicine and Surgery. In these works greater attention was given to the malfunctions of the system i. e., human body and the curative aspects were considered only within the framework of the general system theory of the functions of human body developed by them.

In the West, the earliest literature in Medical geography goes back to the Hippocratic collection of Greek philosophers. The famous treatise "On Airs, waters, and places", is well known in which the description of the effect of topography and climate on the health and character of man is given.

While these scientific works were being brought out in the West and the East, the common man believed in the super natural causes of diseases. The diseases or signs of ill health were often attributed to the anger or dissatisfaction of these supernatural powers. Efforts were made to placate them instead of paying attention to hygiene and curative aspects of the disease.

As explorations and discoveries opened up new areas, they brought people living at different places together. With the movement of the people, diseases of various types also moved from place to place. There were certain recognisable foci of diseases. The spread of these diseases needed certain specific environments. Thus the travelling safaris were the first to associate the existence and occurrence of diseases to a particular climate and environment. A number of articles, letters and monographs were written during the 15th & 16th centuries, indicating the relationships between human diseases and environment.

During the 17th and 18th century further progress was made when a number of books on Medical Geography and related topics were written. Among these Finke, a German clinician accumulated a large collection of the data of his travels and published three Volumes and named it as Medical Geography. According to him, "When one deals with country after country, with regard to its position, the conditions of its soil, the peculiarities of the air, the water, the weather and the food stuffs used by the natives; when one described the mode of life, custom and habits of the people in so far as they have any bearing on health and diseases; when one gives account of the disease, themselves as found in different countries and the local therapeutic measures; in short, when one brings together all which is worth knowing with regard to the medical status of any country, then no one can deny that such a work deserves the name of "Medical Geography".

2. HOWE G. M: National Atlas of Disease Mortality. Royal Geographical Society, London, 1961. p. 9.

During the 19th century August Hirsch's work "Handbuch der historisch-geographischen Pathologie" in 1860-64 in German was published in two volumes. Between 1881 and 1886 its second edition was published and translated into English as "Hand book of Geographical and Historical pathology". In this the distribution of each diseases was related to the local environment of the place of occurrence. At the end of the 19th and the beginning of the 20th century, societies were formed and different plans for medical geographic research were proposed. In 1884 The American Climatological and clinical Association was founded, while in 1929 the International Society of Geographical Pathology was founded.

Later the Royal Geographical Society gave more encouragement in this field. A number of classical works were prepared under its auspices. Considerable progress was noted in U. K., U. S. A., Germany and U. S. S. R., in the recent past. G. Melvyn Howe's National Atlas of Disease Mortality, showing the mortality in U. K. was the pioneer effort, where through the medium of maps, the patterns of variations in the disease mortality in U. K. for the period of 1954-58 was given.

Dr. Malcolm Murray an American geographer drew maps to show the density distribution of certain killing diseases during the period 1949-53.

Dr. Jacques M. May, the director of the Medical Geography, Department of American Geographical Society of New York, released studies in Medical Geography in three volumes:—

1. *The Ecology of Human Diseases*, 1958, deals with the distribution of a number of diseases called world killers;

2. *Studies in disease Ecology*, 1961, deals with the remaining important diseases;

3. *The Ecology of Malnutrition in the Far and Near East*, 1961.

The other volumes of his studies dealing with the ecology of malnutrition in different regions of the world have also now come out. These volumes have kindled interest in other geographers to study problems in medical geography and carry out research work.

Among other important studies of the recent past are Stamp's books on "Some Aspects of Medical Geography" and "Geography of Life & Death". In these publications Dr. Stamp has emphasized that mortality alone should not be taken as a variable in the study of medical geography. The health of the people who are alive should also be studied. These two books are of great help to the beginners in this field.

In India A. T. A. Learment has done several studies. He has published a number of articles in "Geographical Journal" and "Indian Geographical Journal". His publication, "Mysore State", in collaboration with L. S. Bhat devotes a section to Medical Geography. The latest work in this field is by R. P. Misra. His publication entitled "Medical Geography of India" being published by National Book Trust, India, is the most recent addition to the study of Medical Geography in India. This work gives a broad survey of the distribution of diseases in India. It also discusses the geographic problems related to nutrition and health and the availability of medical services.

In India Medical Geography is still in infancy. In Russia and even in the United Kingdom a lot of

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research work is going on and Medical Geography is becoming one of the important disciplines bringing geographers and medical man together. A look into the available literature in medical geography, some of which are mentioned above, brings one to following conclusions.

Firstly, so far more stress has been given to mortality data. This is mainly because the data on mortality are more readily available than those on morbidity. It is of utmost importance that morbidity should be studied and the statistics about the people suffering from these diseases should be collected and correlated to determine the causes of these diseases.

Secondly, the cartographic representation of the distribution of diseases has not been done effectively. The statistics collected are analysed in great detail but very little of mapping is attempted. Maps are very essential tools for showing correlation and inter relationships visually. They impress upon the looker the gravity of the disease. When a map showing the disease distribution is correlated with soil, vegetation, culture etc., we are able to eliminate the vectors which can work as causative factors. Thus mapping is an important aspect in the study of Medical Geography and hence greater emphasis should be given to it.

Thirdly, so far only the diseases from which people die or suffer have been studied. But it is necessary to study the comparative good health also. The healthy life, its requirements and the factors which affect the health of a man etc., should be taken up for further study. While choosing a site for the construction of house, a number of factors have to be studied. For example, the facing of the

house, the height of the building above the ground, the local environment, climate and so on. Even in the West enough attention has not been paid for the selection of building sites. In India such studies have not been even attempted.

Due to the growth of the industries and mechanisation more and more of rural areas are converted into industrial areas. There is marked difference in the health between rural and urbanised centres. The pure, fresh and unpolluted air of rural areas is very healthy and usually the villagers are more sturdy and healthy while the people from the cities or urban areas are less healthy even though there are better medical and public health facilities in urban areas. It is true that rural people become victims of communicable diseases more often than the urban people. But it is because of the malnutrition and poor medical facilities and not because of the poor environment. The urbanites suffer from mental tension because of the strenuous nature of their work and surroundings. As a result they suffer ill-health more often and their span of life is shorter when compared with the rural folk.

With the advance of time, more and more industries spring up. The health of a labourer working in the factory of mill in a country like India is deplorable. Due to the unhealthy conditions inside the factories, and poor housing and low salary, the health of the labourer is affected adversely. They are usually lean, thin and bear a sickly look on their faces.

Other than these, the letting off of the chemical by products, wastes, smoke, soot etc., pollute the atmosphere and water. The same polluted air taken in while breathing give rise to a number of diseases such as cancer and bronchitis

which are found in abundance. The diesel engines and different transporting vehicles let off carbon monoxide gas which is certainly harmful to the human body. Every day an immense amount of these gases pollute the air and lead to the, chemical pollution of the air affecting the human health.

A recent study has revealed that the house dust is also associated with various allergic conditions such as asthma and has serious consequences. All these factors help to promote illhealth which are yet to be studied in detail. Research work in this field will be of considerable help in making human life more healthy and livable.

With the advancement in science and technology people enjoy more comfort with new inventions and more amenities of life and many of the disease are under control. Malaria, plague, influenza and many of the killing diseases in the world are supposed to have been completely eradicated. But still many of the unknown diseases which have come into existence are yet to be investigated. A Medical Geographer can be of great help with his studies in this field. He can have the available data analysed and by correlating it with the different environmental factors, can arrive at conclusions regarding the possible causes of the incidence and the spread of the diseases.

What is the field of medical geography?

Medical Geography is defined as the study of the spatial distribution of health, illhealth and diseases as determined by the natural and cultural milieu of men. In order to show this interrelationship, medical

geography studies the distribution, and influence of geographical factors, such as land forms, soil, climate, vegetation, flora and fauna and microorganism, on the life of man. The occurrence of these singly or in collusion with one another and the reasons of man's physiology and mind to them, form the core of the Medico geographic research.

The aim of Medical Geography is not to find the causal relationship put rather to identify and narrow down the number of factors which might be investigated by the medical men for finding out the causal relationship. It also explains the relationship between man's physiology and the environment in which he lives with a view to find out the ideal environmental medium in which he can lead a healthy life.

Medical Geography is one of the younger disciplines that has been developing rather rapidly in recent years. There appears to be a diversity of views on its objectives and the area covered by it.

According to Yevgeiniy I. Ignatyev and his associates the various views can be grouped into three basic stands³.

1. Medical Geography deals with the distribution of human diseases and conditions under which it arises.
2. Medical Geography deals with the effect of natural conditions on the health of the man.
3. The object of medical geography is to study the geographical environment of human society and its influ-

3. I. M. Gelyakov, et. al. The present state of Medical Geography in U.S.S.R. Soviet Geography. Vol. 8, No. 4, April, 1967, pp. 229.

ence on the health of the man.

So it is not proper to say medical geography deals only with the distribution of diseases, as it also deals with the influence of geographical environment on their distribution. Medical geography stands at the border line between medicine and geography in the same way as biogeography lies on the boundary of Biology and Geography.

The object of Medical Geography is not merely the study of the geographical environment only: It is the study of the geographic environment in so far as it affects the health of man. It is not the study of the disease in itself but the area affected by disease and its distribution within that area. In other words the object of Medical Geography is not the disease and the territory, divorced from each other, but the significance of territorial characteristics for the distribution of disease or pathological states in general and the significance of disease having certain characteristics to a given territory⁴.

Thus diseases and territorial characteristics go hand in hand and the study of correlation between these two is of significance to a medical geographer. The study of only diseases or the territory⁵ will be purely the field of medicine or geography respectively. But a medical geography has to bring into light the existing interrelationship between the two.

Man's economic, social and natural environment determines the incidence and spread of diseases.

4. T. M. Gelyakov, et. al. *Ibid.*

5. The term territory has been used to signify the natural and cultural landscape set apart by physiographic or political boundary.

The patterns of health in societies, with different standards of living and different modes of life, are, therefore different. In the same way the pattern of the distribution of disease in the primitive age and the recent years shows a sharp contrast and difference. For example, in the highly industrialised area, with higher standard of living, improved environmental conditions better housing, educational and medical facilities, the health of the people is much better. Contrarily in the underdeveloped areas with low standard of living, less cleanliness, poor education, poor housing and medical facilities, there is greater incidence of diseases and the general condition of health is poor.

The primitive man depending upon hunting and fishing for livelihood, had developed a rhythm of life which enabled him to adapt himself to the environment. There was less strain on the brain, or heart. All the actions were reflex actions such as fight or flight with less dependence on the central nervous system. Thus there was no mental or heart disease experienced by them. Of course there were major killers like malaria, cholera, plague, dysentery etc., due to unhygienic conditions and poor surroundings. The mortality and morbidity was high. The number of diseases which the deaths occurred was relatively small.

In contrast to this, the modern man has achieved control over most of these deadly diseases to some extent and the world in which he lives is changing faster than he can change himself mentally. He is subjected to a number of

mental stresses. This has led to the increased number of death from mental and cardiac diseases.

Apart from these, the mechanization process in almost all walks of life has brought forward new problems. The natural environment which was unpolluted in a primarily agricultural society which kept human life more in tune with the biological process, has now been changed to such an extent that the physiological processes fail to function smoothly. The chemical by products, waste materials and wash are discharged by larger industrial establishments into rivers, unmindful of their harmful effects on human beings and animals. Thus radio active substance are liberated into air, polluting the water and air to such an extent that they affect the health of man adversely. These factors are giving rise to a number of unknown diseases for which we have no curative medicines so far.

For the study of above noted problems medical geography has adopted the following methodology

of investigation. 1) The compilation or recording of complete and accurate statistics from different parts of the world-collection of factual data is a difficult job, due to the incompleteness and inaccuracy of the records. All the persons affected by the diseases may not come to the hospitals or may come repeatedly who may be everytime recorded as a separate individual, and lead to a wrong information. Sometime, wrong diagnosis may be done of a particular disease. 2) Analysis of the collected data. The distribution of the diseases are irregular in different localities, some having higher and other lower mortality and morbidity rates. 3) Representation of data on maps (Maps are the basic tools of geography). The maps will demonstrate many marked variations and contrasts in disease distribution. 4) Correlating the data with the environmental factors which give the clue to the possible causative factors in the prevalence of a particular disease, which could be studied in depth and possibly rectified.

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THE VILLAGE SAHSARAWAN, BAHRAICH (U.P.)

(A study in Nutrition and Nutritional Deficiency Diseases.)¹

BY

NOOR MOHAMED*

The dietary surveys carried out in India for the last fifty years have shown that the diet of the major portion of our population is inadequate—both quantitatively and qualitatively measured even in terms of Indian standard.² The total supply of protein, vitamins, minerals, fats and carbohydrates falls short of the desirable level in most of the cases. Such unsatisfactory diet results in the wide prevalence of nutritional deficiency diseases specially among the vulnerable segments of the population such as pregnant women, nursing mothers, infants and children. Unfortunately malnutrition is not only responsible for high mortality but it permanently damages the growing generation. It increases the morbidity period, which had bad effects on the working population. In the present paper an attempt has been made to assess the nutritional standard and the prevailing deficiency diseases in village Sahsarawan which lies in the district of Bahraich (U.P.).

Sahsarawan with an area of about 197 hectares is situated in the district of Bahraich at 27° 24' 45" N. Lat. and 81° 47' 45" E. Log. It

lies in a well-drained plain of sandy loam soil. Water-table is low and irrigation facilities are meagre. The economy of the village is purely agrarian and about 80 per cent of the village land is cultivated. The total population at the time of survey was 715, out of which 560 persons (about 78 per cent) directly and 70 persons (about 22 per cent) otherwise were dependent on agriculture. Nearly 80 per cent population consists of the high caste Hindus i. e. Brahmins, Rajpoots and Bhumihars. The remaining 20 per cent includes Kurmis, Harijans, and Muslims.

For the assessment of the consumption of various edibles by the village people in terms of caloric intake, the author has conducted a land use survey during 1965-66. He visited the village thrice during this year. For the assessment of the total amount of the calories intake per head per day by the village people a 'Food Balance Sheet' has been prepared on the basis of the total consumption.³ As grains are almost the only item of diet in this village, and the meat, fish, eggs and milk provide only 33 calories, the calories obtained from foodgrains

THE VILLAGE SAHSARAWAN BAHRAICH (U.P.)

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are by and large indicative of the general nutritional standard of the village people.

Table I shows that more than 98 per cent of the total calories are obtained from foodgrains and the remaining 2 per cent are provided by meat, fish, eggs and milk. Roughly 70 per cent of the total calories are obtained from kharif crops whereas rabi crops provide 28 per cent of the total calories. The

principal kharif crops are rice, maize, sugarcane and pulses which collectively supply more than 90 per cent of the calories of the kharif season. Wheat and gram are the major crops of the rabi season and provide roughly 83 per cent of the calories obtained from rabi crops. Pulses (including kharif and rabi) are also the major item of diet and provide more than one-fifth of the total calories.

TABLE I

Food Balance Sheet of village Sahsarawan⁴

Total population of the village⁵ ...715

Various edibles	Per head consumption	
	Per day in grams	Calories
Rice (Broad cast)	132.6	464
Rice (Transplanted)	7.9	28
Maize	148.3	506
Big millets	0.9	3
Wheat and gram	3.6	13
Barley	2.7	9
Wheat	74.4	253
Sugarcane	39.9	155
Gram	61.2	220
Wheat and barley	14.9	50
Peas	1.3	4
Bejhar	11.4	40
Pulses (Peogion Pea ⁶)	53.5	190
Oil seed	1.3	7
Potatoes	4.1	4
Vegetables	4.3	6
Milk and milk products	3.4	14
Meat	2.5	11
Fish	1.6	8
Total	569.5	1985

⁴ In the preparation of the 'Food Balance Sheet', firstly the total production of various edibles have been computed on the basis of the per hectare yield and the total area devoted to that crop. Then after adding or subtracting the import or export figures, the amount of seed for the next year is deducted from the total production and the remaining figures have been converted in to food net by applying extraction rates published by FAO. The net food were divided by the total population of the village. This shows per head consumption for the whole year which being divided by 365 gives per head daily consumption And finally this figure has been converted into calories.

⁵ During the course of the field work an enumeration of the population of the village was undertaken. Persons living in the neighbouring villages but dependent on the produce of this village were also included in the village population. Similarly the persons living in this village but dependent on the produce of other village, have been excluded from the population of this village.

⁶ It is sown in the kharif season but is harvested during rabi season.

*Dr. Noor Mohamed is working as a lecturer in geography in the K. M. College, University of Delhi, Delhi-7

1. This paper is a part of the Ph. D. thesis of the author submitted at the Aligarh Muslim University, Aligarh and is entirely based on the intensive field work done during the agricultural year 1965-66.

2. Here reference may be made to the following publications of the Indian Council of Medical Research, New Delhi:—

- (i) Report on the results of the dietary surveys in India, 1951.
- (ii) Review of the Nutritional surveys carried out in India, 1961.
- (iii) Review of the nutritional surveys in India (1951-56), 1961.

3. For the concept of 'Food Balance Sheet' see:—

- (i) Food composition table for international use, FAO 1949.
- (ii) Shah, M.: Land Utilization in Uttar Pradesh, (Aligarh, 1960).
- (iii) Sukhatme, P.V.: Feeding India's Growing Millions, (Bombay, 1965).

Table I further shows that per head per day supply of calories in village Sahsarawan is 1985 which falls short of that postulated by Prof. Stamp who taking into consideration the age structure, range of occupation, weight and height of the people living under different climatic conditions of North-western Europe has postulated an average of 2460 calories (900,000 calories p.a.) and he called it standard Nutrition Unit (SNU) for North-western Europe⁷. Prof. Shafi who has carried out an intensive field survey in a dozen of selected village from Eastern Uttar Pradesh has arrived at the conclusion that in the villages of eastern Uttar Pradesh an actual intake of 2000 calories a day equivalent to a farm production of a little over 800,000 calories per annum, is adequate⁸. So in village Sahsara-

wan the caloric intake is inadequate measured on both the standards.

There is no denying the fact that the total consumption of calories per head per day gives a comparative idea of the nutritional standard of the people in terms of calorific value; but the nutritional value of a diet cannot be measured on the basis of the calories alone, because nutritionally adequate diet should contain proportionate amount of protein, fat, vitamins, minerals, and carbohydrates. And, therefore, for the assessment of the nutritional standard of the village people, per head per day consumption of various edibles have been converted into different elements of diet using the conversion table published by the Indian Council Medical Research, New Delhi, and the resulting figures are given in the table II.

TABLE II

Per head per day supply of calories.....1985.

Elements of diet	Standard ⁹ Requirement	Actual intake	+Surplus -Deficiency	Percentage Departure
Protein mg.	68.00	55.35	-12.65	-18.60
Fat gr.	60.00	14.69	-45.31	-75.51
Calcium mg.	900.00	278.85	-621.15	-69.01
Iron mg.	17.00	30.65	+13.65	+80.29
Vitamin 'A' I. U. ¹⁰	5000.00	2595.78	-2404.22	-48.08
Thiamine mg.	1.30	1.60	+0.30	+23.07
Riboflavin mg.	1.40	1.07	-0.33	-23.57
Vitamin C. mg.	49.00	1.87	-47.13	-96.14
Niacin mg.	12.60	16.14	+3.54	+28.09
Phosphorous mg.	1000.00	1624.55	+624.55	+62.45
Carbohydrates gr.	605.00	443.34	-161.66	-26.71

⁷ Stamp, L.D.; OUR DEVELOPING WORLD, (London, 1960) p 110.

⁸ Shafi, M.: op. cit. (Aligarh, 1960) p 222.

⁹ For ascertaining the standard requirements of various elements of diet, the following publications may be referred:-

(i) Mukerjee, R.; *Food Planning for Four Hundred Millions*, (London, 1938).

(ii) Swaminathan, M and Bhagwan, R. K.; *Our Food*, (Madras, 1962).

(iii) Aykroyd, W. R.; *Nutritive value of Indian Food and Planning of a Satisfactory Diet*, (New Delhi, 1962).

¹⁰ I. U.=International Unit.

Table II clearly indicates that there are only 4 elements (vitamins B, iron, niacin, and phosphorous) out of 11 which are adequately supplied and there is an overall deficiency in the remaining 7 elements of the diet. This deficiency as may be observed in the following lines badly affects the general standard of the health of the people. An enquiry relating to the diseases in the village on account of nutritional deficiency in the diet gave the results given in table III.

A comparative study of tables II and III indicates that there is a

remarkable relationship between the supply of various elements of diet and the prevailing deficiency diseases. Table II shows that the supply of vitamin A is less than 50 per cent of the standard requirements. The basic lesion of vitamin A deficiency is hyperkeratinization of the skin at large and the keratinizing metaplasia in the beginning of the respiratory gastrointestinal and genitourinary tract. Night blindness, xeroderma, xerophthalmia, and kerkomalacia are the prominent vitamin A deficiency diseases.

TABLE III

Total number of patients.....108.

Deficiency diseases	Male	Female	Children	Total
Night blindness	5	5	3	13
Retarded growth	3	3	4	10
Xerophthalmia	3	2	X	5
Dyspepsia	X	1	X	1
Constipation	2	2	2	6
Chronic diarrhoea	4	4	3	11
Angular stomatitis	2	X	3	5
Glossitis	X	4	4	8
Pyorrhoea	4	2	1	7
Polyneuritis	3	X	2	5
Kwashiorkor	3	X	X	3
Hypoproteinaemia	X	4	3	7
Dental decay	6	2	X	8
Rickets	X	X	5	5
Osteomalacia	4	3	X	7
Diabetes	3	1	1	5
Pellagra	X	X	2	2
Total	42	31	35	108

It is evident from table II that the supply of vitamin A is less than the standard requirement. The main sources of vitamin A are cereals and pulses. As a result of this short age, 28 persons or more than one-fourth of the total patients were suffering from vitamin A deficiency diseases. Night blindness is due to the exhaustion of the usual purple after prolonged exposure to the brilliant sunlight and lack of vitamin 'A' interferes with the regeneration of usual purple¹¹. Xerophthalmia which affects 5 persons in the village is the other vitamin A deficiency disease. In it the cornea dries up and becomes ulcerated due to the involvement of lacrimal glands, as a result tears are no longer produced and the cornea is not bathed with fluid as it should be.

Vitamin C is one of the chief elements of diet but its supply in the village is only 1.84 mg. i. e. 96 per cent deficient of the standard requirement. This acute shortage has resulted in wide prevalence of pyorrhoea and polyneurites which together have affected 12 persons of the village. Beside the deficiency of vitamin C, pyorrhoea is also aggravated by the personal cleanliness of the people who are habitual of tobacco chewing. The deficiency of Vitamin C may also lead to haemorrhage in various parts of the body, sallowness and other affection of the skin and fragobility of bones and scurvy.

Riboflavin (vitamin B₂) — also known as tissue respirator vitamin, is required for cellular respiration taking part in the transfer of oxygen from plasma to the cell of tissues. It is rapidly absorbed from bowl and widely stored in tissues more particularly in the liver. The supply of riboflavin in

the village is about 25 per cent short of the required standard. This deficiency has resulted in fissure at the angle of the mouth and local inflammation, desquamation and encrustation. However, 5 cases of angular stomatitis and glossitis have been recorded whereas 11 persons were found suffering from chronic diarrhoea.

It will also be seen from table II that the supply of calcium which is necessarily required as building material for bones and teeth, is only 38 per cent of the required standard. This acute shortage of calcium is owing to the consumption of cereals as principal food which are very short of calcium. However, many cases of calcium deficiency were found during the course of field-work. Dental decay is the main disease which influenced 8 persons Rickets osteomalacia are the other calcium deficiency diseases which affect 18 persons.

Proteins are actually indispensable for the normal constituent of every cell in the body. It supplies the building material for body and make good the wear and tears of tissues which is a constant feature of the process of life. But the supply of such an important element of diet in the village is 20 per cent short of the standard requirement which results in wide prevalence of protein deficiency. It will be seen from table III that 10 persons were suffering from protein deficiency. Hypoproteinaemia is the main disease which affected 4 males and 3 children. Kwashiorkor—the other protein deficiency disease, had affected 3 persons in this village.

Besides this, 5 cases of diabetes were also found during the year of survey. It is because of inadequate supply of carbohydrates.

It is interesting to note that the supply of thiamine (also known as anti-beri-beri or anti-neuritic factor) is 23 per cent surplus of the standard requirement but even then 7 persons were found suffering from dyspepsia and constipation which are caused by the deficiency of thiamine. Thiamine is physiographically concerned with the proper utilization of carbohydrates in the body. There is a constant daily demand for it and as such a short deficiency may result in clinical disturbances. Therefore, the prevalence of deficiency may be due to the uneven consumption of thiamine among the village people, as the poor segment of the population was found victim of this disease. On the contrary, in spite of 75 per cent deficient supply of fat, no body was found suffering from fat deficiency. It is because of the fact that the deficiency of fat does not result in any disease directly but it aggravates various deficiency diseases.

It is clear from the foregoing study that there is a close relationship between the prevailing deficiency diseases and the

nutritional standard of the people. and, therefore, if the various elements of diet are provided to the village people according to the Indian standard, they will at least be free from nutritional deficiency. This improvement in nutritional standard will increase their working capacity as well as working hours. Needless to mention that farmers having good health and free from disease shall be in a better position to devote themselves to the agricultural activities. And this in return will surely increase the agricultural efficiency of land.

Acknowledgement

The author owes a sincere and deep debt of gratitude to his supervisor Prof. M. Shafi, Prof. and Head, Department of Geography, Aligarh Muslim University Aligarh, who in spite of his pre-occupations and heavy engagements, has been kind enough to go through this article and gave valuable guidance and suggestions. Thanks are also due to Dr. K. Z. Amani who has helped the author in the preparation of this article.

11. Boyd, W.: *A text book of Pathology—Structure and Function in Diseases* (London, 1961) p. 380.

NOMENCLATURE AND DELIMITATIONS OF THE UMLAND — AN APPRAISAL

By

H. N. MISRA

The term 'umland' is so indiscriminately used in the study of towns and cities that it is on the verge of losing its true meaning. The analysis of the structure of city and its functions is considered incomplete without the treatment of the surrounding region characteristically called the umland, but the extent of umland is neither clearly defined nor properly conceptualized on the basis of any theory or model. Different authors have used different variables and in some cases even unique variables have been taken into consideration for the delimitation¹. Such studies have made the confusion surrounding the concepts of umland more confounded. The objective of this paper is to review the current concept of umland and to suggest an alternate method which can be used for delineating the umland in a variety of urban situation.

A city does not exist within its municipal limits. There exists a socio-economic relationship between the city and its contiguous areas. As stated by Smailes "Towns do not exist in vacuums, cut-off from the contiguous area along clear cut municipal boundary lines. On the contrary they are always intimately related to areas larger than the mere sites they occupy." Thus, the study of the umland is of utmost significance. Such a study is especially important because the growth of the city itself depends, to a great extent upon its relation-

ship with its umland. "That the dynamic urban organism can continue its existence by itself is rather unthinkable for it has to derive at least a part of its life force from the surrounding region."²

The word umland appears to be of German origin. Other terms used interchangeably are catchment area, urban field¹, hinterland, sphere of influence² and city region. According to Van cleef the word umland first appeared in 1883³. Many other expressions such as "catchment area", "urban field", "hinterland", "Sphere of influence" and "city regions" occur in published literature on urban Geography. But the word umland is the most commonly used for the description of the area contiguous to the city. Originally the word had the meaning "environs".⁴ Dr Gilbert is of opinion that the word umland must have been derived from the Swedish word "Ommland".⁴ Dickinson and Harts prefer the term "city region". Van Cleef, Taylor and Dodge have used the term umland to describe the area surrounding the town and which is served by it. A. E. Smailes has used the term "urban field" because he does not want to use a word of foreign origin.

Geographers, planners and engineers are confronted with the problem of defining and delimiting the boundary of the umland. In England, the earliest known work by a

geographer was that of Dickinson. He used wholesaling retailing, insurance, and accessibility as criteria for the delimitation of umland. His effort was followed by several other British geographers among whom mention may be made of A. E. Smailes and Bracey. In the continent and in American works of similar nature have appeared, John Brush, Vivian Huguette, Monliex Blanche, Maugin Claire have all used empirical data for the delimitation of umland.

In Germany J. H. Schultze has summarized the function and sphere of influence of 40 urban centres. On the basis of his investigation he has also commented on the theoretical framework of central place theory. Finland Oiva Tuovinen has delimited the umland of Turku using the traffic flow of school children, shoppers and patients. Similar studies have been done in Australia and Sweden.

In India prof. R. L. Singh¹ of Banaras University was the first geographer to venture in this field. He has followed empirical method used by European geographers for the delimitation of the hinterland of Banaras. He used vegetable supply, milk supply, news paper circulation bus service, regulated markets, agricultural commodity supply and the administrative links as variables for the delimitation.⁴ As he did not consider Banaras to be a part of the urban system of the region, his results were distorted. He has maintained this technique even in his later work on Bangalore. On similar bases, but with greater care Manzoor Alam has delimited the

umland of twin cities of Hyderabad and Secunderabad.² A he did not eat the twin cities as islands his results are meaningful. But he did not go beyond the present. U. Singh and R. L. Dwivedi have used R.L. Singh's method for the delimitation of the umland of Allahabad.

A departure from this method has been made by the Mysore school of geographers. Mahadev, and Jayasankar⁴ have used a mathematical model for the delimitation of the potential umland of Mysore city. In their model, they have modified the simple and well known gravitational model of Newton. Underlying the model is the basic assumption that "The amount of interaction between two cities is directly proportional to the number of people living in those cities and inversely proportional to the intervening distance".

$$I_i = P_i \frac{a \beta \lambda}{d_{ij} x_y}$$

Where I_i = Propensity Index of town i
 P_i = Population of town i
 λ = Weights on population
 d_{ij} = Distance between towns i and j
 x_y = Weights on distance.

They have also demonstrated the operation of the model by delimiting the umland of Mysore and have suggested that further refinement can be made by transforming the population and distance data using appropriate values for a , β and λ . Or by using other variable

¹ Singh R. L., Banaras :—*Study in Urban Geography* Nandakeshore Bros 1955.
² Dwivedi R. L., "Delimiting the Umiland of Allahabad" *Indian Geographical Journal*, Vol. 39, No. 38, (1964), p. p. 123-139.
³ Cleef E. Von "Hinterland and umland, *Geographical Review* Vol. 31, 1941, pp. 308-310.
⁴ Allix Andre, the Geography of Fairs, *Geographical Review* Vol 12, 1922, pp. 532-569.
⁵ Gilbert E. W. "Urban hinterlands, *Geographical Journal* Vol CXVIII, 1951 pp. 365-366.
⁶ R. E. Dickinson "The Regional Functions of influence of Leeds and Bradford", *Geography*, 1930.

1. Singh R. L. Op. cit.
2. Pahl, R. E. "Trends in Social Geography". R.J. Chorely and Hagget. P. (edited) *Frontiers in Geographical Teaching*; in Methuen, 1965, pp. 98-90.
3. Alam, S. Manzoor, Op. cit.
4. Mahadev, P. D. and Jayasankar, D. C. "Concept of a City Region: An Approach with a Case Study", paper presented to 57th Indian Science Congress Karaghpur, Geography Geology section.

over dispersed) or bimodal distribution of spacings. Hence, it is necessary to distinguish true clustering or linearity from patchy variations in density where the pattern may be regular, random, linear or clustered within and between patches, for the pattern in these latter cases is a pattern not of points but of areas of differing density.

Patterns of points in two dimensions can have three properties of which regularity is most general which is also found in patterns of any dimensionality. Patterns in three dimensions retain the possible properties of linearity and clustering in addition to one further property. It is the property of planarity, the tendency to be located preferentially around two dimensional surfaces. Additionally, there is one property for each dimension available to a point pattern: clustering, linearity and planarity for one, two and three dimensions, respectively. Patterns in higher dimensions have all possible properties of those in lower dimensions. These simple properties of patterns may interact in various ways. In a two-dimensional pattern with both clustering and linearity, the cluster centers may be located without regard to the lines, preferentially on the lines or away from them. In three dimensions the addition of planes may increase the complexity.

The interrelationship between properties of pattern is a difficult matter for which a complete solution has not yet been found. Generally, regularity has been considered as negative clustering with randomness as an intermediate reference state. This fits the genetic interpretation of clustering representing attraction and regularity representing repulsion between individuals. However, a pattern of points may have a high degree of clustering as well as regularity as has been

depicted by Isard (1956, p. 272) in a diagram showing a central place system as modified by agglomeration. While this pattern possesses neither absolute clustering nor absolute regularity, it indicates that the two properties are not mutually exclusive. There may also be other transitions such as clustered linear and regular linear patterns. Hence, it seems necessary to have a measure for regularity, separate from that for clustering. On the other hand, increasing regularity usually decreases linearity or clustering and so forth, for the properties are not completely independent. Regularity, linearity and clustering can all increase as randomness decreases, though perfect clustering cannot co-exist with linearity or regularity.

Methods of Analysis

Several methods have been used for measuring patterns of points in two-dimensions but each has its shortcomings. Probably the oldest of these is the quadrat analysis which involves counting the number of points in "quadrats" of equal area forming either a grid or random sample and testing the randomness of the distribution of points by comparing the observed frequency distribution with an expected one derived from a particular probability model. In fitting these models, the observed density of points per quadrat are used in estimating the parameters and goodness-of-fit test such as χ^2 (Chi-square) or Kolomgorov-Smirnov tests are applied in the comparison of the observed and expected distributions. If the variance of the resulting distribution of counts is low, the pattern has a tendency towards regularity. On the other hand if it is greater than the mean count, clustering may be present. Dacey (1966), Harvey (1965) and McConnell (1966) have well illustrated the use of the quadrat method.

The quadrat method has the disadvantage of dependence of point distribution on quadrat size and shape. With different sizes, the same pattern may appear random, regular or clustered. When the quadrats are made smaller as compared to the total area, the probability of a quadrat containing point is decreased and vice versa (King, 1968, p. 109). Ecologists have turned this apparent defect into a method of discerning the scales at which clustering occurs. Quadrats of various sizes are used and variance in counts is plotted against quadrat size. Confidence limits for the variance of a random population is also plotted so that variances above the upper limit represents clustering and that below the lower limit represents regularity (Kershaw, 1964, pp. 104-121; Greig-Smith, 1964, pp. 85-93). However, such a method requires a large number of points, or there will be insufficient large quadrats. It is suitable for plant distributions but many geographical distributions contain few individual within a region small enough to have a homogeneous pattern. Thus, it is desirable to have a measure of pattern which focusses attention to individuals.

Another way of describing a point pattern is by means of nearest-neighbor analysis which takes into consideration the location of point relative to one another and the distance between nearest neighbors. Its theory and applications have been amply illustrated by King (1962), Dacey (1960, 1961), Thomas (1961) and Getis (1964). This method quantitatively defines a scale whereby the degree of departure between an observed spatial distribution of points can be measured from that of a theoretical random distribution. The scale, as is called R , and its individual values are defined as

follows: $R = \bar{r}A/\bar{r}E$, $\bar{r}A = \sum r/N$ and $\bar{r}E = \frac{1}{2}\sqrt{P}$ where r is the mean distance from each point to its nearest neighbor, P is the ratio of number of points to the total area, A and E refer to the actual and expected respectively.

The nearest-neighbor method is useful for analyzing point patterns as it serves for a test of randomness and allows a comparison of two or more distributions. However, it does not consider all relevant spacings between points and cannot distinguish linear from clustered patterns. In general this method seems more appropriate for analyzing patterns in one dimension (Cole and King, 1968, p. 192), although Dacey (1963) has extended its generalization to patterns in multi-dimensional space. Quadrat and nearest-neighbor methods consider only clustering versus regularity and both ignore linearity and angular properties of pattern.

In order to overcome this disadvantage, it is necessary to define which points are neighbors objectively. For this purpose, a given space may be divided into areas closest to each point and lines equidistant from adjacent points may be joined to form a polygon around each point. On this basis, the nearest-neighbor of each point may be defined as those whose polygons are in contact with its own. The areas of the polygonal field around a point is particularly significant in giving a reciprocal measure of density for each point. These point values can be used to analyze spatial variation in density such as by trend surface analysis. In this way regional gradients might be removed so that patterns could be studied without assuming an overall mean density.

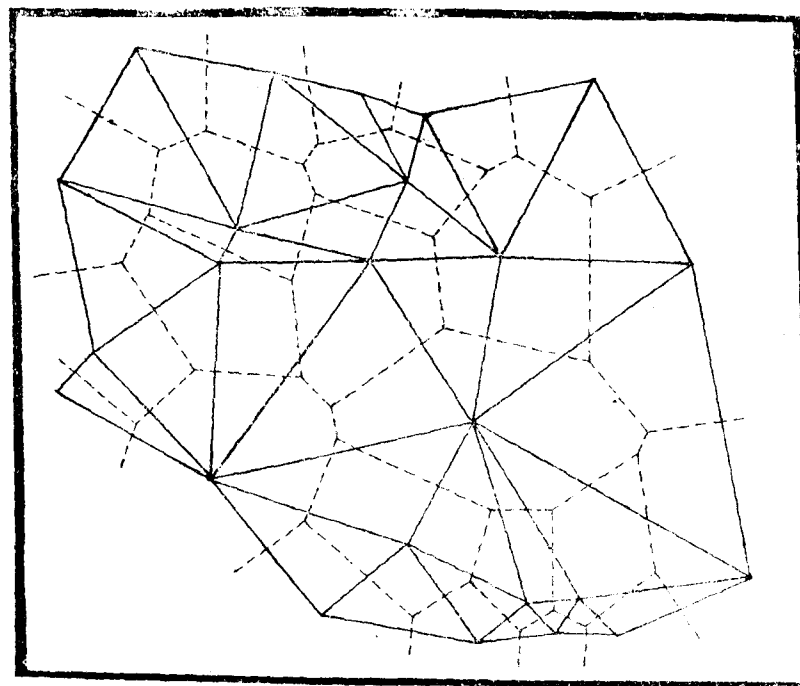


Fig. 1. A Triangular net (solid) joining points and space-filling polygons (dashed) around the points

By means of space-filling polygons, a triangular net of lines joining neighbors can be produced (Figure 1). This consists of joining each point to its nearest neighbor and continuing to join close points until the space is filled with triangles, all apices being at points and all point being apices without being located on the sides of triangles. As regards to which pair of apices of a tetragon should be joined, it is always the pair with the greater sum of angles, for this is almost equivalent to joining the closest point and minimizing the total length of line.

In the triangular net, the distribution of angles, areas and lengths of sides are not distorted by the inclusion of peripheral points and boundary effects on number of neighbors can be treated precisely. The triangle-filled area is bounded by an n -sided polygon joining the n peripheral points which can be

regarded as neighbors regardless of where points outside the area covered may be located. Since the angles of a triangle add up to 180 degrees, if an n -sided polygon is considered to be composed of n triangles based on the sides and meeting at a single point, then the sum of its internal angles is $n \times 180$ degrees minus the 360 degrees sum of angles at the meeting point. Therefore, the sum of internal angles is $180(n-2)$ degrees, the average angle being $180(n-2)/n$ degrees. Consequently, if the sum of internal angles is divided into angles averaging 60 degrees by the lines of the triangular net, there are $3(n-2)$ such angles at the peripheral points. For three angles at peripheral points, there must be four lines; hence, the sum of number of neighbors for peripheral points should be $3(n-2) + n = 4n - 6$. In general, where a two-dimensional pattern of m points has n peripheral points, the sum of the number of neighbors of each

point must be $6(m-n) + 4n - 6$. Essentially the same arguments apply where a two-dimensional area is divided into irregular units, for the contact number (neighbor) of an area is analogous to that of a polygonal field around a point.

The triangular net gives rise to four statistical distributions: (a) the number of lines meeting at a point, (b) the lengths of lines joining neighbors, (c) angles and (d) triangular areas. The number of lines meeting at a point may vary upwards from three and, apart from boundary effects, there must be an average of six, for the angle around a point is 360 degrees containing six 60 degrees angles which are the average for apices of triangles. This number is equal to the number of neighbors of the polygonal field surrounding the point. The variance of the distribution of these numbers may be regarded as a measure of regularity. The lengths of lines joining neighbors can have a peaked

distribution for regular patterns of points, a flattened distribution for clustered patterns and bimodal for linear patterns, the difference between the two providing a measure of linearity. The variance of the distribution of angles may also be operationally taken as a measure of linearity. The dispersion of the distribution of triangular areas provides for the measure of clustering. Thus, measures of regularity, linearity and clustering are provided by the variances of distributions of the number of lines meeting at a point, the angles and triangular areas respectively to the variances of the corresponding distributions from a random pattern. A major advantage of the method of analyzing point patterns proposed here is its ability to provide an objective measure even when marginal points are included. This is particularly important where there are a small number of points available and where marginal points such as towns along a river are significant.

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SILK INDUSTRY OF VARANASI

by

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Varanasi is the main centre with heavy concentration of silk weaving establishments in Uttar Pradesh. The speciality of the place is a very high skill of the cottage weaver in weaving gold and silver threads with silk yarn and producing beautiful floral designs and patterns of wire tinsels in silk fabrics. Of late, however, other yarns like cotton, nylon and art silk etc. are also being used in much larger quantities in addition to pure silk. Individual weavers have their own designs, patterns, and looms on which they weave their fabrics, mainly 'sarees'. The secret of their success lies in the ever changing varieties of colour, pattern and design.

Historical Background:

The city of Varanasi, situated at the left bank of the river Ganga at an altitude of 250' above sea level, is probably the oldest city of India. This sacred city of gods was famous in the past not only as a great centre of learning but also for its arts and crafts, as it is even today. Even in these ancient days, of all the industries of Varanasi, its textile industry was by far the most important. The industry here specialised in the production of certain distinct varieties which are known far and wide. The Pali literature (about 6th Century B.C.) contains innumerable references to 'Kasikam vat-tam' or 'Kashi cloth'. The most reliable references occur in *Dhammapadam*¹ and *Therigatha*². *Anguttar Nikaya* describes 'Banaras cloth' as pleasant to handle and of good colour and great worth. In *Vessantara Jataka*, we find that

Maddi, the queen of king Vessantara is described as weaving Banaras cloth.

This Kashi cloth enjoyed as much popularity and sanctity at the time of Buddha as the silk dress did in the pre-Buddhist India. The 'Kausam-vasa' meaning silk-dress occurs in 'Satpatha Brahmins' testifies the existence and the use of silk in India as early as 800 B.C. There was something sacred about the use of silk. It was generally used on ceremonial occasions and by the religious and rich people of the society. The traditional purity attached to silk fabrics collaborated with the fact that they were manufactured at the holy city of Kashi (Varanasi) might have, in all probability, given to the silk fabrics of Varanasi the dignified title of 'Kashikam-kauseyam-vastram', or 'Banaras silk cloth'. The silk cloth of Varanasi was a speciality of the place, and it is quite probable, therefore, that the word 'Kauseyam' might have later been dropped as being inconvenient and superfluous appendage.

When and how silk industry of Varanasi was first established is altogether unknown. However, this much is certain that it was in existence in the pre-Buddha era and was in full-fledged and flourishing condition during the Buddhist period in 6th century B.C.

It experienced the unbroken prosperity in the Hindu period. How the industry passed from the hands of Hindus to those of Muslims is not known.

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1. *Dhammapadam* (Fansboll Edition 1855), p. 251.
2. *Therigatha* Ch. LXVIII.

According to a manuscript, entitled *Akhbarul Mukhadin*, the first caravan of Muslims entered Varanasi in 380 A.H. (11th century A.D.) several years earlier than they came as the conquerors of the city. As their religion, appearance and dress were all different and strange to the local Hindu population, they were forced to stay outside the main city. At that time, weaving was the main occupation of low sub-caste in Khatri Hindus, known as 'patti-kas'. The newly settled Muslims, unable to contact high caste Hindus owing to the prevalent practice of untouchability, developed contacts with and learnt weaving from the Patti-kas Khatri. They soon began making looms and other weaving tools and installed their own looms and started weaving cloth. The demand for cloth manufactured by them increased rapidly and the Patti-kas Khatri faded away from the scene, except as weaver of cloth for puja purposes.

When the Muslims came as the conquerors several years later and settled at Aliyapuri (the present Alaiyapuri region) and other Muslim localities of the present city, they naturally developed contacts with the already settled Muslims and gradually learnt weaving from them. During the reign of Akbar (1561-1605 A.D.) with the state patronage as well as artistic skill and Master Craftsmanship of Muslim weavers, lifted the industry to new heights of glory in hand-loom weaving.

In the British period this industry has to face a set back owing to competition from the cheap mill-made product. Silk Industry of Varanasi was, however, among the few exceptional handicrafts which survived because of its unique characteristics. Nevertheless the industry had again to adjust itself

to the changing circumstances. The efforts made for the purpose resulted in the introduction of plain Kashi silk—a thing hitherto unknown in Varanasi.

Post Independence Period:

The independence of the country brought in its wake the partition of the sub-continent. The industry had to face some very bad moments owing to communal tensions and disturbances that followed, which resulted in the migration of a number of the weavers (Muslims as they are) to Pakistan. Since the migrants possessed the necessary skill and craftsmanship, they naturally sought to indulge in the same occupation as far as possible, and a tiny Banaras Silk Industry slowly developed at Dacca, in East Pakistan. It is now a developing industry there with a market even in foreign countries, and, strangely enough, its products are also known as Banarasi goods! Thus, in some of the foreign markets, particularly in the U.S.A. the Banaras Handloom Industry of Varanasi have to compete with the Banaras Handloom Industry of Dacca. However, the loomage at Dacca being small, their production is rather limited.

A second and simultaneous setback which the industry had to experience after independence, resulted from the abolition of the princely states and zamindari system. The nobility and the royal families of these states and the Nawabs, Jagirdars and the Zamindars had been the biggest buyers of costly Banarasi goods, and in their disappearance the industry lost its main buyers. Again the industry had to make the necessary adjustments in accordance with the changed circumstances. Firstly, it greatly expanded the production of the cheaper cotton-mixed sarees

which are within the reach of the masses. Secondly, apart from producing costlier fabrics for marriage purposes, it started catering more and more to the fashion market by replacing the gaudy textures and designs with simple and modern ones. Lastly, it endeavoured to find markets in foreign countries and this has led to a certain extent to export-orientation of its production patterns. This has resulted in improvements in the quality of designs, textures and dyeing, etc., and enlarged production of standardised goods.

Present Position

With the adoption of the policy of planned economic development of the country, the condition of this industry has also improved to a certain extent. All-India Handloom Board and All-India Handicrafts Board came into existence to look after the planned development of handloom industry. A weaving school has been established at Varanasi to impart training to the weavers and suggest improvements in designs and in looms and tools, etc., after proper research. Two Government dye-houses with the facilities of silk-dyeing of fast colour have also been opened during the First Plan period. Quality marking scheme has also been introduced to ensure certain standardisation of the products of this industry. Similarly, co-operative movement has also been brought to the industry and a large number of weavers' co-operative societies have been formed. A number of studies have been made and steps suggested by Indian as well as foreign teams of experts to augment exports of Banarasi goods.

In 1962, the industry faced a grave crisis as a result of the

Chinese aggression. Owing to a steep fall in the demand for Banarasi goods (being mostly luxury items), a large number of looms had to be closed down and a good many weavers were thrown out of employment. Fortunately this situation ended soon and the industry again strived forward to make good the loss. But it had yet hardly recovered when a new shock came in September 1965, in the shape of Indo-Pak war. This time the industry was confronted with a still worse crisis and more than half of the total number of looms were reported being idle at one time. This precarious situation lasted only for a short period and as the 22 day war ended with the historic Tashkent Declaration, the situation began to improve. This industry has, however, yet not recovered fully from the shocks of these two crises. Under the present conditions of high prices, shortage of food grains and wide-spread political dissensions in the country, the present difficult situation of the industry is likely to persist for some time to come.

At present there are more than 30,000 looms located in the city and in its neighbouring villages. The industry may thus be estimated to provide direct and indirect employment to about a lakh of persons. It is, therefore, the occupation of the largest number of persons in Varanasi. The gross value of output of the industry today may be put at Rs. 15.17 crores, which finds markets not only throughout the country but in the whole world. Variety is the key note of the Varanasi handloom fabrics. The main items of fabrics produced are sarees, scarves and stoles, dress-materials and brocades. The major part of production is that of sarees which are in demand within the country and also in certain other parts of the world. It is estimated

that the total exports of Varanasi silk fabrics and brocades, including purchases by the foreign tourists visiting India, would roughly amount to Rs. 1.5 crores.¹ Thus, the industry is a good earner of valuable foreign exchange to the country, and there is scope for its augmentation with proper planning.

Organisation :

The silk industry of Varanasi is essentially a household and cottage industry. By far the most important form of ownership among the majority of the establishments is one of the individual ownership. The individual establishment in the industry may be grouped into three main type of organisations, viz., Household, Masterweaver and Partnership.

In the case of household establishments, the family is the unit of the work and no outside labour is employed in weaving except some child labour. Some outsider (hired) labour may be employed in the preliminary process. The masterweaver, on the other hand, employ outside labour in his establishment. He and the members of his family also work in the establishment but in addition there are some hired workers also. The third type does not own any establishment, but supplies the raw material to out workers (weavers) and receive the finished products. Often the last two types are combined so that the person concerned would own his own establishment and engage directly in production, at the same time, advance yarn, or cash or both to out workers and receive finished products.

1. Varanasi is divided into 3 sectors. Sectors A and B are within the Corporation area and Sector C is not in the Corporation area. There are 22,323 looms in Sectors A and B and rest are in Sector C.
2. Notes on 11 works pertaining to silk Industry

All the handloom establishments may conveniently be classified according to their status in the following seven groups:

1. Independent household
2. Independent masterweaver
3. Independent masterweaver and working for dealer
4. Independent and working for both masterweaver and dealer
5. Independent and working for masterweavers
6. Working for dealers
7. Working for masterweavers

Group 1 and 2 are fully independent and 3, 4 and 5 are partly independent on others for their operation. Master weavers and dealers, therefore, have considerable influence and virtually control the whole industry, often dictating terms to small weavers.

In all there are 22,323 looms² and 4977 establishments in the census (Fig No. 1.) A little less than half (46.8%) of the total number of establishment are in smallest size group (1-3 looms). The number of the establishments declines as the size of the group increases so much so that the largest size group (13 and above) comprises only 2.3% of the total number of establishments. More or less the same trend is visible in the case of number of looms, but the largest number of looms (78,000 or 38%) would be found in 2nd with 4-6 looms followed by 7-9 group which would also contain as many as 5,570 or 1/4 of the total number of

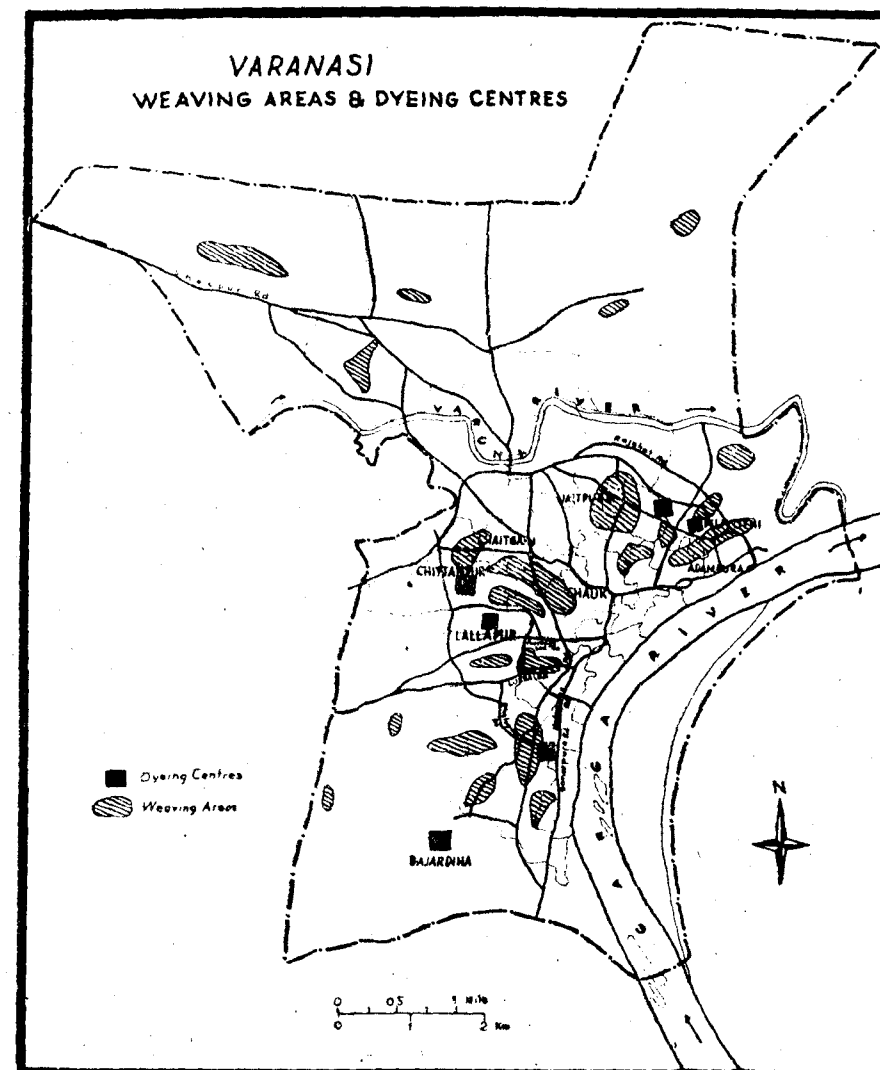


Fig. 1.

looms in the industry the smallest size group would have less than 5,000 looms or about 22% of the looms. The last two groups are, however, found to have considerable larger proportion of looms relative to their share of establishments.

Out of over 22,000 looms in the industry, about 95% are active looms. The remaining 5% being idle. The idle looms being slightly larger proportion (5-6%) in the smaller than in the larger size groups (3-4%).

Labour:

The industry provide direct employment to about 48,000 people, roughly half of which constitute

family labour (Fig No. 2.) This gives average 2.2 persons employed per loom and 9.7 employed persons per establishment for the industry.

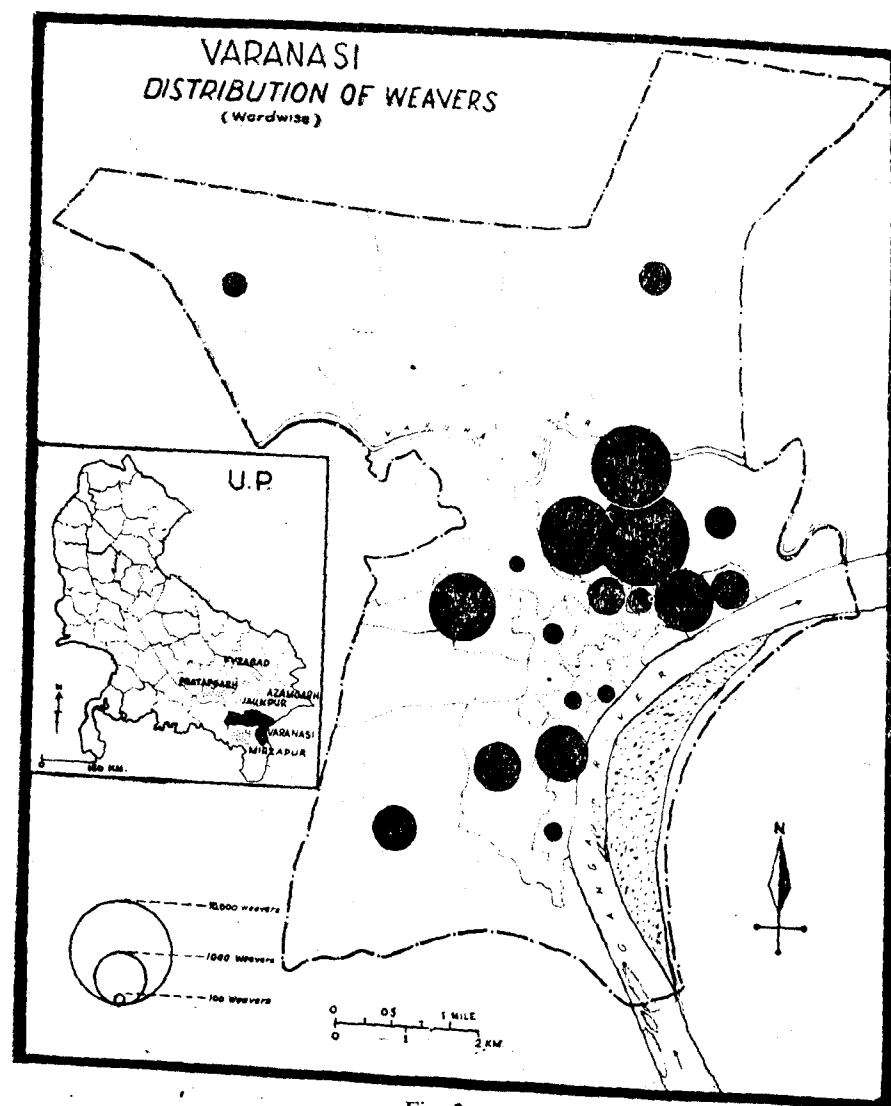


Fig. 2.

	Family labour	Hired labour	Total labour force
Total	24,080 (50)	24,110 (50)	48,190 (100)
Male	10,630 (22.1)	11,220 (23.3)	21,850 (45.4)
Female	9,410 (19.3)		9,410 (19.5)
Children	4,040 (8.4)	12,896 (26.7)	16,930 (35.1)

(Figures within brackets denote %)

The number of full-time workers being about 39,000 or 1.7 persons per loom. More than half these persons (58%) would be found employed in the two smallest size-groups of the establishments as compared to less than 18% only in the two largest groups. The middle group of 7-9 looms accounting for about 24% of the total employment.

Monthly Wages:

It will be observed that the monthly wages bill of the hired workers for the industry as a whole would amount to Rs. 12.6 lakhs, of which slightly over Rs. 10.25 lakhs would go to 11,200 male workers and the remaining Rs. 2.34 lakhs to about 12,000 children. The average monthly wages rate for male workers for industry as a whole is estimated to be Rs. 91 ranging between Rs. 74 and Rs. 109 for the smallest and largest size-groups respectively. For children it would be around 10% per month.

By far the most important raw materials used in this industry are pure silk and zari (silver and gold thread). In addition to this, cotton yarn, artificial silk, imitation zari, nylon threads and other yarns are also used but their consumption is relatively quite insignificant both in

terms of value and volume. Silk and zari are basic raw materials, accounting for as much as 80.96% of the total value of raw materials consumed.

Silk and zari are, however, classified into two separate groups according to differences in their qualities. Imported and Indian silk yarn are taken separately in order to show the degree of dependence of the industry on imported raw materials. The classification of zari into washable and ordinary (non-washable)

has, on the other hand, been done in order to ascertain the standard of quality of goods manufactured.

It is significant to note that the imported silk yarn plays a role of greater importance in this industry than the silk produced in the country. The percentage of the imported silk used in the industry is 34.1 while Indian silk shares 20.9 percent only. The data relating to two types of zari are equally significant. Washable zari shares only 17.2 percent against this ordinary zari, is more important (23.2%). This is obviously due to the fact that ordinary zari is relatively cheaper and also due to the fact that this includes 'silver' zari also which does not require gold polish at all and now the demand for silver zari is more than before.

These two important raw materials of the industry—silk and zari share more than 50 percent (52 to 57%) of the total value of raw material consumed, whereas zari makes as much as 38-44 percent of the total.

Banaras brocades fall in the category of useful art. In other words, this is an industry which is solidly based on its artistic creation. This is one of the features which makes it so popular within the country and outside. Naturally the designs have been perfected by centuries of experience and in accordance with the changing taste of the patrons. Mainly speaking the present time design can be analysed in the following categories:—

- the traditional forms, derived from the 19th century,
- the regional forms which are specially meant to cater clients from distant parts of the country like

Rajasthan, western India or south India.

- (c) the so called modern designs, which are derived from other handloom or machine-loom textiles.

- (d) the export design which are copies of paisley designs or such other embellish-

ments which meet the demands of the western market.

Now we come to the national and international sale. The percentage of the sale shared by the States is estimated as follows: Bombay 40%, Delhi and Punjab 30%, South 20%, Calcutta 5%, Bihar 2%, Orissa 2%. (Fig. No. 3.)

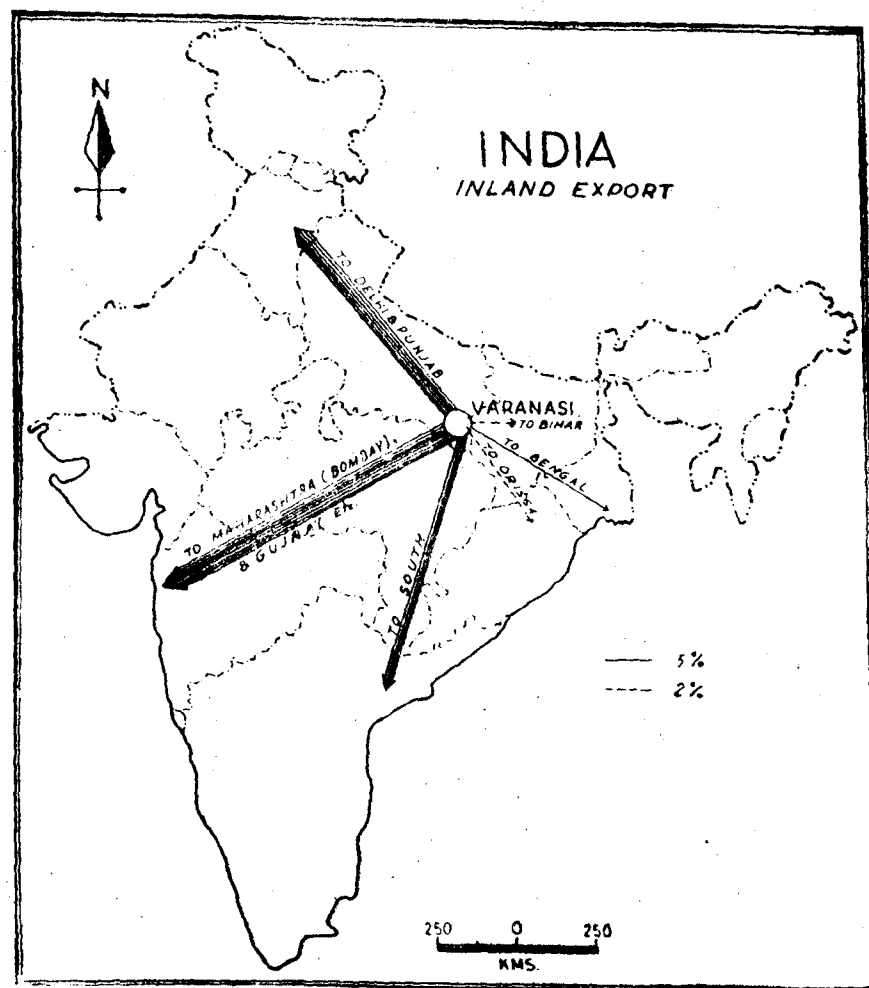


Fig. 3

In the case of export the goods are generally sent by ships but the exporters now have started sending their goods by air also. The main market of banarasi goods outside India is the U.S.A. with England and Europe coming in next. These countries account for nearly 65% of the total export, the balance is divided between East Africa, S. E. Asia and Japan and Hongkong.

The main items of export are dress materials, sarrees, scarves, stoles and ties with oriental designs. In these countries people prefer to have rough textured clothes as compared to the fine textured which is more in demand in India.

Need of giving encouragements to the silk industry of Varanasi is not only on the ground that it absorbs a significant section of the community which would otherwise remain unemployed, but also it produces a specialised and distinct type of handloom products, having wide and internal markets. The industry is good source of earning foreign and has an even greater potential exports of Banaras Brocades may be increased considerably from the present 150 lacs of rupees, if the industry is properly organised in order to produce standardised and quality products for fashion markets. Fullar utilisation of capacity can be ensured if it is given the adequate working capital, sales of product of this industry are increased. Since the products of the industry have both utility and fashion value and cater to a wide national and international market, their demand may be considerable increased, if standardised goods are produced with existing as well as other raw materials like wild silk of 'Muga' or tussure type, mercerised cotton, plastic zari, nylon and other man-made fibres, etc., which are now in greater demand in fashion markets.

Although the industry has received a setback due to a fall in demand for luxury goods, consequent upon the Chinese and more recently Pakistani aggressions, yet it can be hoped that apart from abnormal situations demands for the products of this industry will increase in due course as a result of the raising income of the people following planned economic development of the country. Moreover, the industry also caters, to a large extent, to the requirements of cloth for occasions like marriage. The demand for its products may, therefore, be expected to rise in due course with the growth in population and rise in the standard of living.

Above all, the handloom products of this industry are much in demand in foreign countries, particularly in the U. S. A. In the context of the present foreign exchange crisis confronting the country, the desirability of greater efforts for the export of handloom products need not be over emphasized, particularly when sufficient export potentiality exists in this industry. Given the needed production incentives and with necessary export drive, export of 'Banarasi goods' may further expand considerably. Greater care should, however, be taken to ensure that silks are not cheapened to the point of flooding the market, provisions for short-lived 'promotions' and then receding to the point of no demand. Constant awareness of quality control, manner of distribution and ultimate market in terms of a strong long range growth is what is called for. This means a wise and well organised marketing approach once quality and technical adjustments are made. Continuous experimentation with colour effects and design combinations, even new textures after new yarns are perfected, should, if

discriminately handled, result in accelerated sales not only in the foreign markets but also in home markets.

Keeping in view the above facts, it is strongly felt that there is considerable scope for accelerating the demand for the products of this industry, through an intensive and purposeful programme of standardisation and designing to suit a varying nature of demand on the line suggested above. Since the weaver with his inadequate resources and traditional outlook is not able to take up this responsibility, it can only be brought about by co-operative action indi-

cated. This will ultimately result in fuller utilisation of capacity as well as more wages and income to both hired and family labour. But what would be the magnitude of additional output as a result of increased loom-hours (or capacity utilisation) and how much additional capital would be required to obtain the desired output are the two important questions to be answered before formulating any developmental or organisational programme for the industry. For, without a correct appraisal of the problem and without sufficient capital resources, any half-hearted attempt is destined to end in failure.

Distribution of The Sikhs Outside The Punjab* (India)

By

Dr. Gopal Krishnan*

Among the various population groups in India, the Sikhs are one of the more mobile. The 1961 census revealed that out of 7.85 million Sikhs in India, 1.67 million i.e. 21.3 per cent of the total, were living outside the Punjab, which is virtually their home state. Hardly any district in India is without Sikh population. Besides, an estimated number of about 0.2 million Sikhs have acquired foreign citizenship, notably in the United Kingdom, East African and Southeast Asian countries, and Canada.¹

The Sikhs: 1881-1961

The first regular census of 1881 recorded a Sikh population of 1.85 million in India. About 93 per cent of them were living in the then Punjab and its feudatory states. They had their main concentration in the tract between the Ravi and the Ghaggar rivers—'the area where Sikhism was born and where it grew'.² The remaining Sikh population was distributed largely in the adjoining states of Sind, Jammu & Kashmir, and North West Frontier Province.

The number of Sikhs in India increased from 1.85 million in 1881 to 3.24 million in 1921, a rise of 75 per cent. The growth rate of India's population during the same period was about 22 per cent. The strikingly fast increase of the Sikh population was due to considerable voluntary conversion, especially of low castes engaged in providing services and producing goods required by local peasantry.³ There was some conversion from among the caste Hindus also. Since almost the entire conversion took place in areas of Sikh concentration, no less than 96 per cent of the Sikhs in 1921 were still confined to the limits of the then Punjab and its feudatory states. They, however, experienced considerable redistribution within the Punjab during 1881-1921. The opening of Lower Chenab Colony in 1892, of Lower Jhelum Colony in 1902 and of Lower Bari Doab Colony in 1917—all these now in West Pakistan—furnished new avenues of settlement for hard-pressed-for-land cultivators in the then central Punjab.⁴ It induced out-migration, among others, of thousands of Sikhs from the con-

* The Punjab refers to as it was reorganized on November, 1, 1966. Wherever the Punjab occurs in italics, it stands for its jurisdiction before partition on August 15, 1947. Likewise, India in italics is the country before its partition.

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1. Data calculated from the information given in the *Illustrated Weekly of India*, November 23, 1969, p. 36.

2. Gurdev Singh, Gosal and A. B. Mukerji, "The Religious Composition of India: Population—A Spatial Analysis", *Tijdschrift Voor Econ. En. Soc. Geografie*, 61 (1970), p. 97.

3. The proselytisation activities of the Singh Sabha and other Sikh organizations played a vital role in this conversion. The Sikh denial of caste and their willingness to accept converts was a great inducement for low caste Hindus to change their religion to Sikhism in order to gain social status. The conversion of some of the high caste Hindus is explained, among other factors, by attraction of the patronage given to the Sikhs by the British Government in army service.

4. See Malcolm Darling, *The Punjab Peasant in Prosperity and Debt*, Oxford University Press, London, 1947, pp. 111-113.

gested districts of Ludhiana, Jullundur, Hoshiarpur and Amritsar to these Colonies. As a consequence, number of the Sikhs in the tract between the Ravi and Jhelum rivers increased significantly. It also gave rise to a prosperous Sikh peasantry conditioned to commercial farming on relatively large irrigated land-holdings. These peasants and their progeny, when migrated to India after partition in 1947, played an important role in revolutionizing agriculture of the present Punjab as also of parts of Haryana, Rajasthan and Uttar Pradesh.

The Sikh population in India recorded again a fast growth by about 75 per cent during 1921-41 when population of India as a whole increased by 27 per cent only. Apart from the factor of a continuous rise in the rate of natural increase due to falling mortality, continued conversion to Sikhism explains this phenomenon. A salient feature of this period was a decline in the Sikh migration with the Punjab (following gradual filling-up of the Canal Colonies) in contrast to an increasing tendency among them to migrate outside the state. Their migration to big cities, such as Calcutta, Jamshedpur, Delhi and Bombay deserves special mention. This development was, in fact, associated with initiation of a process of increasing industrialization,

urbanization, transportation and internal migration in India in general after 1921. There was also some agricultural migration of the Sikhs to the Gang Canal Colony which was opened in 1927 in Ganganagar district of Rajasthan. Besides, migration of the Sikhs associated with their recruitment in army, especially on the eve of Second World War as also at the time of First World War, stands as a class in itself.⁵ No wonder, the proportion of the Sikhs living in the Punjab and its feudatory states in the total number of the Sikhs in India declined somewhat from 96 per cent in 1921 to 90 per cent in 1941.

In contrast to its accelerating rate of growth during 1881-1941, the Sikh population increased by only 9.3 per cent during 1941-51 owing mainly to high incidence of mortality brought about the communal riots at the time of partition in 1947. The partition of the Indian subcontinent was indeed a landmark in the history of redistribution of Sikh population. About 2.5 million Sikhs (nearly 40 per cent of the total in undivided India) poured out of Pakistan into India.⁶ Most of them settled down in the Indian Punjab as a result of which they gained an absolute majority in the area now constituting the Punjab state—a development of great signifi-

⁵ The Sikhs possess a strong military tradition, and were recruited heavily by the Britishers in Imperial Army (See Kingsley Davis, *The Population of India and Pakistan*, Princeton University Press, Princeton, 1951, p. 181). In 1944, when the Indian army numbered over two million, 10 per cent of the Indians recruited were Sikhs i.e. nearly seven times their proportion in the total population (See Raleigh Parkin, *India Today*, John Day, New York, 1945, pp. 89-90). This tradition in army service brought the Sikhs to various kinds of areas, exposed them to external influences, and acquainted them with opportunities outside their native areas—all important in stimulating out-migration among them.

⁶ Khushwant Singh, *The Sikhs*, George Allen & Unwin Ltd., London, 1953, p. 120.

cance in the political geography of India. However, a sizable number of agriculturist Sikhs was rehabilitated in other parts of India, mainly Karnal and Hissar districts of Haryana, the Terai (foot-hill) and western districts of Uttar Pradesh, and Ganganagar, Alwar and Bharatpur districts of Rajasthan. The availability of cultivated land vacated by the Muslims on their departure for Pakistan, and reclamation of additional agricultural area through clearing of vegetation and provision of irrigation, facilitated this process of rehabilitation. A number of non-agriculturist Sikh refugees moved to big cities such as Delhi, Kanpur, Bombay and Calcutta. Thus, partition had a three-fold effect upon distribution of the Sikhs: (i) they were completely evacuated from the newly born West Pakistan; (ii) their concentration in the present Punjab (as reorganised in 1966) increased significantly making it a Sikh majority state; and (iii) they scattered considerably to other parts of India for both agricultural and non-agricultural purposes. In 1951, almost 85 per cent of the Sikhs were living within the limits of the present Punjab.

The Sikh population increased by nearly 25 per cent during 1951-61. This growth rate corresponded with the rate of their natural increase as conversion to Sikhism practically ceased after Independence. However, while the Sikhs in the present Punjab increased by only 17 per cent, their increase in other parts of India was approximately 80 per cent. It points to continued out-migration of the Sikhs from the Punjab. This out-migration was largely from the rural parts of the Upper Bari and the Bist Doabs due,

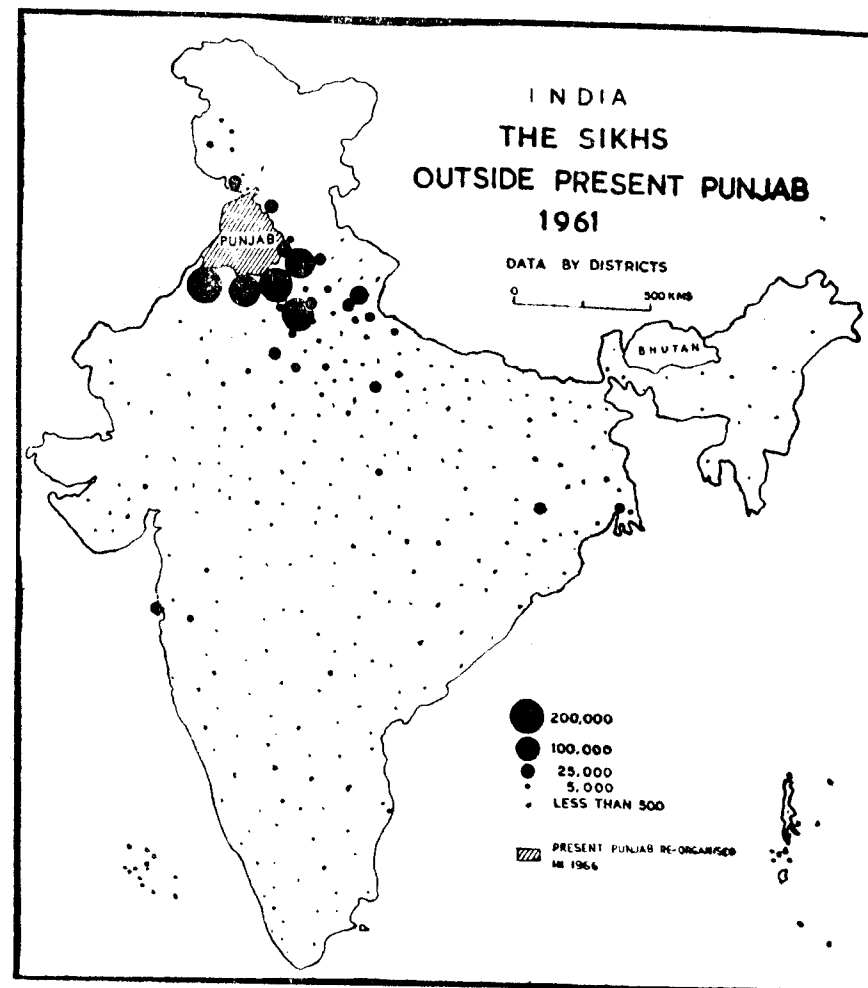
among other factors, to relatively small and declining size of land-holdings, aggravating menace of water-logging, and high rates of natural growth, all intensifying population pressure on land resources.⁷ The characteristic desire of the Sikhs to move to areas of better economic opportunities has been another factor in this mobility.⁸ Besides, the scarcity of land in the present Punjab for allocation to displaced persons from West Pakistan impelled the government to settle many of them, including the Sikhs, the parts of Haryana, Rajasthan and Uttar Pradesh. As a consequence, about one-third of natural increase of the Sikhs in the present Punjab was wiped out through out migration and their percentage to total population in the state decreased from 57.3 in 1951 to 55.5 in 1961.

The Sikhs Outside Punjab: 1961

The 1961 census data show that out of 1,667,173 Sikhs in India outside the Punjab, 31.2 per cent were in Haryana, 17.0 per cent in Uttar Pradesh, 16.5 per cent in Rajasthan, 3.8 per cent in Jammu & Kashmir and 2.7 per cent in Himachal Pradesh. The Union territories of Delhi and Chandigarh accounted for 12.2 and 1.7 per cent of these persons, respectively. Thus, 85.1 per cent of the Sikhs outside the Punjab were distributed among its neighbouring states and Union territories. As regards distant states, Madhya Pradesh, Maharashtra, Bihar and West Bengal had 3.9, 3.5, 2.7 and 2.1 per cent of them, respectively. The remaining parts of India, especially the Southern states, had only a light sprinkling of these persons.

⁷ Gurdev Singh Gosal, "Changes in the Religious Composition of Punjab's Population, 1951-61", *The Economic Weekly*, 23rd, January, 1965, 119-124.

⁸ Gurdev Singh Gosal and A. B. Mukerji, *op. cit.*, p. 98.



The Sikh population in Haryana, Uttar Pradesh and Rajasthan is largely rural and agricultural. As already noted, reclamation of new agricultural area, and availability of the Muslim vacated arable land in parts of these states stimulated considerable Sikh in-migration after partition. Some Sikhs migrated to Madhya Pradesh, especially to its

eastern part which has been a scene of new developmental activities since Independence. The Sikhs in Jammu & Kashmir include partly the descendants of those living in this area since the days of the Sikh rule (1819-1845), and partly the persons who migrated from West Pakistan after partition.

The urban component of the Sikh population outside Punjab is about 44 per cent of the total.⁹ The largest urban concentration of the Sikhs anywhere in India is to be found in Delhi where they number about 0.2 million and make 8.6 per cent of total population. Most of them hail from West Pakistan, and are engaged in diverse activities, particularly trade, industry and transport. During 1947-61, the Sikh population in Delhi multiplied nearly ten times. Likewise, most of the big towns in Western Uttar Pradesh and Eastern Haryana, which also received a large number of displaced persons, recorded considerable Sikh population at the 1961 census. Moreover, certain big cities, such as Bombay, Kanpur, Jamshedpur, Calcutta, Lucknow, Poona, Jabalpur and Indore (mentioned in descending order of their Sikh population) had five thousand to twenty-five thousand Sikhs each. The numerical strength of the Sikhs in large industrial and cantonment cities is especially noteworthy.

It follows that an overwhelming majority of the Sikhs outside the Punjab is distributed in its neighbouring areas. Within these areas, they are concentrated mainly in newly developed agricultural lands as also in some big urban centres. The Sikh population in the remaining parts of India is confined largely to big industrial and cantonment cities. The sparseness of the Sikhs in the Southern states of India is conspicuous.

The Sikh Emigration

The enterprising Sikhs migrated not only to various parts of India

but also to certain foreign countries. Impelled by economic conditions at home and lured by rich opportunities abroad, a small number of them began emigrating during the closing years of the nineteenth century. Starting settling in Burma, Malaya States and Hong Kong, the Sikhs went as far as Canada in 1904. Another wave was directed towards Australia and Fiji Islands. Similarly some of them moved to East African countries and the United Kingdom. Most of these emigrants belonged to agricultural and artisan families, and hailed from the densely populated districts of Jullundur, Hoshiarpur, Ludhiana and Amritsar. They initially got employed as guides (soldiers on guard duties) in the former Malaya states, businessmen in Hong Kong, lumberers in Canada, farmhands in the United States, railroad construction workers in East Africa, and factory labourers in the United Kingdom. By and large, the Sikhs, like other Indians, were dissuaded from emigrating to white countries and were induced to move to non-white Commonwealth countries.

At present, the largest number (about 100,000) of the Sikhs outside India is in the United Kingdom. This was the only country to allow Indians to enter freely for a livelihood till Commonwealth Immigration Act came into effect in 1962.¹⁰ Most of the Sikhs in this country live and work in industrial towns, and are concentrated in East End and other parts of London, Southall, Birmingham conurbation, Broadford, Leamington Spa and Glasgow.¹¹

⁹ By comparison only 11.4 per cent of the Sikh population in the Punjab is urban. It is notable that the number of urban Sikhs in the Punjab (706-600) is less than that in other parts of India (734, 770).

¹⁰ Rashmi Desai, *Indian Immigrants in Britain*, Oxford University Press, London 1963, p. 2.

¹¹ G. S. Aurora, *The New Frontiersmen*, Popular Prakashan, Bombay, 1967, p. 46.

Next to the United Kingdom, the East African countries, which were former colonies of the Britishers, have a large number of Sikhs (about 30,000), who are primarily the descendants of contractors and labourers brought to build Kenya-Uganda Railway at the close of the nineteenth century.¹² They are, at present, confined mainly to big cities, such as Nairobi, Mombasa, Dar-es-salam, etc. and are engaged in a variety of professions, including trade, construction, industry, teaching and general services.

Among the Southeast Asian countries, Singapore has about 20,000 Sikhs, Malaysia about 10,000 and Burma about 5,000. This was the region to experience first emigration of the Sikhs. Burma became a part of the British India in 1886—a factor which facilitated migration of Indians, including the Sikhs, to this area. Now the Sikhs in Rangoon and Mandalay account for most of them in this country. The Sikh emigration to Singapore and Malaysia started almost at the same time. They came initially as soldiers on guard duties but later on they were recruited mostly in police service. Besides, a good number of them got employed as watchmen in banks, factories and offices while some others joined trade. The descendants of these Sikhs are, however, to be found in all walks of life as teachers, lawyers, doctors, etc. Most of them live in big cities, such as Singapore, Kuala Lumpur, Ipoh and Penang. Some Sikhs residing in rural areas peripheral to urban places are dairy farmers.

Using Burma, Malaya and Hong Kong (which has about 3,000 Sikhs citizens, chiefly in business) as spring board, some Sikhs emigrated to

Canada and the United States. The former has about 7,000 Sikhs, notably in lumbering activity in British Columbia, and the latter has nearly 5,000 Sikhs, many of whom work as farmhands in California. In Iran, about 2,000 Sikhs are settled in Tehran, Zaidan, Isfahan etc., and business is their main vocation.

Thus, the United Kingdom and its former colonies attracted most of the Sikh emigrants. Prior to Independence of India, this emigration was largely to East Africa and Southeast Asia but later it was directed mainly towards the United Kingdom and Canada. However, after the implementation of Immigration Act by the British government and imposition of restrictions on immigration by the Canadian government, emigration to these countries has become difficult.

The preceding discussion is a testimony to a great mobility among the Sikhs. The main factors responsible for their migratory tendency have been a long tradition in army service, a strong propensity to colonize newly-developed agricultural lands, and a keen desire to avail themselves of better economic opportunities in other areas. In recognition of their repute as brave soldiers and enterprising farmers, the Britishers in India gave them a preference in recruitment to Imperial army and in colonization of new areas. Basic to the entire process of migration has been the intensifying pressure of fast increasing population on cultivable land, especially in the context of predominantly agricultural economy of the Sikhs. This apart, their complete

evacuation, as also of other non-Muslims, from West Pakistan at the time of partition set them on a move for rehabilitating themselves in various parts of India which enhanced their mobility.

To summarize:

- i) The number of the Sikhs more than quadrupled during 1881-1961. Nearly one-third of this rapid increase is attributed to the process of voluntary conversion (which virtually stopped after partition) to Sikhism, and the remaining two-thirds to the factor of natural growth.
- ii) At the time of first regular census in 1881, the Sikhs were concentrated mainly between the rivers Ravi and Ghaggar, the tract which is practically the present Punjab with the notable exclusion of Lahore district now in West Pakistan.
- iii) The opening of Canal colonies between the rivers Ravi and Jhelum during 1892-1917 stimulated considerable movement of the Sikhs from the congested districts of the then central Punjab to these newly developed areas (all of which fell to the share of West Pakistan at the time of partition). It resulted in considerable redistribution of the Sikhs within Punjab.
- iv) As the Colonies got filled up gradually, the Sikhs started migrating outside Punjab, notably to big industrial cities

of India. None the less even by 1941, almost 90 per cent of the Sikhs remained confined to the Punjab and its feudatory states as compared with 93 per cent in 1881 and 96 per cent in 1921.

- v) Consequent upon partition of India in 1947, the distributional pattern of the Sikhs underwent a phenomenal change. They were evicted en masse from West Pakistan; they gained an absolute majority in the area constituting the present Punjab; and they experienced a wider dispersal in other parts of India. In 1951, about 85 per cent of them in India were living within the limits of the present Punjab.
- vi) Impelled by economic considerations, the Sikhs continued outmigrating even afterwards. The 1961 census recorded that 21.3 per cent of them were living outside their home state of present Punjab. However, no less than 85 per cent of such persons were distributed in the neighbouring areas of the state.
- vii) Lastly, the Sikh emigration, which started during the late nineteenth century, has kept involving a good number still now. The United Kingdom, the East African and Southeast Asian countries, and Canada have been the principal recipient of these emigrants.

ACKNOWLEDGEMENT

The author is highly grateful to Dr. Gurdev Singh Gosal, Professor and Head of the Department of Geography, Punjab University, Chandigarh, for his critical suggestions in preparation of this paper.

¹² See Haraprasad Chattopadhyaya, *Indian in Africa. A Socio-economic Study* Bookland Pvt. Btd., Calcutta. 1970, pp. 335-341.

THE INFLUENCE OF THE ARCHITECTURE OF RURAL HOUSES IN MAHARASHTRA

By

SUDERSHAN MUKERJEE*

With the introduction of shelter it became the prime agony of man to make it more comfortable from bioclimatic point of view. To combat the natural calamities the shelter was introduced, but to make it more comfortable climatic elements like temperature, rainfall, wind, humidity etc. are to be tamed and automatically the architecture of the shelters were moulded accordingly to fight routine forces. In Tundra, Eskimos construct Igloos a dome shaped shelter of ice with a small entrance so as to protect against cold blizzards and to maintain the inside temperature, while

conical roof of equatorial region is made to drain out the heavy rains quickly. But these are not the isolated examples. In case of study of a region like Maharashtra the result comes to be the same. This region though has its situation in the tropical belt of the world climate yet due its position and orographic features has the most diversified type of climatic phenomena. The coastal belt to the west of Sahyandri has a maritime tropical humid type, Vidarbha the eastern division, under the influence of Bay monsoon has tropical sub-humid type while Marathwada the

central division of the state in Deccan plateau has a dry steppe type climate respectively. Such diversified distribution of climatic types in this state has distinctly brought out the influence of climate on the architecture of rural houses.

The wall and roof the two major components of a house if not totally atleast to a major extent are determined by climatic factors like temperature, humidity, amount, intensity and type of rainfall etc. and Maharashtra with its varied climatic regions from humid to dry steppe type is no exception to the rule. Here either mud or stone is used as predominant wall materials though leaves, grass, reed or bamboo, unburnt bricks and burnt bricks have no less a significant place in certain pockets.

While looking into the distribution of various wall materials it appears that in Maharashtra mud is extensively used while constructing even stone walls yet the exclusive use of mud has been made the criteria for demarcation of mud wall zone. Anyway the mud wall has its predominance in Tapi and Godavari basins, south Konkan and nearly whole of Vidarbha division, while the region of stone wall dwellings is in a compact area covering the entire Krishna and South Godavari basins, better known as Manjira basin. As regard grass, leaves, reeds or bamboos the third predominant wall material of the region, its dominance in north Konkan covering districts of Thana and Kolaba and in certain pockets like north west portions of Nasik, Dhulia and Amraoti districts and east and south east portions of Chanda and Yeotmal districts respectively. Though the bricks, in sundried or burnt form have a very limited use in the villages of Maharashtra, yet there are numerous ways of their making here, of which the most refined way is of making

bricks of measured size by using wooden frames. These blocks are than either sun dried and designated as unburnt or backed in the fire and called burnt bricks. Though unburnt bricks as wall material has its concentration in the coastal tahsils of central Konkan still a few tiny pockets in the rainshadow area of north Sahyandri are not neglectable. The burnt brick which is in still more scattered from is significant in the northeastern part of Jalgaon district and central part of Dhulia district.

This distribution of wall materials in villages of Maharashtra are not arbitrary but have a distinct influence of climatic elements like mean annual range in relative humidity, daily mean minimum temperature of the hottest month etc.

An examination of the mean annual range in relative humidity brings to notice that to the west of Sahyandri in the Konkan plain where it is of below 10 percent mud and along the central part of the coast where it is not even of 5 percent unburnt bricks are used as wall materials. Similarly the area to the east of north Sahyandri and south of Godavari basin with the relative humidity range of above 20 percent, and the major part of Godavari, Purna and Tapi basins with a range of less than 20 percent have stone and mud as wall materials respectively. There are some worth mentioning isolated pockets too in Akola and Jalgaon districts where the range is of more than 20 percent and burnt brick is the wall material.

This congruity of the climatic element to that of wall materials of rural Maharashtra can be explained as primarily for physical comfort of the inmates and secondarily for durability of the walls.

In the arid and semi arid regions conservation of the humidity is very essential to minimize oppressiveness

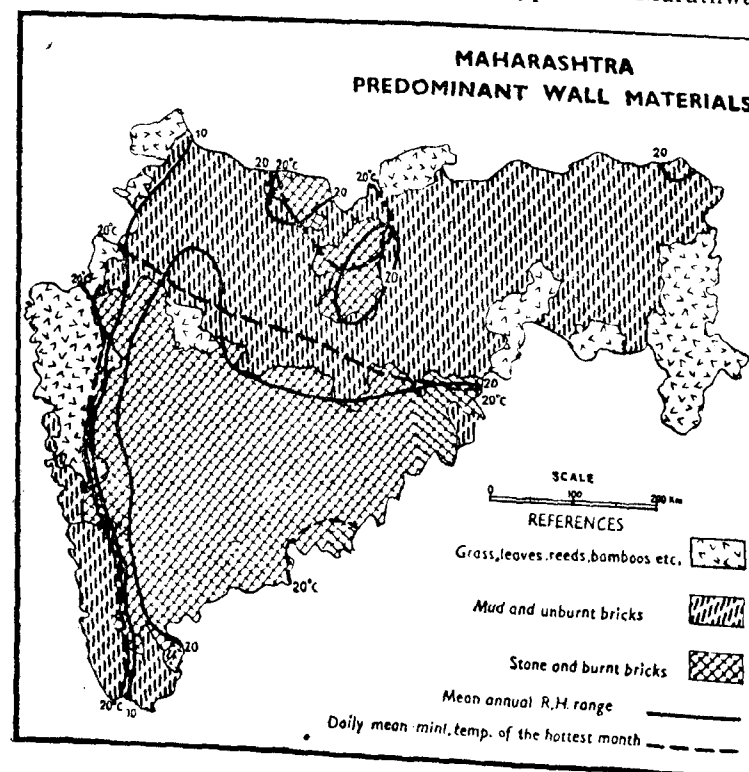


Fig 1.

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of temperature and stone can do this better than any other wall materials due its minimum humidity absorbing capacity. Thus in the semi arid Krishna and south Godavari basins where the mean annual range in relative humidity is of more than 20 percent, stone or burnt bricks are preferred as wall materials while in Konkan plain, Tapi and north Godavari basins and vidarbha division where the mean monthly humidity is higher than the stone wall region and annual range in relative humidity is also of below 20 percent, mud is preferred for walls to minimize the humidity of the air so as to make it more comfortable.

Then again along the west coast the central part of the Konkan with mean monthly relative humidity of 70 percent, temperature range of below 4°C and annual range in relative humidity of below 5 percent is not hot and dry enough to dehydrate a big lump of mud, whereas bricks which are made in small pieces are some what easy to dry up in the sun and also have a greater capacity of humidity absorption than any other wall materials due to fine granular texture, are thus preferred in this highly humid patch of Maharashtra to make air some what dry

Apart from humidity relative range, the daily mean minimum temperature of the hottest month is also one of the factors in determining the physical comfort of human being. It is a known fact that temperature of comfort in the tropical region is between 20° to 22°C . Thus the area that has daily mean minimum temperature between 20 to 22°C during the hottest period of the year is somewhat comfortable during night time i.e. rest hours of the day, but where temperature exceeds this limit its lowering becomes a must. An obser-

vation of daily mean minimum temperature of the hottest month shows that 20°C of isotherm nearly coincides with stone wall regions limit and from there mud wall starts. The mud which has a greater capacity of heat radiation is thus used as wall material in the region where the daily mean minimum temperature exceeds 20°C so as to minimize the heat of the air.

Thus apart from all other factors, the wall materials of rural dwellings of Maharashtra are determined to a greater extent by mean annual humidity range and daily mean minimum temperature of the hottest month. The 20 per cent range of annual relative humidity and 20°C daily mean minimum temperature of the hottest month function as a demarcation line between mud walls and stone or burnt brick walls, while range of 5 per cent relative humidity works as a boundary between unburnt brick pockets and the adjacent regions.

While temperature and humidity determines the architecture of walls it is rainfall that has a primary role in designing the roof of rural houses. In a true sense, roof is an overhead protection against the rain and sun yet rain gets priority due to its more harmful role. Anyway among the roof materials used in the state the tiles predominate with nearly 39 per cent of the total rural houses having tiles as a roof cover. In majority of the cases the tiles are locally made though now a days Mangalore tiles are being used more and more. The tiles have their concentration all along the Sahyandri and its ranges, in the Wardha, Penganga, Wainganga basins of Nagpur plain and in part of east Godavari basin. The flat roof called 'Malwad', 'Dhiba' or 'Dhaba' the second important roof type made of wooden beams and rafters covered with 40 to 75 cm. thick layers of mud and resting on

the second floor roofs in rural areas walls or vertical wooden posts standing on stone basements, cover nearly 20 per cent of the rural houses of Maharashtra. These roof are commonly found in the plains of Godavari, Krishna and Tapi-basins more so in areas of rain-shadow of the Sahyandri. The corrugated iron sheet covering about 18 per cent of rural house tops is the third important roof materials in the villages of Maharashtra. They are generally used to make a somewhat flat roof in regions of low rainfall and moderate summer temperature. The roof here is usually of medium height and corrugated iron sheets rest on transverse wooden angle or iron rafters and are often fixed under

the top cornice wall. Majority of of Poona and Aurangabad divisions are of corrugated iron sheets. The extent of this roof type is from Osmanabad and Nanded districts of Marathwada division in the south upto Melghat plateau on the north of west Vidarbha, covering a compact area of middle east Godavari, Purna and Tapi basins. The fourth in order of preference as roof material is the grass, leaves, thatch etc. which cover nearly 12 percent of the rural houses. The area of its concentration is the western foot hills of Sahyandri and the eastern half of Chanda district. A pocket around Chandore hills in Nasik forms a fifth region of roof materials where stone slabs with other materials are preferred.

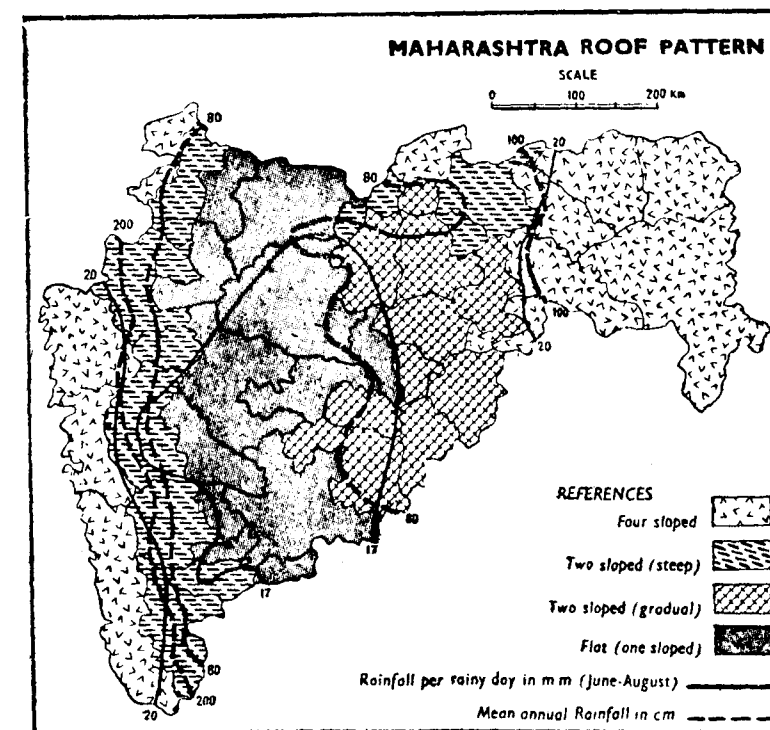


Fig. 2

These roof materials and their design of construction are not free from the influence of rainfall regime

of the state. The west coast of Maharashtra and Sahyandri coming under the onslaught of S. W. mon-

soon and the eastern Maharashtra under the influence of Bay of Bengal cyclonic thrust are getting copious rains, while the central region excluded from the influence of both these monsoons has scanty rains. Due to this in Konkan, Sahyandri and eastern districts of Nagpur plain for quick draining of rains, whatever be the materials, sloped roof with an angle of 90 degrees in the gables of the roof is dominant while in the Godavari Tapti basins of the central plateau where the rain is moderate to scanty flat or gradual sloped roofs are preferred as draining of water is not a problem. This relation of designs in roof slopes to rainfall can be more clear from mean annual isohyet map of the region. The 1000 mm annual rainfall is the limit below which roof is more or less flat while 800 mm annual rainfall is the maximum limit for an absolutely flat mud cum wooden rafter roof of Ahmednagar, Auranadabad, Bir, Sholapur and Poona districts of central plateau. The region coming in between these two extremes and covering the districts of Osmanabad, Buldhana, Akola and eastern Parbhani and western Yeotmal districts have a roof corrugated iron sheet with a gradual slope.

This influence of rains on slope design is still more conspicuous when a detail study is made of difference in number of slopes of the roof. While the amount of rain determines the dip of the slope its intensity dictates the number of slopes to it. In regions of sloped roof two sloped and four sloped roofs are more prevalent with a definite influence of rainfall intensities. The districts of Konkan and western Vidarbha though have not the identical roof materials yet in respect of number of slope to the roof they are same. Similarly the districts around the central dry

basins of Godavari, Purna, though have not the identical roof materials at all places yet have the same number of slopes to the roof. Thus in three districts of Konkan and four districts of eastern Vidarbha where intensity of rainfall is more than 20 mm of rains per rainy day during the rainy period (June to August) of the years the roofs are four sloped while the districts around flat roofed central river basins having an intensity of rains between 17 to 20 mm of rainfall per rainy day during the same period, have two sloped roofs.

Further the variation noticed in the materials of the sloped ones are in no way less influenced by rainfall intensity and its force. The western flank of Sahyandri, the eastern of Chanda and central part of Dhulia districts due to strong relief have orographic rain where rain drops come down with a great force due to somewhat vertical path they follow. To have a control over this tremendous force, without getting roof damaged, materials like grass, leaves etc. which have a sponge like character are used in these domains of orographic rains.

In the semiarid central plateau of the state, though flat roof has less importance in relation to draining off the rains yet its role in reducing the heat absorption is not neglectable. Its massive structure facilitates in forming a greater dimensioned shadow than that of the sloped ones and this reduces the impact of the solar radiation. Further to the east of flat roof domain where daily mean maximum temperature of the hottest month is between 38 to 42°C with relative humidity less than 30 per cent during this period, have preferred corrugated iron sheets as roof materials because of its high conductivity, that allows quick bringing down of the temperature with the sun set,

of abodes. It is not out of the way to mention here that the layout of houses in villages too have a climatic influence. In hot dry zone characterised by excessive heat and glaring sun the shelters are to be designed so as to reduce heat impacts and provide shade. This can be attained by packing buildings together because by this process the amount of exposed surface is reduced. Similarly the hot humid area which presents two major problems to its inhabitants - the avoidance of excessive solar radiation and the evaporation of moisture by breezes, try to cope with these problems by building the dwellings apart so as to allow free air movement and to mix individual units into the shade of surrounding solar flora for radiation avoidance.

The Konkan being in tropical belt and having maritime humid climate with mean annual temperature in between 26° and 27°C and mean annual relative humidity between 70 to 80 per cent has a settlement layout where the houses are not packed in tightly groups but are either built on streets or scattered throughout the village. Strictly speaking there is no village as such and in many cases there is no more open space between the villages than between the houses within the village, to allow a free circulation of air and to take advantage of shades of natural flora. In case of the central plateau due to dry savana type climate the houses are crowded

together to shun open space for solar radiation and to form large shadows of the massive constructions around the habitated area. Then again in the forested hills of eastern Vidarbha where the annual rainfall is between 1500 to 2000 mm. to minimize the humidity by free circulation of air, settlements generally are not exceeded by half a dozen dwellings in the forest where big plot can be held and a dozen or so staggering hamlets forms a village.

Conclusion: The planners of rural abodes were neither architects nor had the data or knowledge on climate. The present form of rural houses are the representation of trial and error method adopted in the beginning of human civilization. Though based on crude observations of climatic phenomena, the design and materials of rural houses were decided by making biological comfort as a primary factor. A correlation of limited climatic observations with design and material of rural houses of Maharashtra are not sufficient to come to any concrete conclusion, yet it can be said that the architecture of rural houses are if not totally, yet to a major extent are based on climatic factors. Derivation of some more climatic indices and their correlation with architecture of rural houses may help us in formulating certain theories about design and materials of rural houses.

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THE IMPACT OF THE DEVELOPMENT OF ROAD AND RAILWAY TRAFFIC ON THE SAGAR-DAMOH PLATEAU

By
B. G. TAMASKAR*

The Sagar-Damoh Plateau, forming the eastern promontory of the Malea Plateau, lies to the north of the central portion of the Narmada Trough. Its total area is 17,581 Kms.², with the total population of 1,234,890 souls in 1961, covering the Sagar and Damoh districts of Madhya Pradesh.

1. Historical Retrospect :

(a) The Ancient Period :

A study of the Pre-historic past of the region reveals that during this period human settlements were confined to the banks of large streams of the Plateau, namely, the Sonar, the Bewas, the Dhasan (Dāśarṇā), the Bina and their large tributaries and, perhaps, also to the Kopara and trap scarps in their vicinity.¹ Most of the movement of the ancient man in this region, must of necessity, therefore, had been restricted to the large valleys of these rivers of the plateau, and perhaps, with slight contacts with the surrounding regions. It may be surmised that these conditions persisted throughout the Paleolithic, Mesolithic and Neolithic ages of the region.

The history of the region prior to 600 B.C. is shrouded in the mist of obscurity. Its later history in fragments unfolds that the region constituted a 'Shatter Zone' among the neighbouring powerful states. Its space-relations and orientation routes were influenced by dominant

political powers within or in the adjoining regions. In the earliest period of the recorded history of the region, its westward orientation led routes from and to that direction. Vidisa had been connected with Eran on the Veena (Bina) River in the Badar-Bina Doab by a route leading to Kausambi in the N.E. and Ujjain in the West.²

(b) The Gond Episode :

In the following period till the Gond predominance on the Plateau, the historical annals, now, available hardly throw any light on the economic conditions and political state of affairs of the Plateau to record here its trade routes and their orientation.

During the Gond regime on this Plateau, from the 15th Century till its occupation by the Marathas, its routes seem to have been oriented towards the East.³

(c) The Maratha Period

During the Maratha Period, the Kareli-Sagar route via Deori, where Marathas settled down permanently

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1. K. D. Bajpal : Sagar through Ages (Unpublished work) through the courtesy Sri Adarsh, District publicity office, Sagar, S.T.A.

2. Ibid. Chap. II

3. Y. N. Sill, History of Madhya Pradesh and Berar " (Indian Press, Allahabad), 1922. H.M.P.B. P 121-8.

first on the Plateau, seems to have been quite important and frequented, as it served as the link with the seat of government Poona⁴.

(d) *The British Period:*

The British period may be subdivided into two phases: (1) the first upto 1904 and (2) the second upto 1947.

The British occupation of the Plateau in 1818 induced the construction of the frame-work of roads mostly for *transit traffic*, linking it with adjacent regions, which in its turn, gave fillip to growing volume of commercial traffic with slight modification of the pre-existing routes.

The trunk routes of the Pre-British Period comprised the Sagar-Jhansi, Sagar-Kanpur, Sagar-Rahatgarh, Sagar-Damoh-Jabalpur and Damoh-Jukehi, meeting the Jabalpur-Mirzapur road.⁵ The construction of the Sagar-Jhansi road gave access to the northern India by linking the Plateau through Malthon with Lalitapur and Jhansi. This road was re-aligned in about 1880 and, in 1888, it became an excellent road, with bridges over most streams and passable in all seasons. In the earlier period, it did not carry much traffic but it was maintained as an alternative trunk road to the railway. The Kanpur road remained no more than a fair-weather road till 1888.⁷ It was re-aligned in 1890, and upgraded to a first-class road for 40 kms. of its length

and made into a fairly smooth and all-weather road upto the northern border of the Plateau. This road records its increasing importance with the growing volume of traffic through the Sagar-Jaisinagar Highlands, the Dhasan Basin and the Dhamoni-Shahgarh Highlands to Kanpur, with Hiraipur, close to the northern extremity as the gate-way of commerce. The Sagar-Damoh road had been important locally, prior to the construction of the railway. Afterwards, nearly two-thirds of its length had been metalled by the year, 1904 and bridged throughout except on the Sonar and Gadheri rivers, close to Garhakota and the Kopara, close to Basa Tarkhera. At the last named place ferry services were maintained during the rainy season. The road carried little external trade with the adjacent or remote regions but it had been useful along certain lengths and connected Sagar with Garhakota.⁸ With the increasing volume of passenger and goods traffic, the road is, now, provided with low-level submergible bridges on the Sonar, Gadheri and Kopara rivers where detention is likely to occur for a few hours during the period of exceptional floods. The road safety rules make it imperative to negotiate these bridges after bullock-carts can pass from one end to the other.

Immediately on the opening of the Great Indian Peninsula Railway in the Narmada Trough to the South (now, renamed as the Central

Railway) in 1907 the Sagar-Kareli road had been vigorously pushed to its completion.⁹ It had been bridged throughout its whole length except on some eight or ten small streams and the Narmada. Even, now, the traffic on the road is held up for a day or two and the region is cut off from Sagar for a few days. The opening of the afore-mentioned railway only served the S. W. part of the plateau. The proposed bridge on the Narmada will enable a through traffic from the region, South of the Plateau to the Northern India. On the Sagar-Rahatgarh road, a fine bridge has been constructed over the Bina river at Rahatgarh, another small one on the Dhasan river at Sihora, and culverts at all required points between Rahatgarh and Sagar.

The year, 1907 makes a distinct landmark in the annals of the road-construction on the Plateau. This phase witnessed the completion of outer links of the Plateau for transit traffic to the surrounding regions. The total length of metalled roads had increased to 705 kms. and unmetalled roads had gone up to the total length of 785 kms. The road pattern constituted the general frame-work to which smaller lengths of feeder roads remained to be added to break down the isolation and inaccessibility of the interiors of the Plateau. As late as 1907, Tejgarh about 32 kms. from Damoh, remained inaccessible from the latter in the rainy season except by elephants, "while the large village of Tendukhera, 25 kms. further south, was equally inaccessible with a small number of carts at the place".¹⁰ Sagar, on the West and Damoh, on the East, formed

the main communication nodes, from which radiating roads spread fanwise to Jhansi *via* Malthon, to the North, to Kanpur *via* Banda to the N.E., "to Bhopal and Vidisa (Bhilsa) to the West, and to Narsinghpur *via* Gourjhamar, Deori and Kareli, on the one hand and to Damoh on the other to the East, while from Damoh to Panna *via* Hatta, to the North, to Katni to the East and Jabalpur to the S. E. *via* Jabera.

The Sagar-Kareli road had carried the bulk of the export traffic of the Western part of the Plateau and its adjacent tracts, and upto the year, 1888 the traffic was almost the heaviest in the erstwhile Central Provinces and Berar. Since the opening of the railway on the Plateau, the road lost its significance as an extra-regional link and only the Southern part of the Haveli and the Western part of the Selwara-Chikhali-Jamunia Highlands were served by this road. The Rahatgarh road was formerly maintained as a continuation of the Jhansi road for travellers and caravans, proceeding by road towards Bombay. For sometime, it remained comparatively unused and fell in ruin, but it was, subsequently, repaired about the year, 1906 and its significance as one of the most important trade routes, connecting Sagar with the rich tracts of Rahatgarh and its proximity was revived and re-emphasized. A good deal of grain began to pass along this road from Gwalior and Bhopal. The Sagar-Rehli road served as a part of this arterial link. A few local feeder roads connecting the grain producing tracts with the interior by the railway became important in aiding

4. Ibid, P.P. 128-35.

5. Rai Bahadur Hiralal, "Damoh Deepak" (in Hindi-second edition) 1919, D.D. pp. 50-1

6. R. V. Russel : Saugor District Gazetteer (Pioneer Press, Allahabad) 1906, S.D.G., P. 162.

7. Ibid.

8. Ibid, pp. 162-3.

9. Report of the land Revenue Settlement of the Saugor District, (Government Press, Nagpur), 1914., R.L.R.S.P., P. 23.

10. Report of the Revenue Settlement of the Damoh District, (Government Press-Nagpur), 1914, R.L.R.S.D.D., P. 4.

the export trade of grains. Among them the Garhakota-Patharia and the Khurai-Khimlasi roads deserve a special mention.¹¹

Prior to the year, 1870, the Plateau had little external trade. Cotton was exported to Mirzapur and Bombay, when Garhakota had been a sizable cotton-mart of the cotton-mart of the Plateau. Sagar was the centre of salt trade from Rajasthan to the adjoining regions with a small export of wheat and oil-seeds in exchange. The opening of the railway in 1870 in the Narmada Trough and the new road to Kareli connected Sagar with the extra-regional markets. The export of grains to Bombay started in 1877. From that year to 1889 the volume of trade recorded a steady increase on the Kareli road. With the construction of the Bina-Sagar branch of the railway in 1882, the exports to Kareli were adversely affected.¹² The export trade, north of Deori, was diverted to the newly constructed railway, while South of it, the exports continued to flow to Kareli. Sagar, together with three large markets in the Badar-Bina Doab at Bina, Khurai and Bamora, served as distributing centres of wheat to Bombay. Since 1895, the Bina-Sagar branch was extended to Damoh and Katni, and the export trade in the vicinity of Garhakota has been diverted to Damoh, due to its nearness than that from Sagar. The intermediate stations did not attract much trade, as merchants and cultivators showed a marked preference to visit district headquarters or large market-places.

Since the completion of the existing railway routes, their further

extension has not been undertaken or proposed. The total length of the railway shows the following break-up within the Plateau:

- (1) Bina-Katni: 183.5 kms.¹³
- (2) Delhi-Madras: 37 kms. and
- (3) Bina-Kota: 22.5 kms. with the overall total of 243 kms.

(e) The Post-Independence Period:

During the first period of the road-construction the framework for *transit traffic* had been completed followed in the second period, by the improvement and upgrading of some stretches of roads. In the Post-Independence period, the emphasis was laid on linking up the forested tracts in the Northern part of the Plateau, infested by dacoits, to curb their lawless activities, coupled with the construction of two small 'famine' roads, north of Tendukhera in the Bearma Basin.

The additional roads constructed in this period leave still large and small patches of difficult of easy access, being more than 8 kms away from the roadsides.

The development of roads, maintained by the Public Works Department since the year, 1962 may be gleaned from the following table¹⁴:

1961	1962	1967
999 kms.	1256 kms.	1490 kms.

(f) The 20 year Road Plan (1961-81)

A comparative study existing roads as on the 1st April, 1963 and the 20-Year Road Plan will serve to reveal the reduction of patches of difficult of easy access,

except in the Bearma Basin in the S.E. part of the Plateau, where dense forest-cover and sparse population can hardly justify the construction of roads on economic grounds.

II Classification of Roads

The lengths of all types of roads in kms., excluding the National Highway passing through the Plateau, as classified by the Public Works Department, are cited in the following table:¹⁵

I. State Highways Roads 815	II. Major District Roads 338
III. Other District Roads 579	IV. Classified Village Roads 622

The above tables serves to record a considerable accretion to the total pre-existing length of 'other district roads' which are intended to remove the time-honoured isolation of interior villages and to link them with arterial roads.

The most of the forest roads, which are merely tracks through narrow and almost linear belts in forest clearings, usable only in dry seasons, will be converted into all-weather roads for automobile traffic including buses and cars. At present, the forest roads are at best 'jeepable', along which carts and trucks run normally to fetch forest produce to market-centres and timber depots.

The functional characters of the different categories of roads may be briefly enumerated below:

- (1) *National Highways*: Main arteries of transport, connecting

capital cities of States and Capital to ports or large market-centres.

- (2) *State Highways*: main roads within the state connecting its important towns and cities and National Highways.

- (3) *Major District Roads*: serve as links to areas of production and market-centres, connecting a State Highway or railway and also mainly headquarters of neighbouring districts.

- (4) *Other District Roads*: mainly serve the needs of rural population connecting rural settlements with each other, nearest district roads and river-ghats and are more important from the traffic point of view than village roads.

- (5) *Village Roads*: are short links to any of the above categories to meet the requirements of the rural population.¹⁶

The roads on the Plateau have largely lost their former 'frontier-character' with the merger of adjacent districts and princely states into the enlarged state of Madhya Pradesh, consequent on the States Reorganisation on linguistic basis.

Only a part of the National Highway No. 26, with its total length of 146.5 kms. on the Plateau, passes from its southern border through the Western part of the Selwara-Jamunia-Chikhali Highlands, the Abchand-Naharmau Highlands and the Rahatgarh-Jaisinagar Highlands the Sagar Hills via Malhon and Lalitapur to Jhansi, proceeding from Barmanghat on the Narmada. Till recently, a ferry service has been maintained to cross the river at Barmanghat. The completion of the bridge on

11. S. D. G. op. cit. p. 163-4.

12. R. L. R. S.S.D, op cit. P.P. 23-24.

13. Ibid.

14. The Chief Engineer, Public Works Department, M. P., through the kind courtesy of the Directorate of Economics and Statistics, M.P., Bhopal,

15. Ibid.

16. U.B. Priyani:- Fundamental Principles of Road Engineering, 1958, F.P.R.E. p. 6.

the river can facilitate through traffic along the National Highway to Madras *via* Nagpur and Hyderabad in the South and *via* Jhansi and Agra to Delhi in the North and beyond to the N.W. frontiers of India, except, perhaps, during the periods of exceptionally high floods, provided all bridges and culverts on small rivers and streams are raised above the normal flood level.

The attention of the reader may be drawn particularly to the functional categories of roads, *sui generis* to the Plateau namely, the 'Famine' road of a short length of 16 kms. from Pura, on the right bank of the Bearma River to Tejgarh, on the left bank of Guraiya Nala in the Bearma Basin constructed to give relief to the labourers of the proximity in the past period of scarcity and *secondly* Dacoit roads, confined to the Rajpura Plateau, the Dhamoni-Shahgarh Highlands, and the Northern part of the Rahatgarh-Malthon Range, constructed to give access and entry from the Haveli and Badar Bina Doab and the Sagar-Jaisinagar Highlands into the dacoit-infested tracts of the Plateau. Obviously, they have been constructed to give an easy and quick access to the secure and isolated lairs of dacoits on the Northern margins of the Plateau with a view to curb their undesirable and menacing activities. Since the construction of these roads, the threatening attitude of dacoits has vanished. They had been operating mostly into the Northern margins of the Haveli and the Badar-Bina Doab from their inaccessible hideouts, keeping the people of the nearby villages in a state of constant threat and terror of their surprise incursions on unprotected inhabitants.

I II. The Physical Control of Railways and Roads:

(a) Railways: As the main railway on the Plateau traverses the

rich and fertile Haveli, Dhasam Basin and Badar-Bina Doab against the grain of the country, mostly in the valleys of streams embankments are essential and in the hills and ranges of hills, lying athwart, deep cuttings have been excavated to reduce the gradient of the track and a large number of bridges on small and large streams and rivers has been unavoidable. Except for its relatively steep gradient in the Eastern margins of the Plateau, this railway avoids relatively less fertile and productive highlands to the North as well as the South, and, therefore, is able to negotiate the Plateau, with comparatively easy gradients throughout its length on a firm and dry bed and a relatively few cuttings through hills and ranges and embankments only in the low-lying tracts and valleys. The obvious functional character of the railway on the Plateau is primarily and distinctly regional. Its links with Bina and Katni junctions connect it with *trunk* lines, giving it access to Delhi and beyond in the North, Madras in the South, Bombay in the West and Calcutta in the East. In times of emergency particularly during dislocation of traffic due to accidents or floods on main trunk lines, it serves as an alternative route for its diversion for north-south bound trains.

The high railway bridge on the Bearma River needs to be renovated particularly, for fast trains. However, ballast for railways is easily available in abundance on account of the occurrence of sandstone, basalt and limestone ready at hand. In the vicinity of Bina Junction, not many hilly stretches occur, but the low-lying stretches, particularly in riverain areas, necessitate the building of embankments.

(b) Roads:

The main roads in the Haveli and the Badar-Bina Doab, the Jabalpur

Bhopal road in particular, bear a close resemblance to the nature of alignment to the main railway line, requiring frequent bridging at many points though there are not many deep cuttings, except on the northern slope of the eroded Jabera 'dame'. The Jabalpur-Bhopal road, while negotiating this inverted topography of the Jabera 'dome', has, of necessity, to pass in the direction of the quaquaversal dip in its Northern and Southern edges against the principles of road engineering. This road enters the Jabera Basin through the narrow and long 'Katangi' Gap and passes on a relatively steep gradient to emerge through the 'Bhansipur' Gap into the Haveli, after traversing through low scarped hills for some distance. However, other roads branching off from the main arterial road, almost at right angles, pass mostly along or close to local water-divides to reduce the necessity of a large number of bridges on streams or rivers as far as possible. The main railway and State Highways have been laid through the largest traffic-generating area of the populous and agriculturally rich plains of the Plateau.

In the Bearma Basin, the Jabalpur Eamoh road *via* Patan and Tendukhera ascends up the S. E. part of the Plateau through a relatively easy gap in the Bhandar Hills and lies close to the local water-divide upto Tendukhera from where it proceeds further north close to the Bearma River, avoiding its flood-plain and joins the Jabalpur-Bhopal road at Abhana.

The steepest gradient among the roads of the Plateau occurs on the Sagar-Chhattarpur road where it

descends by a small hair-pin curve from the *Ghatia Upar* (Highland) to the *Ghatia Niche* (Lowland). Another remarkable example of the physical control of roads is instanced by the road from Gubra to Sihora (on Jabalpur-Allahabad railway) *via* Majholi, an offshoot from the Jabalpur-Bhopal road, close to the Northern end of the Katangi Gap, passing through the remarkable water-gap of the Kair, N., known as 'Katav' locally or cleft for its exquisite beauty, in the Central part of the eastern edge of the Plateau. Elsewhere, gradients of roads do not exhibit marked steepness and short stretches of steep ascents (ghats) do not occur. These gradients do not, normally, exceed the desirable or recognised maximum level for different surfaces of roads, according to the principles of road engineering.¹⁷

The Sagar-Jaisinagar road has to traverse across a number of short affluents of the Dhasan River, liable to sudden and unexpected floods during the rainy season which hold up the local traffic for a few hours or, sometime, for a day or two and cut off Jaisinagar and its vicinity from Sagar occasionally in the rainy season. Recently, bridges have been thrown across them which will facilitate uninterrupted traffic, except during unusual floods.¹⁸

On the National Highway, south of Sagar, though bridged throughout its length, detention of traffic may occur for a few hours or, sometimes, for a day or two, because of the submergible bridges on small streams. The alignment of this road is somewhat akin in its character to that of the Jabalpur-Sagar road through the Haveli.

17. Ibid, pp 30, 31.

18. Reference may be made to one past accident, sweeping off a private car in the rising flood of a stream on the road.

IV. Road Foci:

With the linear expansion of roads, the following two categories of roads have sprung into existence: (1) mostly for transit traffic, linking the extra-regional tracts and (2) mostly for local or regional traffic with corresponding major hubs or foci and secondary hubs and foci from which roads radiate in different directions. Sagar and Damoh are the major foci of roads, while Mariadoh, Hatta, Batiagarh, Garhakota and Rehli in the Haveli, Rajpura on the Rajpura plateau, Tendukhera and Deori in the Bearma Basen, Taradhi on the Selwara-Jamunia-Chikhali Highlands, Gouribamar on the Abhand-Nalarnau Highlands, Jaisingar on the Sagar-Jaisingar Highlands, Rahatgarh and Malthon on the Rahatgarh-Malthon Range, Bina, Khurai and Khimlasi in the Bina-Badar Doab, and Banda, Shahpur, Hirapur, Bandari Karauti and Behrol on the Dhamoni-Shahgarh Highlands partake the nature of secondary foci of roads on the Plateau.

The highest number of secondary road foci in the Haveli is a telling evidence of its greatest economic prosperity and growth, reflected in its rich agriculture and large and dense population and the resulting large volume of traffic in passengers and goods. The highlands of the Plateau are noted for the existence of a single road hub in each of them except (a) the Dhamoni-Shahgarh Highlands with five road foci which can be accounted for its relative large areal extent and consideration of security to the people of the adjacent plains and (b) the Rahatgarh-Malthon Range with two road foci, both being close to the margins of the Physiographic unit in South and North respectively, serving as links to adjacent extra-Plateau regions.

V. Surfaces of Roads:

The National Highway has a bituminous surface throughout its whole length. Though the carriage way has been widened somewhat than that in the past, the bridges have remained unwidened for some time. All the State Highways and most parts of Major District Roads, not unlike the National Highway, have bituminous surfaces. The remaining Major District Roads and Other District Roads have usually water-bound macadam surface, but the Classified Village Roads still continue to be murrum-surfaced though a few of them have water-bound macadam surfaces. Along the National Highway, Major District Roads and other District Roads, fast vehicular traffic can move with ease except in the rainy season. The murrum surfaced Classified Village Roads are not generally used by vehicular traffic, except bullock-carts.

VI. The Traffic-flow:

A comparative study of the traffic flow upto June, 1957 and upto June, 1964 respectively serves to bring out the following shifts and changes in the nature and volume of traffic of the Plateau:

- (1) The perceptible shift in the orientation of traffic of the region from Nagpur, east-while capital of the Central Provinces and Berar to Bhopal, the new capital of the reorganised State of Madhya-Pradesh.
- (2) The marked increase in the volume of traffic from Jabalpur to Damoh, relatively less increase of traffic from Damoh to Sagar and markedly visible increase of traffic from Sagar to Bhopal.

- (3) A small amount of increase in the volume of traffic from Jabalpur to Abhana via Patan and Tendukhera to avail of bus-services bound for Bhopal for administrative and official work at the capital.
- (4) The general pattern of traffic flow indicates its persistence with the largest volume along the Jabalpur-Sagar-Bhopal road, which decreases progressively North of Damoh and Sagar and South of Sagar till margins of the Plateau are reached.

The timings of bus-service from tahsil headquarters enable the needy persons to transact their business in courts, offices or make purchases of commodities at district headquarters, normally not available at the places of their residence and return to their homes early in the evening. Some non-residential students avail of these bus-service to attend their school or University at Sagar and the College at Damoh. About additional services on market days a mention has been made in the paper on "The Weekly Markets of the Sagar-Damoh Plateau".¹⁹

With the establishment of the State capital at Bhopal, there is a marked increase in the volume on railways, more particularly to meet its increased requirements emanating from Chhattisgarh with increased passenger services on the Katni-Bina branch of railway. The pattern of traffic flow during periods of fairs has been indicated in the paper on the "The Fair-centres of the Sagar-Damoh Plateau".²⁰

Besides the regular and normal bus-services, for occasional urgent needs of the local people, particularly in vicinity of Sagar and Damoh three-wheelers or locally known as 'Tempos' have come into use, in addition to already available small buses, providing contract services for specific purposes, distances and periods of time. The circulation of rural passengers and goods, of late, is markedly and continuously on the increase, since the villagers of the region have developed the habit of availing of either regular bus-services or in their absence or in case of their non-availability at the required time for visits to market-centres, government or other offices physicians, etc., even for short distances of about 8-10 kms they choose to hire small buses on contract basis or three-wheelers, carrying about five passengers for their quick movement to and from their destinations.

VII. The Present Position and Problems:

Though the geographical analysis of the means of communication and transportation points to the inescapable conclusion that their existing position has recorded a spectacular expansion, improvement and development since the early period of the British occupation and earlier periods of the past history, it still leaves much to be desired.

For a proper evaluation of the means of communication and transport of the Plateau, their statistical analysis can be quite illuminating and instructive.²² Only 3.6 p.c. of the total income from all services has been derived from Transport Services, while 1.15 p.c. of the total working finds employment in

19. B.G. Tamaskar: Weekly markets of the Sagar-Damoh Plateau (The National Geographical Journal of India, Varanasi) Vol. XXI, No. 1, March 1966, W. M. S. D. P.
20. B.G. Tamaskar: The fair centre of the Sagar - Damoh Plateau (Nagpur University Research Journal) Vol. XVII, No. 1, Oct. 1966, F. C. S. D. P.
21. They are licensed to ply upto a distance of 32 kms from towns.
22. The study of Voluminous data in Transport offices can throw light on weekly monthly and seasonal fluctuations in passenger traffic though the processing of the data is a stupendous task.

them²³, as against 0.9 p.c. for the corresponding figure for the whole State. The road length for 1000 sq. kms works out to 99.3 kms as against this corresponding figure of 208 kms for the whole State and 1.26 kms for 1000 persons on the Plateau.

It has been already mentioned above that the alignment of roads on the Plateau conforms to a large extent to fundamental principles of road engineering in avoiding unnecessary detours²⁴, marshy grounds, gardens, cultivated lands or thick forests, with normally easy gradients, straight stretches, flat curves, minimum of cutting and embankments easy and abundant availability of road metal from the local geological formations of sandstone, trap and limestone. However, it cannot escape the attention of the traveller that the roads particularly in the Haveli, the Badar-Bina Doab and the Sagor Jaisinagar Highlands are *per forne* required to cross a large number of streams and pass through habited areas of villages and towns, for example, Patharia, Garhakota, Khurai and others. Similarly, the widths of the different categories of roads do not come anywhere close to those either the minimum or normal recommended for them.²⁵ Consequently, temporary jams of traffic frequently occur even with the first showers of rain, as vehicles, crossing each other in opposite directions over the heavy, slippery and moist black-cotton soil of the basalt region, get stuck up on the edges of carriage ways of roads. These traffic jams result in unexpected detention of passengers and goods *en route*, causing delay in their arrival at destinations.

This calls for an urgent necessity of immediate widening of roads at least to their minimum requirements. Similarly, the construction of high bridges on roads, more specially, on the Jabalpur-Bhodol road needs immediate attention.

The impact of the expansion and further proposed closer net-work of roads on weekly markets and cottage and small-scale industries has been fully examined in a paper on "The Weekly Markets of the Sagar-Damoh Plateau." It will not be too much to expect that the retarded cottage or domestic industries in the existing inaccessible areas and patches will get fillip and stimulus to start industries at some places and to expand existing ones and also brighten up the fortunes of the agriculturists, particularly in the Bearma Basin and the Highlands of the Plateau on account of increased, speedy and reliable means of transport within and outside and add to the general prosperity, on the completion of the 20-Year Road Plan.

Acknowledgments :

I am sincerely thankful to Dr. S. Mookerjee, Principal, Vidarbha Mahavidyalaya, Amravati for his kind permission to utilise the cartographic facilities provided in the Geography Department of the Mahavidyalaya. I owe a debt of gratitude to the Director of Economics and Statistics, Madhya-Pradesh, Bhopal, the Chief Engineer of Madhya-Pradesh, and also Shri. Adarsh, District Publicity Officer, Sagar for readily supplying me relevant information and statistical data.

PROBLEMS OF ECONOMIC BASE STUDIES : A NOTE ON THE CHOICE OF THE AREA

by

George C. KOTTIS*

In every economic base study, perhaps the first decision the economist has to make in the choice of the area which will become the object of his survey. Such studies examine the economic base of a region which is part of larger economic regions such as the state or the nation. The local economic region becomes a subspace of socio-economic time-space. A subspace is closed with respect to certain elements and relations and open as to others.¹ Usually, the smaller the subspace compared to the larger space, the smaller the number of elements as to which it is closed and the larger the number of those as to which it is open. But as the number of elements in the first group diminishes, the definition of this subspace as a separate economic region becomes less significant.² The economist faces a dilemma: if he defines his economic regions in a way that guarantees subspaces closed as to most ele-

ments, he will have to content himself with larger regions which allow him little spatial disaggregation of the various economic variables. On the other hand, if he wants to gain more insight in the way the "little economics" operate, he may have to satisfy himself with regions that are subspaces open as to most elements. Usually he compromises by selecting a subspace which is closed as to some of the most important elements. The choice of those elements is based on a set of criteria for defining economic regions which can vary according to the individual. By means of a variety of criteria regional economists have developed different approaches. But all regional classification schemes are variations on the criterion of homogeneity.³ Homogeneity with respect to one or more characteristics simply means that the subspace is closed as to those elements.

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1. See Kazimierz Dziewonski, [2]. He discusses critically the assumption that the city is an economic region and examines its relevance and implications for today's reality. He indicates the difficulties for rigorously defining cities as economic regions and discusses the relationship between city and region.

2. The nation is unambiguously considered an economic region because it is an almost closed system. As one moves from the nation to the state, the definition of the latter as an economic region becomes less significant because it is a subspace which is open as to many elements. The percentage and relative importance of open elements increase as one moves down to the level of the urban region. If one wants to proceed even further in one's attempt at disaggregation, and consider the neighbourhood or even the city block as an economic region, one will probably find that this region is open as to almost all elements. In such a case it does not make sense to consider it as a separate economic entity.

3. One of these approaches stresses homogeneity with respect to one or to a combination of economic, social, physical or other elements; another emphasizes the criterion of nodality or polarization, usually around some central urban place; still another is programming-or-policy-oriented and is mainly concerned with administrative identity between the area under study and political institutions for implementing policy decisions. Naturally these three general criteria are not mutually exclusive. See John Meyer [6], especially p. 22 (for a discussion of the various criteria), and pp. 20-26. Also, Richard B. Andrews [1], and Hugh O. Nourse [7], pp. 129-136.

23. Income Atlas of Madhya-Pradesh, Bhopal 1959, R. I. A. M. P. p. 112-3.

24. The existence of a number of 'detours' in the Marathwada Region of Maharashtra is striking.

25. W. M. S. D. P. Op. Cit.

For the urban economist, the criteria he employs for defining his economic regions are usually related to one, or a combination of the following factors; labour; industrial production; trade; and political boundaries. For some urban economists the local economic region is considered to be the local labour market area which was defined by the American War Manpower Commission in 1945, as a

...geographical area surrounding a central city (or cities which are only a few miles apart), in which there is a concentration of labor demand, and in which workers can change jobs without changing their residences. The extent of this area is usually limited by local transportation and commuting facilities. A radius of 20 to 30 miles from the center of economic activity (usually equivalent to an hour or an hour and a half travelling time each way), is considered a normal maximum commuting range.[11]

Richard B. Andrews maintains the foregoing to be the most complete and rigorously worked definition of its kind[1]. Indeed, this areal boundary is chosen by many economists and planners to be the best approach for defining urban regions. Karl A. Fox believes that urban areas defined in terms of this basic criterion could be called "functional economic areas" and would be

...more useful than the current SMSAs and SEAs for the analysis of the impact on the area of business cycles, the removal of a plant, the loss of a government base, or the loss of a government contract to an important local business⁴

There is no doubt that the labour market area is a more meaningful economic region than those defined on the basis of county lines or other political boundaries. The local labour supply is, after all, probably the most important single economic variable and, as such, it may be considered as an element with regard to which the urban subspace should become closed. But this criterion is not without shortcomings. Every improvement in transportation technology that allow people to travel faster extends the commuting radius. Thus, with constant improvements in travel technology, a continuous revision of the boundaries of the labour market area is required. Also, major relocations of industry within the same urban area may affect accessibility to workers and may increase or decrease the size of the labour market area, depending on whether industry moves, to the periphery or to the centre of the urban region. When industry moves to the periphery, some jobs become accessible to people who live in nearby communities which were not previously within the commuting radius measured from the centre of the city. The effect would be the opposite if the movement of industries took place from the suburbs to the central city. Repeated revisions of the boundaries of the labour market area would be extremely difficult and therefore impracticable. But these periodic adjustments do take place; in periods between adjustments, data on employment would show a downward bias.

A number of economists have specified an economic region to be the local industrial area, which in turn is defined by the Bureau of the Census as a group of "contiguous counties having large numbers of

manufacturing earners.⁵ While the definition reflects the great importance usually attributed to manufacturing or basic activities it is rather narrow since it ignores completely the existence of other labour groups. This oversight could result in a very serious under-estimation of the extent of the local economy. The definition has become obsolete and has been replaced by that of the standard metropolitan areas.⁶

In certain instances the urban economic region has been identified as the trading area. That definition delimitates an area that can be larger than the industrial or the labour market areas.⁷ Trade may be a very useful criterion defining the area in an economic base study, since after all, the economic base is usually referred to as the export base. However, there are serious practical difficulties for identifying the actual trading area and this makes that criterion rather unreliable to apply because of the effect of the choice of different boundaries on the evaluation of the importance of exports.⁸

For many economists, the definition that comes closer to the theoretical ideal concept of an economic base region is that of the metropolitan area given by the U. S. Bureau of the Census. It is argued

that that definition delimitates a more integrated economic and social entity. In a study for Metropolitan New York the region was a twenty-two-county area, with all the counties connected with the urban core of Manhattan through employment. The choice of such large regions as the metropolitan areas is an appropriate one for an economic base study, particularly for examining "area-wide" problems. Their boundaries are largely determined by commuting and shopping patterns. Metropolitan studies usually generate data that are useful to individual communities within the metropolitan areas and allow those communities to see how they fit within the overall structure of the area.⁹

Political boundaries are often used as a criterion for delineating urban economic regions. Thus, the city is sometimes used as the area for studies concerning tax levels, future service needs, and other variables that may be of interest to city officials. This is a very simple definition since it involves the legal boundaries of the city. But in many cases it may be preferable to study an area larger than the legal city even when the interest is on city-wide problems, because the economy of the city is affected by the surrounding areas.¹⁰ Several economic base studies have used the country

5. U. S. Bureau of the Census, [9], p. 13.

6. R. Andrews [1] criticized the emphasis that the Bureau of the Census placed upon the manufacturing labour force making this the sole criterion for defining SMSAs.

7. In an economic base study of Philadelphia, population estimates were made for several types of trading areas. These areas included the traditional retail trade area but also the industrial area and the labour market area. See [1].

8. If the city is chosen as the unit exports will be high as they will include trade with the suburbs.

9. See [1]; [8] p. 22; according to the definition of the Bureau of the Census, a standard metropolitan statistical area must include at least one city of 50,000 or more; the area as a whole must have a total population of at least 100,000; areas may cross state lines; where two cities of 50,000 or over or within twenty miles of each other, they will ordinarily be included in the same area. Individual counties included in a SMSA must have either 10,000 non-agricultural workers or ten per cent of the non-agricultural workers in the area or more than one-half of the country's population must have been included in the metropolitan district as defined by the Bureau of the Census. In addition, non-agricultural workers must constitute at least two thirds of the total employed labour force of the county. Each peripheral county included in a SMSA must be economically and socially integrated with the central counties of the area. For the New York Metropolitan Region Study, see Raymond Vernon, [10]. Also see Nourse [7], p. 136.

4. See Karl A. Fox and T. Krishna Kumar [4]; also Walter Isard [5] p., Nourse [7], p. 136; Charles M. Tiebout [8], p. 21.

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or a group of counties as regions. On some occasions the county has been used as a unit in some larger area such as the industrial area. The single county has been employed as a unit for studying the economic base of small cities such as Albuquerque, New Mexico, where it was observed that the economic area of the city corresponded to the Bernalillo county by ninety-five per cent.¹¹ Finally, one can find economic base studies for suburbs although such a region is of very limited use for specific problems concerning specific suburbs. Incorporation boundaries may be often used as appropriate base area limits

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- [11] War and Manpower Commission, Reports and Analysis Service *Directory of Important Labour Market Areas*. U. S. Government Printing Office, Washington, D. C., (May 1945).

10. Revenues and costs incurred by the city will depend upon the fortunes of business in the larger region, and upon the particular areas where employment and residences will be located within that region. See [1]; [7] p. 136; [8] p. 22.

11. See [1]; also Federal Reserve Bank of Kansas City [3].

particularly when suburbs are contiguous, ([1] and [8] p (22).

One can see from the above brief discussion that the choice of the area that is the object of an economic base study is based on various considerations such as the type of the problem under examination and the availability of data, but it includes a certain degree of arbitrariness which is due to the inability to take into account many elements at the same time. This arbitrariness makes the comparison of economic base studies that are based on different definitions of regions rather unreliable.

REVIEW

FUNDAMENTALS OF CARTOGRAPHY, by R. P. Misra, XXIV, 429 pages, Prasaranga, University of Mysore, Manasagangotari, Mysore-6, 1969, Rs. 28/\$ 8.

This book covers the various processes in Cartography, in 24 well arranged chapters. As we all know, in its briefest form, Cartography can be defined as the sciences and art of making maps.

Dr. Misra has done well in describing the types of maps and their uses in Chapter I. His definition of a map as a symbolic drawing to scale of the visible as well as conceived locational and distributional patterns of the whole or a part of the earth, the sky, or any other heavenly body covers maps of all possible conceptions. Maps may be classified into General purpose Maps, Thematic Maps and Special purpose Maps, of course, only on a broad basis, as there are also varieties of maps under each of these three categories.

The size of the drawing will depend mainly on the size of the negative and the plate of the printing machinery but not on any of the printing processes, as direct printing will be to same scale and by photo lithography, reductions are possible.

The history of Cartography is dealt with fairly exhaustively in Chapter III, dealing with periods upto 400 A.D., 400 to 1500 A.D., 1500 to 1900 A.D. and 1900 A.D. to-date. It is very interesting to note how even the most primitive people, like the Eskimos of the Arctic, the Bedouins of the Arab Desert, the Bangaras of India; had the remarkable ability to draw sketches of areas on skin, wood bone, etc., during the very early stages.

According to the author, the Babylonians were the first to guess the shape and size of the earth and considered it to be flat and circular.

Anaximander, a Greek, was the first to prepare a map of the World (as known at that time) and Hecataeus, wrote the first book of Geography.

Only later, as the expansion of the world was known through military and sailing expeditions of the Greek, the idea that the earth was a sphere as propagated by Plato and Pythagoras gained wider recognition. Hipparchus and Ptolemy also contributed much to the compilation of data for map constructions.

It is also interesting to note that Arya Bhatta the great Indian astronomer discovered the relative movement of the Earth and the Sun, a clear thousand years before Copernicus. The knowledge of the world in India was far advanced than in Greece and Rome before the Christian Era.

Dr. Misra after dealing with the shape and area of the Earth with reference to its satellites, then takes the reader to the next important items, i.e. scales and their constructions and the directions.

The various types of map projection and their functions are very vividly described in Chapter VIII, which occupies the maximum space in the book, perhaps to emphasize its importance in the science of Cartography.

The main principles of Geodetic, Plane and Air Surveying are briefly described in the next few chapters.

A chapter giving interesting information regarding the Cartographic coverage of the World is Chapter XI and the mapping by Survey of India of the Topo mapping is not counting uniform the world over.

The interpretation of Topographical and Geological maps and the collection and interpretation of Statistical Data for various maps are very clearly described in an appealing manner, by Dr. Ramesh, who has ably assisted the author in the construction of the illustration also. Visual perception in maps, techniques of making objects visually significant and the limitations within which a cartographer functions are dealt with as ably by Dr. Misra as the chapters dealing with Map design, mapping the weather and climatic data, the Socio Economic Data and Thematic and complex Mapping.

The fairly exhaustive elaborations noticed in the other chapters is not noticed in the chapter on Map Reproduction. I wish that the author enlarges this Chapter in the next edition, which is bound to come out earlier than anticipated by the author as the present edition is going to prove itself to be an invaluable guide not only for the students of Geography and Cartography but also any one interested in Cartography in particular.

As many as 231 diagrams illustrate the contents at appropriate places.

Printed on quality and durable paper, the printing and get-up are good and the price moderate for the enormous information contained in this book.

This is certainly a book which no one interested in Cartography in all its aspects can afford to miss. This is ideal for the teacher as well as for the taught and useful for institutions connected with cartography and the libraries.

K. A. SAMPATHI, B.A., M.I.S.,
Assistant Director,
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GEOGRAPHICAL RECORD

1. *Post-Graduate Studies at Madurai University*: The Madurai University has started post graduate studies in Geography, leading to M.A. & M.Sc., degree. Dr. (Miss). A. R. Irawathy, B.A., (Hons.), B.Ed., Ph.D., (London), D.A., who is the president of the Indian Geographical Society, has been appointed as Director of the department. The Indian Geographical Society congratulates one of its long standing members on her appointment as Director, Department of Geography, Madurai University. The new syllabi of the M.A. & M.Sc., course include a number of optional papers which give due emphasis on cartographic and applied side of the Science of Geography.

2. *Institute of Development Studies, Department of Post-Graduate studies and Research in Geography, University of Mysore, Mysore-6, India*: This institute which has been recently established at Mysore is oriented to interdisciplinary research involving all those natural and behavioral sciences which attempt to study man and his changing environment. It studies economic development too, but only as an aspect of a broader range of problems associated with resource development and technological change.

The Institute of Development Studies has the following functions:

(1) An interdisciplinary programme of research into the development process and its potentials, and problems. (*General Development Research*)

(2) Research on a project basis to delineate, delimit and solve general problems posed by the development process. (*Problem-oriented Development Research*)

(3) Research into technical problems with a view to improving productivity of agriculture and small scale industry. (*Intermediate Technology Research*)

(4) The development, possibly on an experimental basis, of new types of organizational systems and techniques that may help to speed the development process. (*Systems Development Research*)

(5) On a commission or invitation basis, research into and solution of specific technical, economic, social and political development problems of local or regional dimensions. (*Consulting Research*).

(6) The dissemination of such knowledge generated under 1-5 in such a way as to reach not only those with an academic interest in this area but also those directly concerned with the development process in the field. (*Diffusion of Information*).

(7) The training of the research staff needed to carry on the research mentioned above, both for the parent institute as well as other institutions concerned with similar problems.

(8) The training of personnel intending to take up employment in agencies or organizations within or connected with the developing communities.

(9) The schooling of personnel drawn from the developing communities and their organizations as well as from agencies concerned with the work of development.

(10) To organise advanced courses of study and seminars on development problems and provide facilities for joint-degree programmes, post-doctoral study and co-operate with the Union Government/State Government/International Agencies in areas of common interest and needs.

Further, the Institute plans to start a post-graduate programme in developmental studies. This will be a two year programme which can be further expanded towards a Ph.D. Degree. The students selected for these programmes will be few and will invariably be those who are capable of taking initia-

tive, bearing responsibility and organizing co-operation of the individuals for developmental goals.

The courses will be managed by the staff of the Institute in collaboration with resident foreign and Indian experts. The Institute proposes to give opportunities for the academicians and administrators, serving as well as retired to develop courses in the area of their specialization. Such courses may also be kept open to the students of Master Degree Courses in other social science departments of the university who can combine them with their other courses related to the field of specialization.

The Institute's point of departure in matters of training is a balance between theory and practice on the one hand and between class work and field work on the other.

The Institute will serve as a clearing and co-ordinating agency for information regarding all aspects of development planning. Besides, it will function as a documentation centre in conjunction with other national and international agencies to keep its research work up-to-date. The Institute is developing close bilateral relations with similar institutes concerned with the problems of developing societies. Contacts have already been established with the German Academic Exchange programme, Bonn; Institute for Developing Countries, Berlin; South-Asia Institute Heidelberg; Harvard University and M.I.T.; Institute of Social studies, the Hague, and the United National Research Institute for Social Development, Geneva.

The documentation centre will not only be a storehouse for information but also a centre for research in information theory, information systems, mass communication (specially rural broadcasting) and data collection, storage and retrieval. It will provide opportunities for the members of the academic community and for administrators for research and discussion which may lead to individual as well as joint publications in the Institute.

The documentation centre will maintain files of institutions engaged in social science research; of development project in operation; of research Projects, studies and reports already completed; of experts in various fields of development planning; and of academic events such as seminars, conferences, workshops, exhibitions etc. The publication and dissemination of information will also come within the purview of the documentation centre. An important function of the Institute is to organise expert meetings, seminars and conferences from time to time.

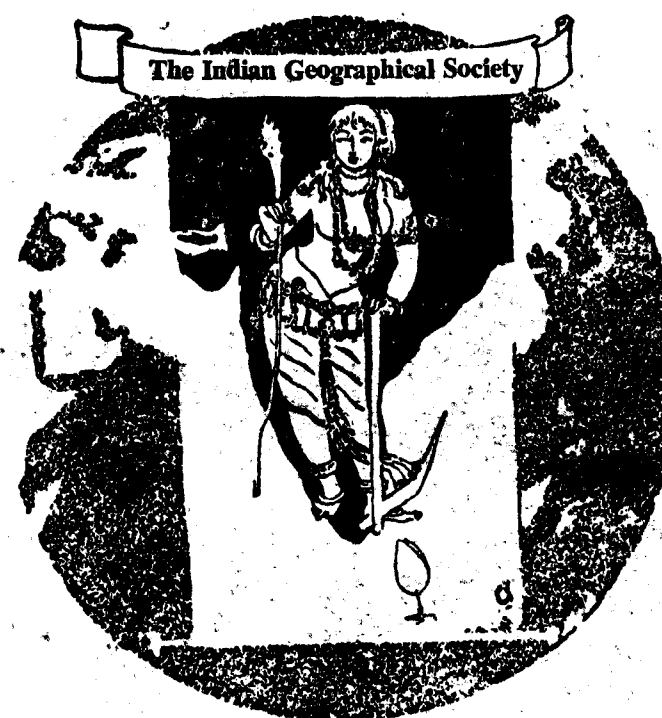
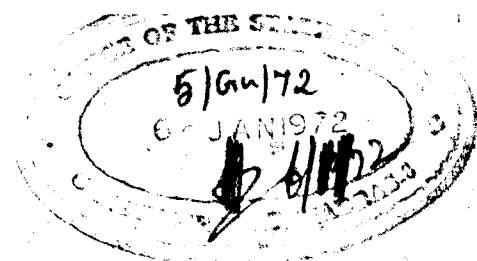
The research and training activities of the Institute are carried out by the staff specially recruited for the purpose and by the resident guest experts, administrators and members of the faculty of the University of Mysore. The emphasis of the Institute is not just to develop a heavily staffed operational research and training centre but to stimulate the talents wherever available and to guide them towards applied theory and research and to serve as a nucleus for intensive activity to meet the requirements of the community, the State and the Society.

In General the Institute's functions and activities are handled by the following six divisions.

1. Centre for Urban and Regional Studies
2. Division of Population Studies
3. Division of Resource Analysis and Landuse Planning
4. Bureau of Perspective and Environmental Planning
5. Centre for Rural Development
6. Documentation and Computer Centre

The current year's activities include a workshop on research methodology in social sciences and a seminar on policy implications of population in India during 1961-71 decade. Further information can be had from: Dr. R. P. Misra, Director, Institute of Development Studies, University of Mysore, Manasagangothri, Mysore-6, S. India.

THE INDIAN GEOGRAPHICAL JOURNAL



Volume XLVI

July - September

No. 3 & 4

October - December

1971

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The Indian Geographical Journal is published quarterly in March, June, September & October by the Indian Geographical Society (formerly the Madras Geographical Association) at Madras, India. Address all Communications relating to the subscriptions, recent back numbers, proposal for Exchange of Publications etc. to:

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Indian Geographical Society
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THE INDIAN GEOGRAPHICAL JOURNAL

Formerly
THE JOURNAL OF THE MADRAS GEOGRAPHICAL ASSOCIATION

Vol. XLVI

July-Sept. and Oct.-Dec. 1971

Nos. 3 & 4

The Editor takes no responsibility for the views expressed in the Journal. Authors alone are responsible for their respective statements.

CHANGES IN CULTIVATED AREA AND PERMANENT FALLOW LANDS IN GUHLA SUB TEHSIL, HARYANA.

By
INDER DUTT SHARMA*

A geographic phenomena is characterised by both temporal and spatial dynamism. The undertaking of this characteristics is crucial in the identification and solution of the problems of regional development. Particularly significant in the economic development of rural areas are the changes in the agricultural use of village lands. Easily the most important category in the agricultural land use is the cultivated area. However it is from the permanent fallow lands that any extension in the cultivated area is to be obtained.

In newly settled areas, the understanding of the changing

pattern cultivated area and permanent fallow acquires added significance. In Haryana, the area of Guhla Sub Tehsil is an ideal example of recent reclamation of permanent fallow and waste land and their resettlement by Punjabi refugees.

This paper intends to analyse the distributional pattern of cultivated area and permanent fallow land as they existed in 1951, 1956 and 1961 and the changes which have occurred between these years.

The analysis is based on the mapping and interpretation of the quantitative (choropleth maps) on which the percentage data of the two land use category pertaining to each village have been plotted.

It is to be noted that the maps of the same land use elements of different years are based on different sets of choropleth categories. This was necessitated by the need for meaningful pattern of generalisation in the face of extremely large changes in the values of averages during different years and marked changes in the internal structure of the series which are

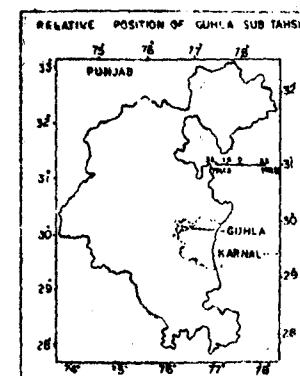


Fig. 1

* Mr. Sharma has his M.A. in Geography from Punjab University Chandigarh. He is Lecturer in Geography at Nehru Memorial College, Hansi Hissar and is researching on aspects of agricultural geography in Haryana.

vents the formulation of same sets of categories. For example the average category of proportion of cultivated area in 1951 ranged between 15 and 27, while it was 68 to 80 in 1961. If the categories of 1961 are used to prepare the maps of 1951, when almost the whole of Guhla Sub Tehsil will appear as having very low values. Similarly, if we use the categories of 1951 for preparation of map of 1961, when the whole of the Sub-Tehsil will appear as having very high values. In both the cases therefore the areal differentiation will not emerge and hence the objective of the study will not be fulfilled.

ASSESSMENT CIRCLES

The revenue Department has divided the area of the Guhla Sub Tehsil into three assessment circles which are shown on the map (Fig. 2) by different shadings. The 'Powad', 'The Anderwar' and the 'Naili' Circles. The powad area fringes the northern part of the Sub Tehsil. In this circle four ten villages of the present area have been included.

The Second assessment circle is the Anderwar which very much coincides with the area of older

alluvium as its surface material. In this circle sixteen villages of the Sub Tehsil have been included.

The third circle is the Naili Circle which covers rest of the Sub Tehsil and has 141 villages. It more or less coincides with the area of younger alluvium.

The basis of the formation of these circles is the assessment of revenue. As there is great variation in the agricultural productivity of the land, the whole of the Sub-tehsil cannot be considered at the same level of assessment. These regions or assessment circles reveal

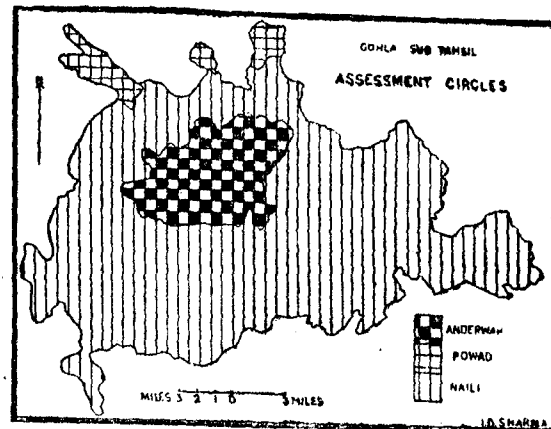


Fig. 2

considerable inter-regional differences in the agricultural pattern within the sub-tehsil.

SUBFACE MATERIAL REGIONS.

The area of Guhla sub-tehsil forms a part of the great depositional plains of North India. On the basis of their place of occurrence and time of deposition, these deposits may be classified as follows:

1. The Older Alluvium ('Bangar' or upland area)

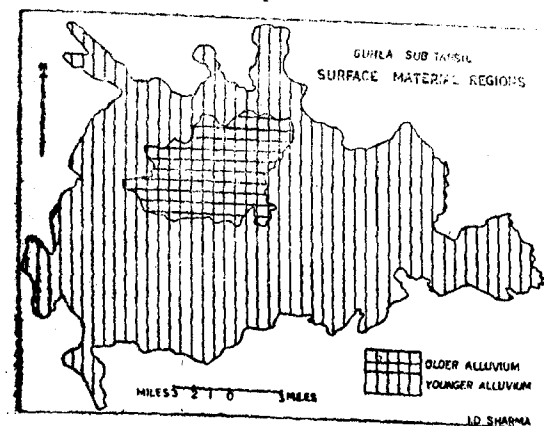


Fig. 3

CHANGES IN CULTIVATED AREA AND PERMANENT FALLOW LANDS 3. IN GUHLA SUB TEHSIL, HARYANA

2. The Younger Alluvium (Khadar or riverine track)

The Guhla sub-tehsil is no exception in having these two types of alluvium as its surface material. The map (Fig. 3) shows older alluvium in Anderwar Circle and the younger in the Naili and Powad Circles.

OLDER ALLUVIUM.

These deposits occur where the riverine influence has more or less ceased to be active. Indian geologists have named such an area as 'Bangar'. In the present map such alluvial deposits are found covering a small area more or less in the centre of the sub-tehsil. All the villages of Anderwar Circle are included in it. This deposit is located at a comparatively higher level.

The material on the surface varies from stiff loam to pure sand. Stiffest loams are found where the action of water has washed away the particles. Such a surface material is locally termed 'Dakar'.

YOUNGER ALLUVIUM

These deposits occur where alluviation is still in progress. In geological terms these have been named as 'Khadar' Soil. In the map it is clear that the entire Naili circle is covered with such an alluvium. Markanda is sandy and devoid of any kind of cultivation. In Naili Circle the lack of slope has caused poor drainage resulting in some what clayey soil and at places, alkali matter has emerged through efflorescence.

WATER TABLE.

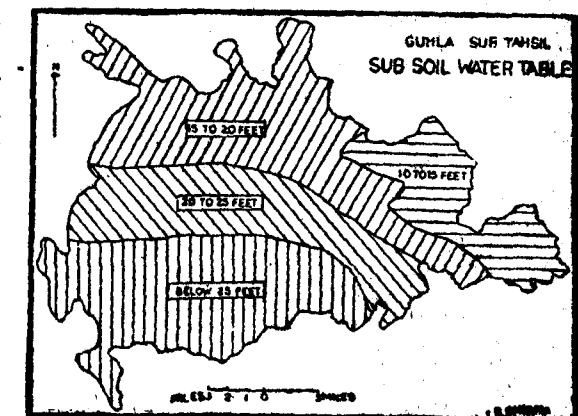
The present map (Fig. 4) of Guhla sub-tehsil reveals the sub-soil water-

table condition in the area. The area is divided into four zones.

Zone I: (Between 10 and 15 feet) This area lies in the north-eastern part including all the villages of eastern getting out portion and the villages of Borak, Surni, Tibri, Zolmat, Dhani Rampura, Bodhni, Shahpur, Kalsa in the north-eastern side. The cause of the high watertable is the frequented flooding in these villages.

Zone II: (Between 15 and 20 feet). The area lies in the northern section of the sub-tehsil. Many villages of Anderwar Circle and all the villages of Powad Circle lie in this section. Here, also Watertable is not too low. This may be due to seasonal flooding by Markanda which has a low incompetent channel.

Zone III: (Between 20 and 25 feet). In this category, few villages of Anderwar Circle and most of the villages of Naili Circle are in-



cluded. These villages form a continuous belt running from west to east.

Zone IV: (Below 25 feet) This lies in the Southern periphery of the Sub-tehsil in the Naili Circle.

SOILS

Guhla Sub-tehsil is almost entirely covered with clayey soil. It is locally known as 'kat' in Naili. As a rule the kat does not yield autumn crops and the tillage for rabi is perforce rough, for the land can only be ploughed at all immediate after a heavy flood. This soil is so compact and sticky that ploughing becomes difficult.

According to the fertility zone, i.e., ph value of soil, the Guhla sub tehsil can be divided into the following three zones.

ZONE I WITH PH VALUE OF 7 to 8.5: This zone coincides with the region of Karnal district receiving 30 to 40 inches of annual rainfall. The soils are neutral to alkaline reaction containing too low amount of organic matter and nitrogen.

ZONE II WITH PH VALUE OF 7.5 to 8.5: Most of the area of Guhla Sub-Tehsil is covered by this type of soil. The area of this soil in the map is represented by dots. These are alkaline in nature, poor in organic matter and nitrogen. It is in this zone of the alluvium that a peculiar saline efflorescent product is found covering the surface and

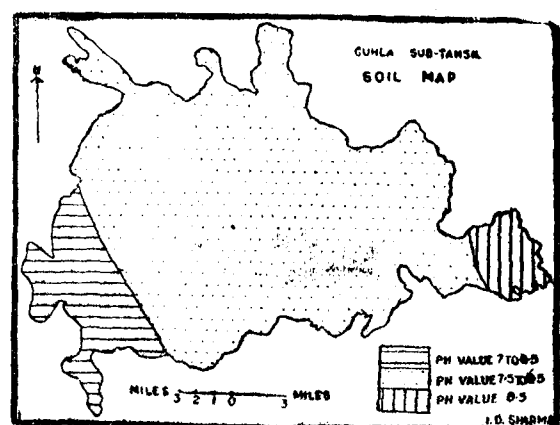


Fig. 5

destroying, in a great measure, its fertility.

ZONE III WITH PH VALUE 8.5: This type of soil is found in the south west part of the Guhla Sub-Tehsil. These soils are alkaline and also poor in organic matter and nitrogen. Appreciable amount of calcium carbonate and kankar concretions are found in lower depths, which if present in compact layer in the root zone, may hinder the proper plant development. These are known as hardbans. These also prevent the annual precipitation. Small pebbles are also found in these soils. These do great harm in tillage. Such type of soils definitely respond to nitrogenous fertilisers and also to phosphatic green manuring may be needed, especially in the soils of poor structure.

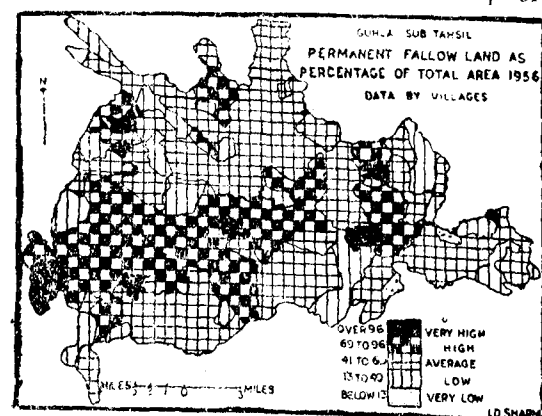


Fig. 6

TOTAL CULTIVATED AREA IN 1951

The total cultivated area in 1951, on the whole, was strikingly low. This is immediately suggested by few village blocks having very high values. Although there are patches having different values, the continuous large areas are equally emphasised by the map. The very high value of about 42 itself proves

that the total cultivated areas was rather low considering, the predominantly agricultural nature of the sub-tehsil economy.

There are two types of location of this very high value areas, Peripheral and Central. The central location areas are spread in the Anderwar assessment circle and on the older alluvium, (figs. 2, 3 & 4). The older alluvium consists of silty loam which is highly fertile. This area remains free from floods. The Anderwar and Powad Circles have been in continuous agricultural settlement for a long time. Strikingly enough most of the villages in this area have only average percentage of Barani land so that the effect of irrigation in the extension of cultivated area is not supported. It is suggested that the pressure of population indicated in the high density of population (307) as compared (to 173) with Naili and (163 of) Powad has resulted in a higher percentage of the total cultivated area. However it should be noted that there was still 58 per cent of the total area which was still not under cultivation.

There is a maximum concentration of wells in the Anderwar Circle, so that the percentage of well irrigated to total irrigated area is uniformly very high. This stands in a very sharp contrast to the surrounding areas in general but to the Naili Circle in particular. The general elevation of the Anderwar Circle is higher than that of the surrounding areas. Therefore it has remained free from the flood, at the same time in 1951, there was no canal irrigation here. Further as is universally true the old agricultural occupation has been based almost entirely on well irrigation. The ground water-table is only about 15 feet deep and since the soil is compact even the *kuchcha* wells have a high longevity without requiring frequent repairs

(fig. 5). The facts given above have encouraged a high degree of development of well irrigation and through that the extension of cultivated area.

There is general gradient of decreasing values of the total cultivated area in the radial direction away from the Anderwar Circle.

The Naili is basically the wide flood plain in flanking the Saraswati river. Although, it includes practically the whole of Guhla Sub Tehsil and therefore a large part of the floodplains of river Markands also. Flooding is therefore a very common feature of the Naili Circle with its associated younger alluvium. The villages immediately adjoining the Saraswati river are annually flooded. The floods bring an enormous mass of sandy material and thus devastating whatever agricultural land is available. Wasteland, therefore, is a common element in the landscape. The reclamation could have needed very high capital investment, enterprise, and resourcefulness, which the farmers well settled in the surrounding villages did not possess in necessary degree. This explains the low and very low cultivated area in 1951 immediately flanking the Saraswati river.

Immediately south of the above mentioned area, there is a belt of high, very high and average values, running parallel to the Saraswati river. The total cultivated area is clearly co-related here with the number of wells, the protection from uncontrolled annual flooding, average and high values of canal irrigated area and an old established agricultural occupation. The very large number of wells are easily co-related with the very high value of the total cultivated area. There is a very distinct positive correlation between the number of wells and the extent of total cultivated area, so much so that in villages having low value of

cultivated area, there may be either one or may not be a single well for irrigation. The development of of cultivated area and the increase in number of wells have gone paripassu. Not less striking than the convincing co-relation between the number of wells and extent of cultivated area in the fact of intra-regional differences within the same belt. There are some villages which have high cultivated area but a very small number of wells. These villages are located in the eastern jutting out portion. Such villages are Bibipurkalan, Tioher and Sainsa. In these villages the total area is very small hence the cultivated area with reference to number of farmers is also very small. Hence on the small holdings the farmers did not think it economical to dig wells for irrigation. Secondly, the flood irrigated area here is quite high, further the major crop in these villages during the kharif is paddy, which cannot be economically irrigated by wells.

The low value villages have neither well nor canal irrigated area. Besides well irrigation, canal irrigation is very highly co-related with the total cultivated area, so much so that in some villages, the low cultivated area coincides with low canal irrigated area.

The part of Naili located west of Anderwar Circle has patches of all the different values. This indicates a rapid spatial change of the

controlling factor of a regional dimension. The area of these villages is comparatively small and hence the total cultivated area tends to be large. However if these villages the farmers are very enterprising and even for small holdings, they have dug wells. Here again therefore the number of wells increases along with the increase of cultivated area. It is also interesting to note that in these villages, the flood irrigated area is either average or low and generally there is no flood irrigation at all. This also has encouraged the digging of a large number of wells. In this Western wedge also, there is a marked positive co-relation between the number of wells and the total cultivated area and there are no striking cases of anomaly. In one or two villages the number of wells is proportionally smaller, although the cultivated area is very high, this can easily be explained by the average value of flood irrigated area in some villages. In some villages the high cultivated area is due both to average flood irrigated area and a large number of wells. The flood irrigation encourages the cultivation of paddy crops and thus increases the kharif area while the well irrigation encourages extension of chilli area and thus increase in rabi area. Chilli itself has been encouraged by the proximity of Samana Mandi located across the the boundary in Patiala district.

1956 PATTERN.

The map of 1956 represents a marked contrast to that of 1951. The very high value villages are Shahpur, Bheriyan and Garhi Nazir and Bheriyan where irrigation has increased the proportion of cultivated area. In Bheriyan canal was a major source of irrigation and in Garhi Nazir the wells,

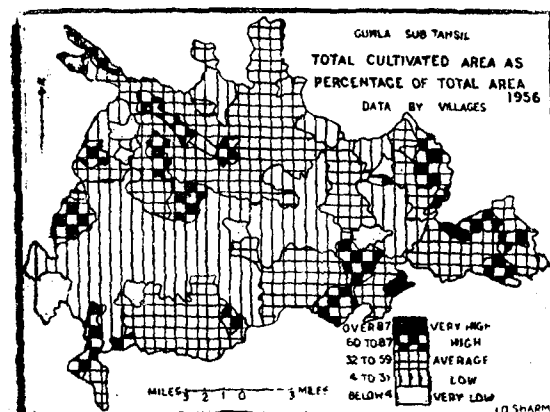


Fig. 7

CHANGES IN CULTIVATED AREA AND PERMANENT FALLOW LANDS 7 IN GUHLA SUB TEHSIL, HARYANA

In the village Shahpur the total area is small therefore it was economical to bring a large proportion of it under cultivation. All these villages show marked increase in the proportion of total cultivated area. In these villages, there was no allotment of land because all these three villages are small in total area, and no vacant culturable waste was available. Floods might have increased the cultivated area in Shahpur village, because flood that comes in the months of August and September almost dissipates itself by the time the rabi crops are sown providing a good ploughing condition in the soil for rabi crops. Hence it increases the proportion of cultivated area. In the months stated above flooding increases the proportion of rice cultivation in kharif and through it the cultivated area.

The high value areas are scattered on the map. Such villages are located in the eastern half and in the north-western part of the sub-tehsil. In the village, Kheri Seisgren, the high value of canal irrigation was an encouraging factor in increasing the proportion of cultivated area. Other villages of eastern part have been encouraged by average proportion of flood irrigation which gives favourable conditions to paddy and hence increases the proportion of kharif. All the villages of high value in the north-western part, except the village Sadar Heri, have been encouraged by an average proportion of flood irrigation and by very high proportion of well irrigation. In the village Sadar Heri, the canal irrigation was as encouraging factor. In the high value villages of Powad Circle, the only dominant factor in increasing the total cultivated area was well, as canal irrigation was not developed in the Powad Circle in the year 1956. These villages were also free

from flood. The increase in total cultivated areas was also due to the fact of reclamation because all these villages show sharp increase in its proportion. Though some of these villages such as Peedal, Saleempur and Seomajra show the same very high value in 1951, the value of high category ranges between 29 and 42 in 1951, which is between 60 and 87 in year 1961.

The value of average category stands at 46 which was 21 in the year 1951. In this average category most of the villages of the Sub-tehsil are included. All these villages are located either on the southern periphery of Naili Circle or are located in the Anderwar and in the Powad Circle. In the Anderwar and the Powad Circles, the long agricultural occupation and the provision of well irrigation have been responsible in increasing the proportion of cultivated area. The villages situated on the southern periphery of the Naili Circle were encouraged partly by canal irrigation and proximity of Kaithal market and partly due to the fact that in some villages there has been reclamation of land, because these villages show a sharp increase in the proportion of cultivated area. It is more than double of what it was in 1951.

The low value villages form a continuous long belt running from west to east almost in the centre of the sub-tehsil. All these villages are located in the Naili Circle. It is because of the fact that these villages show some increase but they do not show reclamation on large scale. These villages had the same low value in 1951. The low value here is also due to the fact that in these villages there is an almost complete absence of canal irrigation. No doubt canal irrigation shows increase in some other villages of Naili Circle in the year 1959. The well irrigation in many of these villages has only a low

value. Other low value villages are scattered in the northern part of the sub-tehsil. These all are the same villages as had the same low value in 1951. This shows a very small proportion of increase in total cultivated area, because the value of the low category is higher in 1956 than what it was in 1951. These villages are Bahpur, Kalsa, Adhoya and Bodha.

The very low value villages are scattered here and there on the map. Most of these villages are the names of the forests and pasture lands. Such villages are Kohli Khera, Theh Bersun and Theh Nazibulla. Other very low value villages such as Khark, Janedpur and Berad had only a very small proportion of cultivated area ranging from only 1 to 4. These villages do not show marked change because in these villages canal irrigation and well irrigation was practically absent. A very small proportion was only of Barani land.

1961 PATTERN.

The map of 1961 (Fig. 8) shows a marked contrast to that of 1956, because almost every village of the sub-tehsil shows increase in the proportion of cultivated area. It is due to the fact of reclamation and allotment of land to the immigrants.

In The very high value villages the factor of canal irrigation encouraged the increase in cultivated area. But in Bilochpura it is due to the fact that the total area of this village is very small, therefore only a small increase in

cultivated land, increased its proportion markedly. In the village Kakarala Gujran the marked increase is also due to the fact that there has been some reclamation of land. This village showed only a low value in 1956, and such a striking increase in cultivated land could not possibly be achieved by the already settled farmers in this village. The increase in cultivated land is certainly with the provision of canal irrigation because this village has high value of it in 1961 but shows absence of its proportion in 1956.

The high value villages are found scattered and also in small continuous patches in the eastern half of the sub-tehsil. In the east eastern half, all these villages have either average or high proportion of total irrigation in which the major proportion was of Canal irrigation.

It is partly due to an increase in canal irrigation and partly because of reclamation of land. Many of

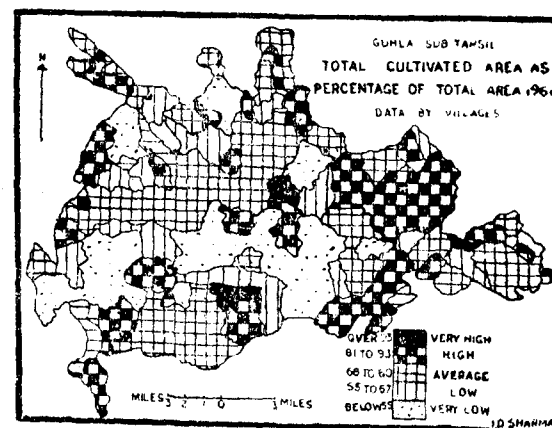


Fig. 8

these villages such as Saina Sadan and Zulmat show low and very low proportion of it in 1956, therefore, such a marked increase in cultivated land was undoubtedly due to reclamation. The high value villages located on the southern

periphery also show increase. It is partly due to increase in canal irrigation, and partly due to proximity to Kaithal market and facilities in transportation. Other high value villages are scattered here and there in the northern section of the sub-tehsil. The increase in cultivated land in these villages show absence of canal irrigation in 1956 but either average, or high value of it in 1961. The villages having this value in Powad Circle have been encouraged in this circle in 1961 and these villages also show the absence of flood. The digging of wells was encouraged by sufficiently high water table.

The average value areas include most of the villages of Anderwar and Powad Circles and many villages of Naili Circle. The Anderwar and Powad Circles do not show much change because the inhabitants of these circles have been in agricultural occupation since long. They had sufficient amount of cultivated area in 1951 and 1956. The villages of Naili Circle such as Pehowa, Adhoya, Kalsa and Urlana show an increase in total cultivated area. It is partly due to development in canal irrigation and partly due to allotment and reclamation of land. Other average value villages are more or less the same as were in 1956. No doubt these villages show an increase in cultivated land because the value of the average category stands at 74 in 1961 but it was 46 in the year 1956.

The low value villages are few in number. Many of these villages had the same low value in 1956. It shows a marked increase in cultivated land because the value of low category ranges between 55 to 67 in 1961 but it was between 4 to 31 in the year 1956. This increase in some of these villages is due to an increase in

total irrigation in which the major proportion was of canal irrigation. In some villages the total area was small, therefore only a small increase raised its proportion markedly. In the villages, the cultivated land has more or less remained the same. These villages show average value in 1956 which is only slightly less than the low value of 1961. It is because of the fact that there has been no reclamation of land in these villages and a small increase in cultivated land could be possible by already inhabited farmers in these villages with the provision of canal irrigation.

The very low value villages form a continuous belt in the central part of the sub-tehsil. Other very low value villages are scattered in the northern section. All these villages had low value in 1956. It is to be noted that though these villages do not show marked increase in cultivated land they do not show decrease at all, because the value of the low category ranges between 4 to 31 in 1956, it is below 55 and undoubtedly above 31 in the year 1961. Some part of the total area of these villages was still covered by forests in 1961.

In the villages situated in the western side of the sub-tehsil, there was no reclamation of land. That is why these villages do not show increase in cultivated land. Most of these villages show only a low proportion of well irrigation. Other, very low value villages are those in which the entire land is covered by forests. These forests have been acquired by Government for experiment purpose.

PERMANENT FALLOW LAND

In the category of permanent fallow land the following types of land have been included: (i) area

covered by forests; (ii) barren land; (iii) banjar land; and (iv) area covered by habitation, cremation ground, ponds and lakes.

because the number of farmers was very small. These villages had small number of houses ranging from 10 to 30 only. This is to be

1951 PATTERN

The map of 1951 shows that the very high value areas are scattered. They are all individual villages. In these villages there was no habitation in 1951. But these areas were given names by the surrounding inhabited villages of the sub-tehsil. In these villages the total cultivated area was 0. The entire land was lying as barren, banjar and forest. The permanent fallow land was used as pasture for the cattle of the surrounding villages.

The high value areas make a continuous elongated patch running from west to east. It also includes a few scattered villages. In all these villages the proportion of cultivated area was rather low. A large proportion of the total land of these villages was lying barren or banjar. Many of these villages are big in total area but had a small proportion of total cultivated area.

noted that all the high and very high value villages are in the Naili assessment circle. It shows that in 1951, a large part of the Naili circle was lying as permanent fallow land. It is because of the fact that in 1951 very few villages were inhabited in Naili circle, which is clear from the total population and the nutritional density of the same from the following table.

TABLE I.

Year	Total Population of Naili Circle.	Nutritional Density
1951	37431	173

Source: Census Office.

This low density of population in Naili Circle was responsible for a high and very high proportion of permanent fallow land. Since there was no pressure of population on land resources the farmers did not take initiative to reduce the proportion of permanent fallow land.

They could easily meet their demands from a small cultivated area.

The average value villages are found both scattered and in continuous patches. The value of the average stands at 79 for the sub-tehsil. In this category a few villages of Powad Circle and most

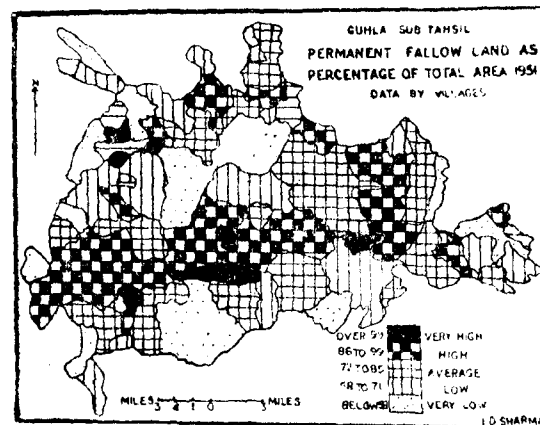


Fig. 9

CHANGES IN CULTIVATED AREA AND PERMANENT FALLOW LANDS 11 IN GUHLA SUB TEHSIL, HARYANA

of the village of the Naili Circle are included. This all speaks of instability of agricultural structure of the Naili Circle. Only that portion of land was under crops which was accessible for cultivation, though it was surrounded by barren, banjar and forest covered land.

The low value villages are more or less individual. They have either the peripheral location or are situated, in the Anderwar Circle, the low value is due to the fact that these villages have been in this profession since long. So it was beneficial for them to bring more of land under cultivation.

The very low value villages are situated in Anderwar and Powad Assessment Circles and some villages in the Naili Circle. In Powad and Anderwar Circle and in some villages of Naili Circle, the long period of cultivation was responsible in reducing the proportion of permanent fallow land. Other very low value villages are those which are very small in area ranging from 100 to 150 acres. So it was economical to bring a large proportion of it, under cultivation. This has reduced the percentage of permanent fallow land.

The high value villages have increased in number. It is clear from the map that the increase in number of villages of this value are in the neighbouring villages of the same value of 1951. The permanent fallow land has not increased in these villages. The high value of 1956 is nearly equal to the average value of 1951. So the proportion of the permanent fallow land has decreased in all these villages. This was all due to allotment and the reclamation of barren and banjar land to the immigrants. This land was brought under cultivation. All the high value villages are in Naili Circle. It is due to the fact that there was no immediate effect of reclamation order of the Punjab Government. The effect was gradual. So the villages of Naili Circle which show high value in 1951 also show the same value in 1956. Had there been any immediate effect of reclamation, these villages of Naili Circle would have shown low or very low values in 1956.

The average value villages have the peripheral location in the sub-tehsil. Most of the villages of the Anderwar and Powad circle and many villages of Naili circle are included in this category. The

1956 PATTERN.

The maps of 1956 displayed a marked contrast to that of 1951. The very high value villages are more or less the same. Some villages showed high value in 1951 but very high value in 1956. But it is to be noted that high and very high villages in 1951 were with reference to the average value of 79, and in 1956 with that of 54.

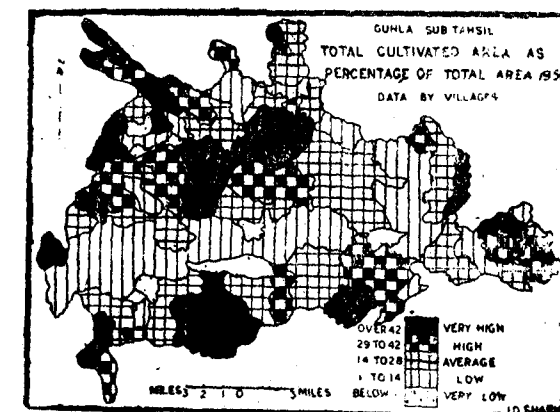


Fig. 10

value of the average for the sub-tehsil stands at 54. But it was 79 in the year 1951. So the sub-tehsil shows sharp decrease in the proportion of permanent fallow land, which is the consequent effect of Notification of Utilisation of Land Act by the Punjab Governments. All these villages had either very low or average values in 1951. It is again to be made clear that even the very low value villages of 1951, which have average value in 1956, show decrease in its percentage, through percentage decrease in such villages is small. Most of such villages are in Andwar Circle, and the village 'Sewan' of the Naili Circle. The cause of small proportion of decrease in these villages is that all of them had already sufficient amount of total cultivated area in 1951.

The low value villages are found scattered on the map. All these villages had either low, very low or average values in 1951. Here also, it is again to be noted that even the very low value villages of 1951, which show low value in 1956 reveal a decrease in the proportion of permanent fallow land. It can very well be made clear from the close comparison of the values of low and very low categories of both the year 1951 and 1956. The cause of decrease in the proportion of permanent fallow land is partly due to allotment of some land to a very few immigrants and partly due to that most of these villages are small in total area. So it was beneficial to bring more of the proportion of land under cultivation for the farmers already residing in these villages. The effect of all this is the decrease in the proportion of permanent fallow land.

The very low value villages are three in number. This is because of the fact that these villages had already large proportion of cultivated land. Because in 1951 a large part of the Naili Circle was lying as permanent fallow land.

1961 PATTERN.

The map of 1961 represents a marked contrast to that of 1956. The very high value villages show rapid increase in number. Most of these villages had either high or average values in 1956. All these villages are in Naili circle. It is due to the fact that a large proportion of allotted and reclaimed land belonged to Naili Circle. Because it showed high and very high values of permanent fallow land in 1951 and at the same time the very few number of farmers, as is revealed from density of population of this circle in 1951. In the year 1961, though these villages of Naili Circle show very high value it is with reference to the average value of 26 which was 54 in 1956. The increase in density of population which speaks of the immigrants of farmers has been responsible for reducing the proportion of permanent fallow land. It is clear from the following table.

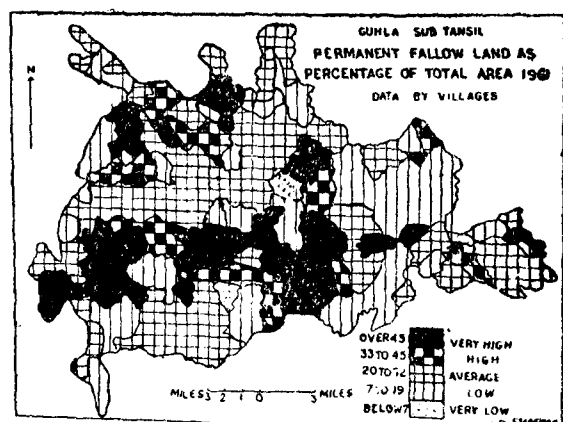


Fig. 11

CHANGES IN CULTIVATED AREA AND PERMANENT FALLOW LANDS IN GUHLA SUB TEHSIL, HARYANA

Table 2.

Year	Total Population of Naili Circle	Nutritional Density
1961	90057	416

Source: Census Office.

Here also it is to be noted that even the average value villages of 1956, which show very high value in 1961 reveal decrease in the proportion of permanent fallow land. It is due to the fact that the value of high category of 1956. Another fact becomes clear that such villages in 1961 show smaller percentage of decrease in permanent fallow land than those which had very high value in 1956 but very high in 1961. So from this we can have a comparative rough judgement of allotment and reclamation of land which was definitely larger in those villages which had the high and very high values in 1956 and high value in 1961 than those which had average value in 1956 but high value in 1961. Other very high value villages are more or less the same. These villages do not show any change, because in these villages the entire land is permanent fallow. These are also forests which have been acquired by the Government.

The high value villages are scattered here and there on the map. Most of these villages are in Naili Circle. All these villages had either average or high values in 1956. These villages show decrease in the percentage of permanent fallow land. Here also the same explanation holds good which is for the very high value villages. The only differences is that in these villages are proportion of allotted and reclaimed land was larger than the very high value villages. This can be made clear from the values of

categories of both the year 1956 and 1961. Here also a rough judgement of allotted land and reclaimed land can be made. Such land was larger in those villages which had high value in both years than those which had average value in 1956 but high in 1961. This is because the value of high category was more than double in 1956 than what it is in 1961.

The average value villages are found scattered and also in continuous small patches. Most of the villages of Andwar Circle and Powad Circle and many villages of Naili Circle are included in this category. Most of these villages had either average or low values in 1956. The villages which had the same average value in 1956 show decrease in the proportion of permanent fallow land because the value of the average of 1956 was double of what it is in 1961. But some do not show any change. These villages had low value in 1956. But average in 1961. And the average value of 1961 is equal to the low value of 1956 the average for the sub-tehsil stands at 26. But it was 54 in the year 1956. So the proportion of permanent fallow land was markedly decreased in the sub-tehsil in the year 1961.

The low value villages have peripheral location and few villages are in the centre of the sub-tehsil. All these villages had either high, average or low values in 1956. Most of these village are in Naili Circle. The cause of low value of permanent fallow land in these villages situated on the southern

Correlates

Ruggedness number is not independent of the factors affecting other parameters of drainage basins.

Ruggedness number being the product of drainage density and relative relief of the area increases as relief of the area increases. With the increase in relative relief drainage density also increases and thus results in an increase in ruggedness number.

Climate of the area also affects both directly and indirectly the values of ruggedness number. Rainfall affects directly. Increase in rainfall is correlated with increase in run-off, drainage density and ruggedness number.

Indirectly, climate affects ruggedness number through the moisture content of soil. In sandy areas soils are dry, percolation is large and thus, formation of new drainage lines is checked. Drainage density and ruggedness number decrease.

On the other hand clay being more moisture-retentive than sand, shows very soon the development of numerous small drainage lines which affect the ruggedness number.

Lithology of the area also affects ruggedness number. Ruggedness number is higher in compact sandstone areas than in clayey areas. Further, presence of sand in area suggests lower value of ruggedness number. In compact sandstone areas or igneous rock areas power of resistance is larger. It checks free-fall of rocks and thus, the area comprised of hard rocks becomes higher than the surrounding areas of clayey or sand material which can be easily

eroded. As the height of area increases, drainage development also increases further, finally resulting in an increase in the values of ruggedness number.

In sandy areas which can be easily eroded and flattened by the running water ruggedness number decreases with the decrease in the relative relief of area.

Following table shows the correlations between ruggedness number and other terrain parameters.

TABLE

Basin Parameters	Correlations Coefficients (r)
Basin Area	-0.43
Basin Circularity Ratio	-0.07
Stream Length	-0.25
Bifurcation Ratio	-0.44
Drainage Density	+0.83
Drainage Texture	+0.55
Stream Frequency	-0.03
Length Ratio	-0.16

The table reveals that ruggedness number is positively correlated with drainage density ($r = +0.83$) and drainage texture ($r = +0.55$). All these three parameters are positively interrelated with each other. Further ruggedness number is negatively correlated with bifurcation ratio ($r = -0.44$) and basin areas ($r = -0.43$).

Other parameters are weakly correlated with ruggedness number. This is due to the variations in structure and lithology.

REGIONAL DISTRIBUTION OF RUGGEDNESS NUMBER

Values of ruggedness number in the Study Area display large spatial variations which are associated with these of slope, lithology, and

RUGGEDNESS NUMBER AS A PARAMETER IN TERRAIN REGIONALIZATION A CASE STUDY OF HOSHIARPUR KANGRA TRACT

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relative relief. The values of ruggedness number are higher in the lower Himalaya, moderate in the Siwalik Hills, and lower in the Dun tract.

I. SECOND-ORDER DRAINAGE BASINS (Fig. 2)

(a) Regions of Higher Values

(More than 2500)*

Regions of higher values of ruggedness number are mostly concentrated in the Lower Himalaya along the Bharwain-Dheonsar Anticline. These regions are mostly concentrated on the steep slopes and in areas of relatively higher relief. Beginning from the north-eastern corner of the Study Area along Bharwain-Dheonsar Anticline upto Rajpura (D46R, 43N)** the values of ruggedness number range between 2500 and 4500.

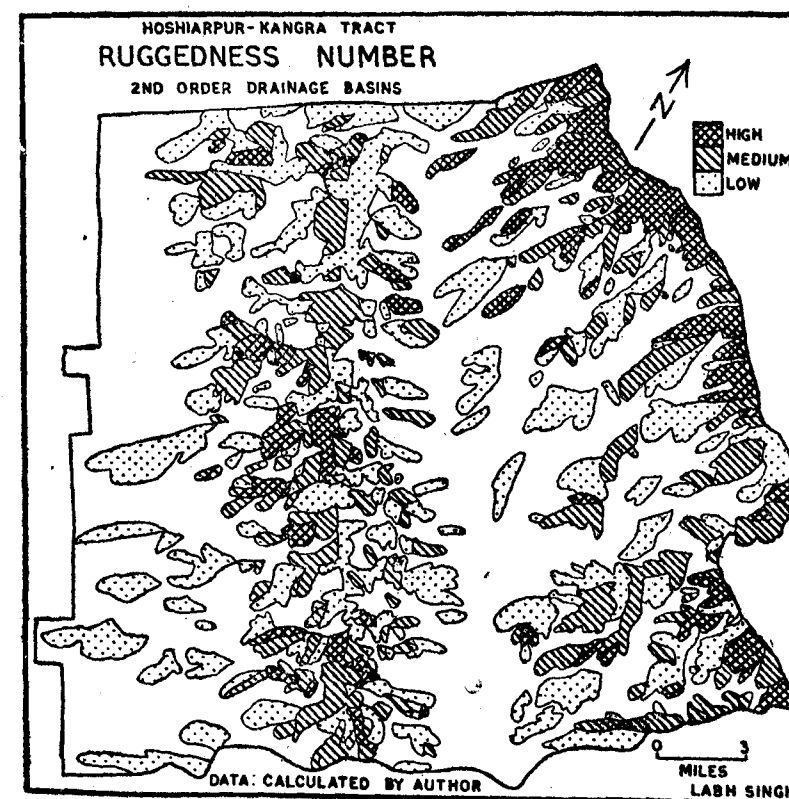


Fig. 2

The second region of such higher values begins from a basin about two miles in the south-east, and runs along the anticline covering an area of about 7 and 8 square

miles in the form of a strip. Other patches are found in the south-eastern corner of the Study Area where the values range between 2500 and 8600.

* Units of Ruggedness.

** Grid Reference D X 000 E, X 000 N Yards.

On the Soan valley-fill material there are a few small areas of higher values of ruggedness number which are mostly concentrated along the scarps. They are found along the Gubri-Khad, Barera Khad, Kajani-Ki-Khad, Sunkaliwali-Khad, south-west of Baroh (D31E, 41N) north of Pandogha (D45E, 13N) and north-east of Ispur (D45E, 10N).

In the Siwalik Hills regions of higher values of ruggedness number are concentrated mostly on steep slopes, scarps, badland topography, and relatively high relief which are favourable conditions for the development of drainage lines. Such areas are found between Mangl Hill Station (D33E, 21N) and Mangewal (D28E, 25N) along the Janauri Anticline and south of it in a semi-circular shape, around Bankhandi Rest House (D40E, 13N) and along the anticline near it, then south of Bankhandi Rest House along the anticline. Here the values of ruggedness number range between 2500 and 5400. Other areas of higher values are concentrated in the north and north-western corner of the Study Area.

There is no such area of higher values in the Hill-foot dissected plains.

(b) *Regions of Moderate Values* (1500 to 2500).

Regions of moderate values of ruggedness number are found on the areas having relatively moderate slopes and moderate relief values range between 1500 and 2500.

In the Siwalik Hills there lies a belt of moderate values on both sides of Janauri Anticline. This belt is disrupted at a few places by higher value areas. This belt covers almost the whole of the Siwalik Hills.

In the Lower Himalaya the regions of moderate values of ruggedness number are concentrated to the south of Bharwain-Dheonsar Anticline almost along all the tributaries falling into the Soan river. Slopes are moderately steep, and relief is relatively moderate.

In Dun tract moderate values are found interrupted by only few areas of higher or lower ruggedness number.

In the Hill-foot dissected plains moderate values are concentrated east of Hoshiarpur and along the tributaries of Janauri-wali-Khad.

(c) *Regions of Lower Values* (Less than 1500)

Regions of lower values of ruggedness number are concentrated mainly on the areas where the slopes are gentle, relief is very low, and topography is essentially comprised of sand. Such values can also be found on the flat-topped hills where the slopes are gentle.

In the Hill-foot dissected plains the values of ruggedness number are lower, ranging between 0 and 500. Almost all along the choes flowing through this region lower values are characteristic. There are a few regions of lower values in the Siwalik Hills in the northern part of the Study Area. Here the Siwalik Hills are flat with gentle slopes which restrict the development of new drainage lines.

In the Dun tract one area of lower value lies near the water-divide of Sdhan Nadi and Soan river. Here the values are found 390. Another area lies on the left bank of Sunkaliwali Khad. There are other areas on the right bank of Soan river where the values

of ruggedness number range from 300 to 500.

II. *THIRD-ORDER DRAINAGE BASINS* (Fig. 3)

In the third-order drainage basins regional distribution of ruggedness number resembles the second-order drainage basins. Higher values are concentrated in the Lower Himalaya, moderate in the Siwalik Hills, and lower in the Hill-foot dissected plains.

Thus, to summarise, higher values of ruggedness are concentrated in the Lower Himalaya, moderate in the Siwalik Hills, Lower in the Hill-foot dissected plains and the Dun tract.

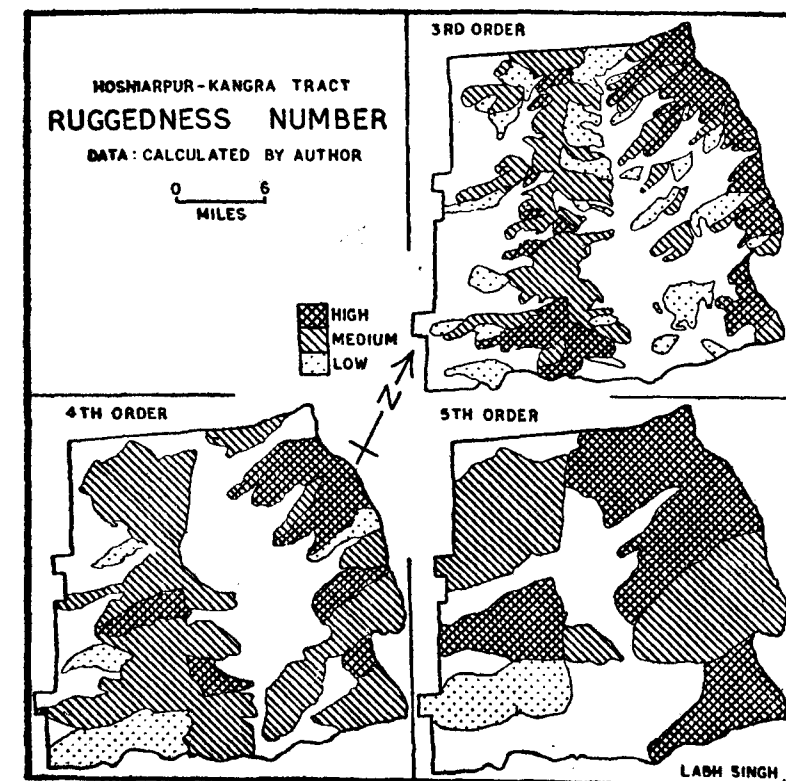


Fig. 3

(a) *Regions of Higher Values* (More than 3500)

Regions of higher values of ruggedness number are concentrated in the Lower Himalaya. The belt extends for one to four miles to south of Bharwain-Dheonsar Anticline. Although this belt is broken at four places by the drainage basins of moderate values this belt seems to be continuous. Relative relief is high and slopes are steep which result in such higher

values of 3500 to 5580. The extensions of these higher values of ruggedness cover some portion of the Dun tract in the north-eastern corner of the Study Area.

In the Siwalik Hills the regions of higher values are concentrated between Mangl Hill Station (D33E, 21N) and Mangewal (D28E, 25N). The steep slopes with underlying clayey material help in the development of drainage and thus, increase the values of ruggedness.

Another area lies in the southern portion of the Study Area which spreads on both sides of Janauri Anticline. Values here range between 3622 and 6882. This area covers some portions of Hill-foot dissected plains also. There are two small areas; south of Mahaguruwai (D23E, 28N) where the values are 4240 and to the south of Bahera (D22E, 40N) where values of ruggedness number are around 3672.

(b) *Regions of Moderate Values*
(2000 to 3500)

The regions of moderate values of ruggedness number are found concentrated on moderately steep slopes and moderately high relief areas.

In the Siwalik Hills beginning from Bankhandi Rest House (D40E, 13N) there is a continuous belt of moderate values upto the northern end of the Study Area. This belt stretches on both sides of the Janauri Anticline. Here values range between 500 and 3500. Such values are mostly found on the moderate slopes.

In the Lower Himalaya and the Dun tract these regions of moderate values of ruggedness number cover almost all the third-order drainage basin areas of tributaries falling into the Soan river.

In the Hill-foot dissected plains regions of moderate values are concentrated along Dungi-Chou, Patariwali-Khad, and some area lying to the east of Mahlanwali (D28E, 09N).

(c) *Regions of Lower Values*
(Less than 2000)

Regions of lower values of ruggedness number are concentrated mostly in the Hill-foot

dissected plains, where the slopes are very gentle. Relative relief is very low and the underlying material is sand which checks the development of gully erosion and thus decreases the value of ruggedness number.

These regions of lower value are along the tributaries of Rajni-Devi-Chou, south of Mahlanwali (D28E, 09N) and in the east of Janauri town (D16E, 35N).

Thus, higher values of ruggedness number are found in the Lower Himalaya, moderate in the Siwalik Hills and Dun tract, and lower in the Hill-foot dissected plains.

III. *Fourth-Order Drainage Basins*
(Fig. 3)

In the fourth drainage basins the regional distribution of ruggedness number resembles same distributional pattern as in the third and second-order drainage basin areas.

(a) *Regions of Higher Values*
(More than 4000)

Regions of higher values of ruggedness number are concentrated in the Lower Himalaya. One of the most prominent area lies in the north-eastern corner of the Study Area. This area is surrounded by Nari Nauranga (D45E, 36N), Baroh (D31E, 44N), Dharmsal (D35E, 50N), Bharwain (D40E, 47N) and Rajpura (D46E, 43N). Here values range between 4008 and 7784.

There are two other areas in the Lower Himalaya. One along the tributaries of Ambwali Khad and another along one tributary of Barera Khad.

In the Siwalik Hills one area lies between Mangl Hill Station Hills (D33E, 21N) and Mangewal (D28E, 25N). It stretches towards south from the Janauri-Anticline.

Another area lies between Nanguli (D42, 17N) and Bahera (D22E, 40N) and stretches towards the Dun tract from the Janauri Anticline. The values in both areas range between 5112 and 5704.

(b) *Regions of Moderate Values*
(1000 to 4000)

Regions of moderate values in the Lower Himalaya cover fourth-order drainage basins of Barera Khad, Garni Khad, Saherian-Di-Khad and a tributary of Panjea-Ki-Khad. There is another area which lies to the east of Mubarkpur (D37E, 36N) and Kharal Muhali (D37E, 47N) and stretches in north-west direction. Values here are around 3737.

In the Dun tract there are two regions of moderate values of ruggedness number, one lies along the water-divide of Soan river and Sdhan Nadi and another covers the drainage basin area of Gubri Khad and its adjacent small tributaries of Soan river.

In the Siwalik Hills there is a belt of moderate values of ruggedness number which begins along the Janauri Anticline from the south of the Study Area and ends in the north of Study Area. Here the values range between 1000 and 4000.

(c) *Regions of Lower Values*
(Less than 1000)

Regions of lower values of ruggedness are found mostly on the gently sloping, sandy, and low relief areas. Such areas are mostly concentrated in the Hill-foot dissected plains along Rajni-Devi-Chou, Dungi Chou, and a drainage basin area south of Mahaguruwai

(D23E, 28N). In these areas values of ruggedness number range between 259 and 597.

One area of such lower values lies in the Lower Himalaya where the slopes are relatively moderate, drainage net-work is not so developed, and relief is low. Here the values are 896, slightly higher than in the Hill-foot dissected plains. In conclusion, values of ruggedness number are higher in the Lower Himalaya, moderate in the Siwalik Hills, and lower in the Hill-foot dissected plains.

IV. *FIFTH-ORDER DRAINAGE BASIN* (Fig. 3)

In fifth-order drainage basin the ruggedness number is higher in the Lower Himalaya ranging between 3252 and 8085 and moderate in the Siwalik Hills ranging between 259 and 2980. In fact the Dun tract and the Hill-foot dissected plains both are covered by these fifth-order drainage basins.

To sum up, ruggedness number is higher in the Lower Himalaya, moderate in the Siwalik Hills and lower in Hill-foot dissected plains and the Dun tract. These are associated with the geology, slopes, relief and drainage density of the Study Area.

ACKNOWLEDGEMENT

The author is highly grateful to his teachers Dr A. B. Mukerji, Ph.D. (Louisiana), Reader in Geography, Panjab University, Chandigarh, for supervising the research incorporated in the paper, and Professor G. S. Gosal, Ph.D (Wisconsin), Head of the Geography Department, Panjab University, Chandigarh, for encouragement and for liberal facilities.

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REGIONAL CONTRASTS IN DISTRIBUTION, DENSITY AND RELATIVE STRENGTH OF SCHEDULED CASTE POPULATION IN ANDHRA PRADESH

by

A. B. Mukerji*

Introduction

No one, with even a superficial familiarity with the country will controvert the assertion that no element so nearly completely dominates the fabric of the life of the Indian nation in all its multitudinous aspects as the caste system. Resisting and eluding all efforts at transformation on the caste system has displayed a remarkable persistence through all the historical periods beginning right from the Vedic Age. This then is one permanent feature of Indian society. Surviving all the onslaughts of history, legislation, and zealous reformation the caste system reappears phoenix-like, rejuvenated and in still more attractive forms attained through partially understood in-built techniques.

Although through long periods of evolution the higher castes have appropriated to themselves a major part of power, wealth, and prestige, it is the lower castes who have played the negative roles of friction and drag in the overall development of society in particular regions, notwithstanding their supplementary contributions to the social economy. Not less intriguing and anomalous is the correspondence of many areas of high levels of agricultural prosperity and productivity and the high proportion of scheduled caste population. The creators of wealth are themselves the poorest in the areas of richers. Scheduled caste members

had been made use of for the economic uplift and well-being of higher castes in society.¹ Hence the imbalance in the development of different sections of society. Any study of this condition must logically begin with fundamental questions—where are the scheduled caste groups concentrated, in what numbers, in what relative numerical strength and with what areal association? The actual numbers, the relative proportion, and the density of the scheduled caste population are of great importance in the understanding of the socioeconomic character of areas.

Problem of Definition

If permanent ritual pollution were to be accepted as the sole criterion for the identification and labelling of a particular group of people in India as scheduled castes their numbers would have been much less, and still limited would be the purpose, scope, and utility of the studies made on their salient attributes. But a Scheduled caste person is not necessarily an untouchable. A vast number, almost a legion of castes are included in the group of scheduled caste people.

It is ironical that the Constitution of India which lays down the rules for providing special privileges to the Scheduled Castes has not formulated any criterion or criteria for their identification and definition. Article 341, Part XVI, pp.

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1. Report of the Committee on Untouchability, Economic and Educational Development of the scheduled castes and connected Documents, 1960, p. 103, Govt. of India, Manager of Publications, Delhi, 1969.

181 and 182 of the Constitution of India² simply states "The President may with respect to any state or Union Territory, and where it is a state, after consultation with Governor thereof, by public notification specify the castes, races or tribes or parts of or groups within

castes, races or tribes which shall for purposes of this constitution be deemed to be Scheduled Castes in relation to that State or Union Territory, as the case may be". Rao³ also asserts that the scheduled castes; races or tribes or parts of a groups within castes, races or

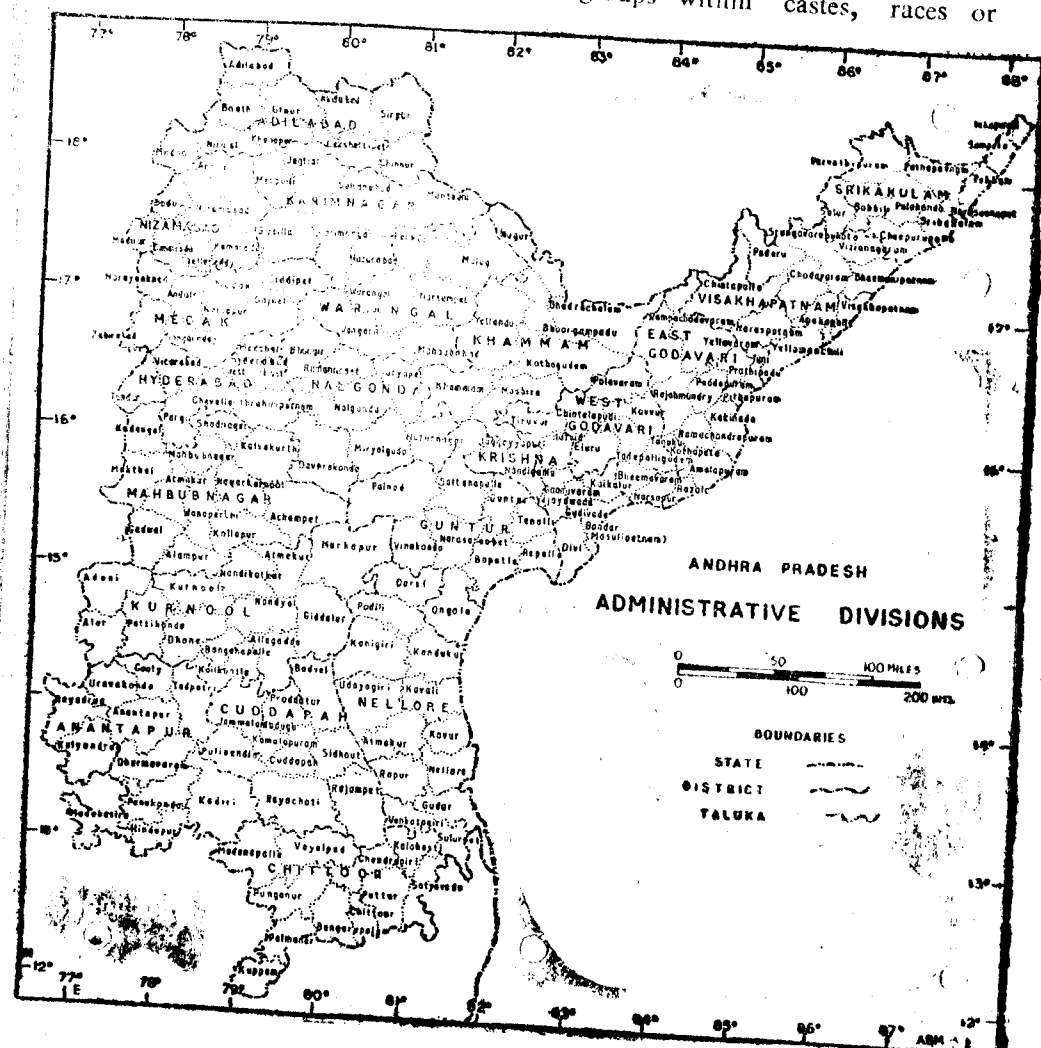


Fig. 1.

2. The Constitution of India (As modified upto 1st July, 1960) (1961), Delhi Government of India Press.
3. Rao B.S. (1968). The Framing of India's Constitution, Nasik: Govt. of India Press, p. 765.

tribes as were recognised as such under the Government of India Act, 1935. Further, in his classic *Caste, Class and Occupation*, Ghurye⁴ (p. 213) also treats the scheduled castes as those groups which are named in the scheduled castes order in force for the time being. Obviously, there is a great deal of divergence in the criteria involved in the country, in the region and even in the district. Be that as it may, scheduled castes are legally defined; while, socially meaningful and economically expressive are the terms untouchable and depressed class respectively. In geographical studies of number, distribution, and density, the scheduled caste population as defined legally contributes most significantly to the comprehension of character of areas through its social, cultural, historical, political, and economic associations. It is the intent of this paper to explore these apparent and hidden lineaments in the context of attributes of areas.

Data and Mapping

The paper utilizes the data of the number of scheduled caste persons provided by the relevant volumes of *Census of India of 1961*^{5,6}. Three maps with data plotted in the constituent *taluks*⁷ have been prepared. These portray the actual distributional pattern of the absolute numbers of the scheduled caste persons, their density (per sq. mile), and their proportion in the total population. In addition, five tables provide the interdistrict variations in the

absolute numbers of general, rural and urban scheduled caste persons, and their proportions, their rural-urban composition, and their density. It is on the pattern portrayed on the maps and summarised in the tables that the entire discussion comprised of description and interpretation are based.

Gross Pattern.

With a population of 4,973,616 of scheduled cast persons Andhra Pradesh ranks fifth among the States of India. About 8.0% of scheduled caste population of India has been enumerated in the State. Both in the state and India, the proportions of scheduled caste population in the total population are practically similar at 13.82% and 14% respectively. In terms of proportion the rank of Andhra Pradesh among the States of the country is rather low. It needs to be pointed out that the ranges of interstate variations in the absolute numbers (from the minimum of 5,68,61 in Pondicherry to the maximum of 15,41,245 in Uttar Pradesh) and of proportions in India's total scheduled caste population (from the minimum of 0.08% in Pondicherry to the maximum of 24.0% in Uttar Pradesh) are much more striking than that of proportions in the total population (from the minimum of 6.5% in Assam to the maximum of 20.8% in Uttar Pradesh).

While the number of Scheduled caste persons in India increased by 13.5 million during 1951-1961 through 26%, in the state of

4. Ghurye, G. S. (1961) *Caste, Class and Occupation*, Bombay: Popular Book Depot.
5. Census of India, 1961, Vol. II, Andhra Pradesh, Part II-A General Population Tables, 1963, Delhi, Manager of Publications.
6. Census of India, Paper 1 of 1962, 1961 Census, Final Population Totals, Delhi Manager of Publications.
7. Taluks are smaller administrative and revenue sub-divisions forming a district.

Andhra Pradesh the increase was of 5,90,424 persons through 13% only. The low rate of growth in the state is due to conversion of scheduled caste persons to Buddhism, Islam, and Christianity; migration of these persons from the state to other comparatively developed states for employment; and faulty enumeration in the Census⁸.

In the State of Andhra Pradesh, however, the inter-

district variation in absolute numbers range from the minimum of 1,42,954 in Khammam to the maximum of 4,59,656 in East Godavari and does not parallel the range of India. On the other hand, the proportion of scheduled caste persons in the total generation population displays a striking range from the minimum of 5.24% in Guntur to 32.92% in Nellore, which is a difference of 26.68% as compared to 14.3% for India.

TABLE 1*

Number of Scheduled Caste Persons

Areas	Rural	Urban	Total
India ...	57,611,465	6,899,848	64,511,313
Andhra Pradesh ...	4,421,528	552,008	4,978,616
Srikakulam Dist. ...	2,03,192	17,575	2,20,767
Visakhapatnam Dist. ...	1,52,048	32,998	1,85,046
East Godavari „ ...	4,13,521	46,135	4,59,656
West Godavari Dist. ...	2,79,604	24,974	3,04,578
Krishna Dist. ...	1,97,704	25,628	2,23,332
Guntur Dist. ...	1,37,213	20,637	1,57,850
Nellore Dist. ...	3,18,165	17,161	3,35,326
Chittoor Dist. ...	3,24,780	15,354	3,40,134
Cuddapah Dist. ...	1,39,254	9,371	1,48,619
Ananthapur Dist. ...	2,13,833	22,452	2,36,285
Kurnool Dist. ...	1,67,132	28,952	1,96,084
Mahbubnagar Dist. ...	2,76,716	15,162	2,91,878
Hyderabad Dist. ...	1,72,172	1,54,136	3,26,308
Medak Dist. ...	2,00,300	9,059	2,09,359
Nizamabad Dist. ...	1,49,135	13,969	1,63,104
Adilabad Dist. ...	1,64,193	22,931	1,87,124
Karimnagar Dist. ...	3,03,601	11,662	3,15,263
Warangal Dist. ...	2,33,010	27,493	2,60,503
Khammam Dist. ...	1,22,055	20,899	1,42,954
Nalgonda Dist. ...	2,53,909	15,540	2,69,449

*Extracted from Census of India 1961, Vol. II. Andhra Pradesh, Part II-A, General Population Tables, 1963, Delhi Manager of publications, pp. 192-205.

8. This has also been suggested in the Annual Report of the Commissioner for Scheduled Tribes for the Year 1963-64, Delhi, Manager of Publications.

The preceeding table reveals that the variation in the urban scheduled caste population is impressive, ranging as it does, from the minimum of 9,059 in Medak to the maximum of 1,54,136 in Hyderabad. In the latter district about 62% of the total population is urban. Such a large concentration of population in a huge urban

tract creates and sustains a correspondingly large employment complex of menial, domestic, and miscellaneous services with which as with many other Scheduled castes have been traditionally associated, particularly in the recent past when population was steadily becoming urbanized.

TABLE 2

Density of Scheduled Caste Persons per Sq. mile

Areas	
Andhra Pradesh	47
Srikakulam District	57
Visakhapatnam District	35
East Godavari District	110
West Godavari District	101
Nellore District	42
Chittoor District	58
Krishna District	66
Cuddapah District	25
Guntur District	27
Kurnool District	21
Anantapur District	30
Hyderabad District	109
Mahbubnagar District	40
Nizamabad District	52
Medak District	57
Karimnagar District	68
Adilabad District	29
Khammam District	23
Warangal District	52
Nalgonda District	49

Data provided by the source referred to in Table-I.

TABLE 3

Percentage of Scheduled Caste persons in Total population*

Areas	General	Correlation Ranks	Rural	Urban
India	14.00		16.2	8.7
Andhra Pradesh	13.82		15.0	8.0
Srikakulam District	9.81	18	9.0	8.0
Visakhapatnam District	8.07	19	8.0	8.0
East Godavari District	17.54	7	19.0	4.7
West Godavari District	15.39	12	17.0	8.0
Krishna District	11.23	15	12.0	5.2
Guntur District	5.24	20	6.0	3.3
Nellore District	32.92	1	17.0	8.0
Chittoor District	17.76	6	19.0	7.0
Cuddapah District	11.07	16	11.8	5.2
Anantapur District	13.36	14	14.6	7.2
Kurnool District	10.27	17	10.8	7.9
Mahbubnagar District	18.34	4	19.4	9.5
Hyderabad District	15.81	11	22.6	12.1
Medak District	18.05	5	17.7	9.6
Nizamabad District	15.95	10	17.5	9.4
Adilabad District	18.54	3	19.2	14.6
Karimnagar District	20.05	2	20.1	10.8
Warangal District	16.85	9	17.6	12.6
Khammam District	13.51	13	13.1	16.2
Nalgonda District	17.10	8	17.8	10.6

In India, the scheduled caste population forms 14% of the total population, and this is almost equal to that of 13.82% of A. P. (Andhra Pradesh). Within the state the interdistrict variation from the minimum of 5.24% in Guntur to the maximum of 32.92% in Nellore is highly impressive. It is this variation that prompts the exploration

into the operation of spatial correlates.

Equally marked and considerably significant in the characterisation of the areas are the inter-district variations of the proportions of the rural scheduled caste population in rural population, and of the urban scheduled caste population in urban

*These percentages refer to the proportions of general Sc. Caste population in general pop., rural Sc. C. pop. in rural pop. and urban Sc. C. pop. in urban pop. computed from data provided by the Source referred to in Table I.

population; the former ranging from the minimum of 6.0% in Guntur to the maximum of 22.6% in Hyderabad, and the latter from the minimum of 3.3% in Guntur to the maximum of 16.2% in Khammam. Since most of the scheduled caste persons are traditionally ruralities the variations in the general and rural proportions bear close correspondence, while the range in urban proportion is smaller. It is interesting to note that Guntur district has the lowest proportions in all, general rural, and urban populations. This may be explained by the fact of a very high proportion of 13.4% of Christians in total population of the district as compared to 4.0% of the state. About 30% of the Christian population of the state is concentrated in this district. Further, the proportion of 8.6% of Muslim population in the total population of the district is also slightly higher than that of 7.6% of the State. Most of these Christians and Muslims are converts from the scheduled caste groups originally included in the Hindu communities⁹. After conversion these groups lost their scheduled caste identity and were permanently absorbed in Christian and Muslim communities who, completely in theory and mostly in practice,

believe in and conduct their mode of living in accordance with the principles of social egalitarianism. The extent of proselytizing activities and its effect in drastically reducing the proportion and number of scheduled caste population in the district are further evidenced by the fact that the proportion of Scheduled caste population in the Hindu population is also similarly low at 6.7%, although the proportion of the latter in the total population is as high as about 77%. In particular, the areas having low proportions of Christians and Scheduled tribes in the total population reveal a high proportion of scheduled caste population.

On the other hand, in areas such as parts of Telengana where the original Muslims¹⁰ have been living in large numbers in both the rural and urban areas display high proportions of scheduled castes. Obviously, conversion has not been an extensively operating social process here. At the same time there has been considerable movement of the Scheduled castes into these areas to get employed as agricultural labourers and domestic works in the Muslim land-lor, families who have needed them to work on their large holdings¹¹. A large part of Telengana was jagirdari land held by absentee and

9. Guntur has been the centre of considerable proselytization and missionary activities conducted by American Evangelical Lutheran Mission since the mid-19th Century (vide The Imperial Gazetteer of India, Vol. XII, p. 390; Oxford: Clarendon Press, 1908). In general, throughout the country as in the state, the most intensive Christian conversion activities were carried on in 18th, 19th and early 20th centuries A.D., while conversion of Hindus to Muslim faith was largely restricted to the later centuries of Moghul period. Thus, as between the Christian and Muslim conversion processes the former has been of greater consequence in explaining the present distributional patterns of scheduled castes and of religion groups. The motive behind conversion of scheduled castes to other religions was to attain freedom from social disabilities, and a rise in social status.

10. As distinguished from the converts.

11. Compared to the net area sown per cultivator, 3.6 and 3.8 acres of Andhra Pradesh and the State respectively that of Telengana works out to be larger at 4.1 acres (Computed from data provided in Statistical Abstract of Andhra Pradesh, 1962, Hyderabad: Govt. Press, p. 55).

non-cultivating Muslim jagirdar¹², who maintained a large retinue of domestic workers bound to their masters through family tradition than merely by the pittance of wage.

TABLE 4*

Rural-Urban Composition of Scheduled Caste Persons Percentage to total scheduled caste population.

	Rural	Urban
India	89.3	10.7
Andhra Pradesh	89	11
1. Srikakulam District	92	8
2. Visakhapatnam District	82	18
3. East Godavari District	90	10
4. West Godavari District	92	8
5. Krishna District	89	11
6. Guntur District	87	13
7. Nellore District	95	5
8. Chittoor District	96	4
9. Cuddapah District	94	6
10. Anantapur District	91	9
11. Mahbubnagar District	95	5
12. Kurnool District	86	14
13. Hyderabad District	53	47
14. Medak District	96	4
15. Nizambad District	92	8
16. Adilabad District	88	12
17. Karimnagar District	97	3
18. Warangal District	90	10
19. Khammam District	86	14
20. Nalgonda District	95	5

Essentially rural in nature, both to the strength of tradition and the forces of economic necessities the rural scheduled caste population forms 89% of the total Scheduled Caste population in the State. In the rural areas the illiterate scheduled caste persons have been forced by tradition to maintain their identity separate from other caste groups, to be employed in menial

and domestic activities, and as landless agricultural labourers. Even though landless, the bonds of land cannot be broken. Poor and illiterate, the Scheduled Caste person is perpetually dragged down by the whirlpool of his own existence. Vast employment opportunities and expanding economic horizons in the growing urban areas are beyond his grasp. Literacy, skill, and money needed for an initial investment in settling permanently in the urban areas are all lacking among these depressed groups. Hence, these people have to remain, perforce, confined within the rural realms. On the other hand, in the urban areas, tradition is losing its strong hold, and social segregation is being fed increasingly by economic status rather than by the accidents of birth and caste. The overwhelmingly rural component of the scheduled caste population, therefore is to be comprehended in terms of tradition - reinforced attachment to land, cultivation, and villages, and castewise segregation on the one hand; and the demands of urban living which it cannot fulfil on the other.

It may be pointed out that the rural numerical supremacy of the scheduled caste population in Andhra Pradesh is just about equal to that of India. Because it is uniformly overwhelmingly rural, the proportion of the rural component of the scheduled caste population in its own total displays very little inter-district variation. Excepting Hyderabad with 53% of its scheduled caste population enumerated are rural, in all other districts the proportions are more than 80%. In as many as thirteen

districts the proportions are even more than 90%, with the highest of 97% occurring in Karimnagar. These data provide the strongest possible evidence of the existence of the favourable functional lineaments in the rural areas, where the Scheduled Caste population can continue to reside permanently.

The fact that about 11% of the total scheduled caste population is urban is to be given some consideration, as it is slightly higher than the Indian figure of 10%. If we follow up the suggestion that the basal stratum of the scheduled caste population is overwhelmingly rural, it is immediately apparent that the urban scheduled caste was derived, to a very large extent, if not in its entirety, from the rural areas. Further, regardless of the severe strains and handicaps in urban living, the rural scheduled caste population has tended to move into the urban areas in families, a suggestion supported by the fact that the sex ratio of 974 of urban scheduled caste population is higher than that of 955 of urban general population. In as many as seventeen districts (out of twenty districts comprising the State) the sex ratio of urban scheduled caste population is much higher than the figures of the urban general population. A large volume of migration of the rural scheduled caste population, and in families to the urban areas is, thus, reasonably well established. The movement of the Scheduled Caste persons to the other States is much more voluminous than their re-distribution within the state which is generated and sustained essentially by their search for new land and/or opportunities in agricultural labour employment. Among the Scheduled Castes, persons shown as landholders, 51.5% have holdings of less than 2.5 acres, and therefore all practical purposes they may

be treated as landless workers. The hunger for land among the scheduled caste persons is much greater than among the general population, but practically no land is available for allotting it to them. Only about 3,720 acres of land were distributed among the landless agricultural labourers in 1966-1967. This was the maximum that could be done despite the notification issued in 1958 by the state government directing the village officers to reserve only 5% of the cultivable (but not cultivated) areas as *garan* (pasture land) and to throw open the surplus land thus made available for allotment to the scheduled caste agricultural workers. Further the Scheduled caste people want to move from one rural area to another only when land is allotted to at least 50 of their families for cultivation and residential purposes. In addition they also demand taccavi loans, implements, and irrigation facilities. It has not at all been possible for the government to fulfil these demands and hence, the component of rural to rural migration generated by the hunger for land and its satisfaction has been of small dimension and consequence. It is encouraged and sustained by a large need of labourers in construction activities in the developing areas, also in miscellaneous services and domestic and menial works. Also, the high sex ratio and family migration points to the availability of permanent occupations. Cheap labour is provided by the illiterate and unskilled scheduled caste persons flocking in from the rural areas. After 1947, there has been considerable rural to urban migration of scheduled caste persons following that of general population. However, notwithstanding the increasing employment opportunities occurring in urban areas and the volume of migration so initiated, the scheduled caste person is basically a ruralite, and

*Computed from data provided by the source referred to in Table I.

12. Immediately before the abolition of Jagirdari in 1949, about 36% of the total area of Telengana was occupied by the Jagirs (vide Economic and Social Effects of Jagirdari Abolition and Land Reforms in Hyderabad, A.M. Khuro, 1958, Hyderabad; Osmania University, p. 2).

TABLE 5

Culture Areas/Attributes	Telengana	Rayalseema	Andhra Coast
Total Scheduled Caste population	21,65,942	9,21,119	18,86,555
Density of Scheduled Caste persons per sq. mile	49.0	32.0	56.0
Percentage of Scheduled Caste population in total population,	17.1	13.2	11.5
Percentage of Scheduled Caste Population in Total Scheduled Caste population of the State	43.6	10.8	45.6
Percentage of Rural Scheduled Caste population in Rural population	10.9	14.4	12.5
Percentage of Union Scheduled Caste Population in Urban Population.	11.9	7.1	6.8
Percentage of Rural Scheduled Caste population in total Scheduled Caste population.	86.5	91.7	95.5
Percentage of Urban Scheduled caste population in Total Scheduled Caste population.	13.5	8.3	4.5
Average Scheduled Caste population per district.	2,40,660	2,30,279	2,69,508

even when he temporarily migrates to urban places, his roots are still retained in the rural areas.

It is already apparent from the preceding discussions that the gross pattern of the state can be immediately resolved into three sharply differentiated area-components of Telengana, Rayalseema and Andhra Coast¹³. Table 5

brings out the differences in the attributes of the scheduled caste populations residing in these three regions.

Andhra Coast has both the largest number of scheduled caste persons and the highest density. The latter is higher than that of the state. In contrast, Rayalseema

13. Telengana is comprised of nine districts of Adilabad, Nizamabad, Karimnagar, Medak, Hyderabad, Mahbubnagar, Nalgonda, Warangal and Khammam which till their merger in 1956 in the state of Andhra Pradesh were part of the erstwhile state of Hyderabad.

Rayalseema as a distinctive historical-cultural region is the aggregate of Chittoor, Cuddapah, Anantapur and Kurnool districts, which before 1953 (when Andhra State was created) formed part of the erstwhile Madras State. Andhra Coast is a well defined geographical region formed by the Agency and Plains districts of Srikakulam, Visakhapatnam, East Godavari, W. Godavari, Krishna, Guntur, and Nellore Districts.

has the smallest number and lowest density. Rayalseema has only 10.8% of the total scheduled caste population of the state, while Andhra Coast and Telengana share the remainder almost equally. The last four data in the column of Andhra Coast establish the fact that the scheduled caste population in this region is comprised overwhelmingly of rural dwellers. Similarly, it is clear that in Telengana there is an unmistakeably prominent urban component, which corresponds fairly closely to the fact that while in Telengana about 80.73% of the total population is rural, in Andhra Coast it is about 84%.

It is interesting to note that though Andhra Coast has the largest number and highest density the percentage of Scheduled caste population in the total population is the lowest, despite the facts that in this region the cultivator/agricultural labourer ratio is 0.8 as contrasted with 0.6 of Telengana and agricultural productivity (in terms of food production efficiency) is the highest in the country¹⁴. One important reason might be the high proportions of tribal populations in the Northern Circar and Nellore districts, and of Christians in West Godavari, Krishna and Guntur districts.

In conformity with the prevailing pattern of occupational composition of India's scheduled caste population, in Andhra Pradesh it is involved in an overwhelming majority in agriculture. Cultivators and agricultural labourers form 23% and 57% respectively of the total scheduled caste workers, immediately bringing out the great economic and numerical significance of the latter. These propor-

tions can be instructively compared with those of 41.1% and 28.6% for the general population. It further brings out that while the proportion of scheduled caste agricultural labourers is about double that of general population, the proportion of cultivators is about half. Together, the scheduled caste cultivators and agricultural labourers account for about 80% of their total workers. Evidently the scheduled caste persons, as yet, own little land of their own. The number of scheduled caste landless agricultural labourers is 16,92,763, which is about 55% of the total scheduled caste workers, suggesting that about 2% of them also own some land. Besides agriculture, the scheduled caste workers are also engaged in household industry and miscellaneous services, the proportions in total scheduled caste workers being 6.4% and 6.5% respectively. That the scheduled caste persons or the Sudras have been workers from the early periods of Indian history is attested to by the details given in *Anusasana Parvan* which states that the *Sudras* are workers (*Karmakaras*) and that there would be no workers if there were no *sudras*. Names of various types of hired labourers and servants are listed in the *sudra-varga* of the *Amarakosa*. As many as eleven names for *sudra* domestic servants (*bhrtiyas*) were in currency in Ancient India¹⁵. Agricultural labourers were numerous and the *Santi Parvan* and *Brihaspati Smriti* laid down higher wages for agricultural labourers which attracted large numbers of scheduled caste persons into their ranks. This traditional pattern of occupational specialisation has continued, practically unchanged, through the succeeding centuries upto the present.

14. M. Shafi (1969) "Can India support Five times her population" *Science today*, Vol. 3, No. 9, pp 21-37.

15. Sharma, R. S. (1958) *Sudras in Ancient India (Upto Circa 500 A.D.)* Varanasi, Motilal Banarsidass, p 224.

Another Characteristic of the Scheduled Caste population is the large participation of its female members in the work force. The proportion of female workers in the scheduled caste work force in the state is much higher than that in the work force of the general population. It suggests that the general poverty of the scheduled caste population forces its female members also to take up manual work. In addition, it may be noted that about 62% of the workers of the state were scheduled caste persons which is the highest in India. Similarly the proportions of 33.61% and 27.96% of male and female workers are also the highest in the country

It has always been difficult for the government or the local administrative bodies to procure sufficient land for allotment to the scheduled caste persons. In the state only about 15,429 acres of wastelands have been allotted to them during 1947 and 1955. Hence, the redistribution of the numbers and relative strength of the scheduled caste persons in response to the allotment of cultivable land has not been of much consequence. The bulk of cultivable wasteland is available in scattered small sized plots, and require special, costly surveys to locate them. Hence these still remain unutilized. Although imposition of ceilings on present holdings had some effects, the land made available through this process is small. Transfers circumventing the laws pertaining to land reforms have taken place on a considerably large scale. And lastly, about 25% of the land made

available through *bhoodan* and *gramdan* are reported to be unsuitable for cultivation. A sizeable portion of the rest requires reclamation measures, and Andhra Pradesh has had no scheme of land colonization for the benefit of its scheduled caste population. To add to, and to multiply the existing handicaps and miseries the scheduled caste landless agricultural labourers are also the victims of the *jeetha* system of bonded agricultural labour. In this system the agricultural labourers are advanced petty sums of money in time of their need. Under the terms of bond they get food, clothes, and small salary only. They are unable to repay the loan which continuously multiplies. This has the effects of holding the scheduled caste agricultural labourers back in the rural areas, preventing their outmigration, and thus adding to their concentration.

It may be concluded from the study of gross pattern that (a) the absolute numbers, density, and proportion of the scheduled caste persons in the state are comparable with those of India as a whole, (b) this population group is essentially rural, (c) the major occupation are agricultural labour and miscellaneous services, and (d) except for locally operating factors, the numbers, distribution, density and relative numerical strength have been mainly determined by socio-economic attributes of agriculture, processes of religious conversion, and the presence of other population groups such as scheduled tribes.

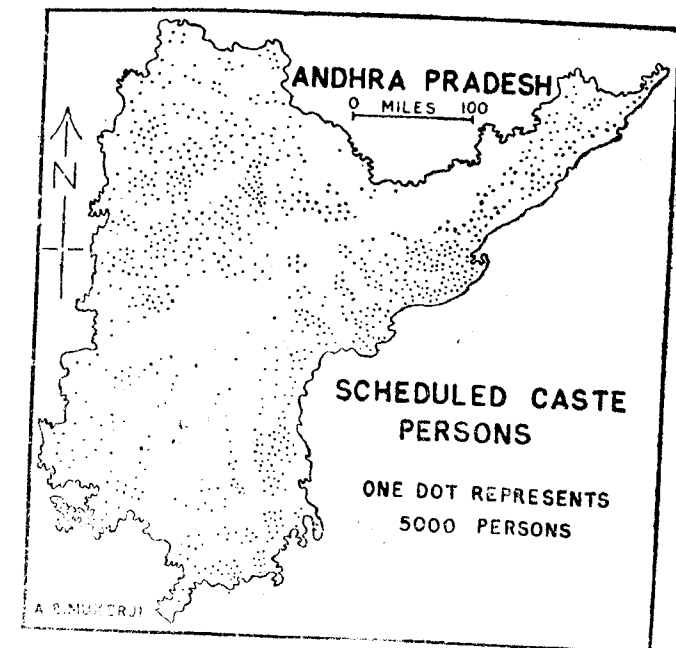


Fig. 2

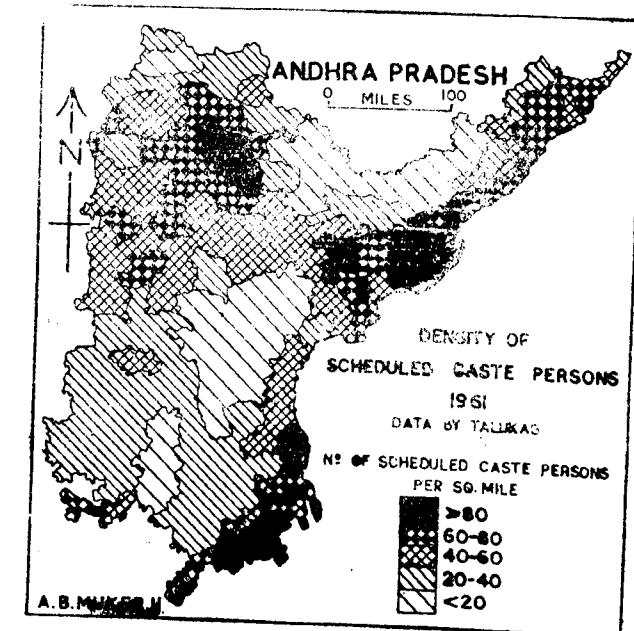


Fig. 3

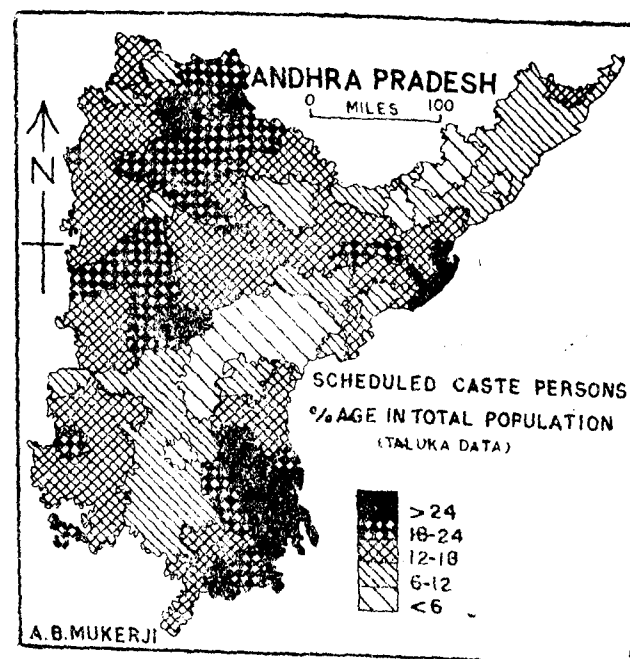


Fig. 4

Regional Pattern

The discussion of the regional pattern is based on the description and interpretation of the three maps depicting the numerical distribution, density, and relative proportion. For the sake of developing an integrated account the discussion is organised around three regions of high, moderate, and low proportions of scheduled caste persons as revealed in the choropleth map (Fig 3). Into this discussion will be incorporated the details of distribution and density. It seems necessary to repeat here that the major focus of the study is on the identification, description, and analysis of the regional patterns of the relative proportion of the scheduled caste persons, while the distribution, absolute numbers, and density are adjunct interests.

Areas of high Proportions (18 to 24 and more than 24%):

These are comprised of the areas which have percentages of scheduled caste persons in the total population higher than the state average of 13.82%.

Four areas of prominence can be identified on Fig 2, two each in Telengana and Andhra Coastal Regions. In terms of proportion and the extent of very high proportion areas the Nellore Plains are the most striking. As many as 9 of the 16 talukas having very high proportions are concentrated here. In addition there are five taluks of high proportions, one having coastal plain and the other four interior hilly locations, and one interior taluk of very high proportion. The proportions range from the minimum of 17.42% in Rajampet to the maximum of 51.9% in Sullurpet taluks. In this area inhabit some 4,05,614 scheduled caste persons forming about 8% of the total group of the state. About 90% of the

scheduled caste persons are rural inhabitants, and an equally large proportion is engaged in agricultural activities, which enable a reasoned identification of the distribution as pattern as conforming to that of the general rural population.

In this area the total population of the scheduled caste persons is 5,86,059 which forms about 11% of the total group of the state. Most of it is rural. The largest numbers of 5,14,64 and 5,36,75 are found in Nellore and Puttur Taluks.

While there is a sprinkling of a relatively small number of scheduled caste persons in the piedmont of the Velikonda Ranges, they are uniformly distributed in large numbers in relatively large clusters in Chittoor Plateau, and display striking concentrations in the Penner Delta and the deltaic plains. West of the Velikonda Ranges is to be observed a linear belt of high concentration located on the inner, longitudinal valley extending from near Renigunta through Rajampet to Cheyyeru Stream, an affluent of the larger Penner River. In this valley and in the piedmont sections the distributional pattern is strikingly linear and dendritic hugging the drainage lines which have been bunded at innumerable places to create tanks that supply water for irrigating several crops, the most important among them being rice. In every rural settlement there are scheduled caste persons, their numbers varying with the population of the former.

Since every group of rural population needs the services of scheduled caste population and there are traditional links between the two groups, it is expected that there should be close correlation between their numbers. This is borne out by the correlation

co-efficient of on +0.640 which is significant at 1% significance level. Further since there is occupational specialisation of the several groups within the scheduled caste population, their numbers increase in relation to the number of occupations which fulfil the needs of the total rural population. Where the rural population groups are large the needs generated are diverse, numerous, and complex, and hence several scheduled caste groups, each comprised of large number of persons, are required to fulfil them. This is particularly marked in the areas, such as the Nellore Plains, where the proportion of the Hindus with their caste-based social structure is very high.

Among the scheduled caste groups of the area the most numerous are the Malas, a very large proportion of whom are engaged as agricultural labourers, other ubiquitous and essential functions engaging the Malas include those of musicians, weaving coarse white cotton fabrics, servants of traders, caste messengers (*Challa vathi*) carrying messages on the occasions of marriages and funerals cutting the heads off the bodies of pigs, lambs, and buffaloes at sacrifices, domestic servants and horse-keepers. Village services such as those of sweeping, scavenging, carrying burdens, grave-digging, and washerman; and weaving¹⁶ and farm labour engage the largest number of the Mala persons. In addition to the Malas, the other large scheduled caste group is that of the Madigas who are the leather workers of the Telugu country, and are engaged mainly in the jobs of curing and tanning of hides, and secondarily in the making and beating of drums. In recent years there has been a voluminous shift of madigas from their traditional occupation to field and construction labour in various

16. So important numerically is the occupation that one of the enogamous septs of the Malas is named Maggam which is the Telugu equivalent of weaving loom.

development projects and in urban areas.

In the littoral strip, the narrow hill-foot belt of Velikonda Ranges, the ranges themselves, and the tracts interspersed with the hilly outliers the numbers of the scheduled caste persons are particularly small.

A striking feature of the area is the discordance between the low and very low density of general population and the high and very high density of scheduled caste persons, which is apparently due to the high proportion of the latter in the former group. Similarly, many interior taluks having high and very high proportions of scheduled caste persons display moderate and low density. The density varies from a minimum of 20 in Udaygiri to a maximum of 113 in Chittoor Taluk. It is clear from the map that the high density belt is peripheral in location where the proportions are mostly very high.

The main reasons for the high density and high proportion of the scheduled caste persons in these areas are agricultural/functional. It is expected that the labour-intensive crop of paddy occupying about 34% of the net area sown would be able to generate and sustain a large employment potential which is utilised by the scheduled caste persons. So important is paddy in this district that its name itself has been derived from the crop (Nelluru-rice-town). In the southern and eastern parts of the area wet crops are dominant and extensive irrigation is practised from the Pennar Canal System and numerous tanks, both of which facts are associated with large labour participation*. In the taluk

of Gudur where rice is grown extensively and indigo was grown and manufactured in the recent past the proportion of scheduled caste persons is as high as 51.99%, one of the two highest in the whole state. In Rapur and Kavali taluks scheduled caste labour in large number is engaged in the manufacture of coarse sugar from the juice of palmyra and wild date-palm (*Phoenix Sylvestris*). Throughout the area the correspondence between the high proportion of Scheduled caste persons and the high and very high values of food production efficiency is unmistakable (Shafi, Op. cit.). It is interesting to note that about 50% of the total land of the taluks comprising the areas of high proportions is *Zamindari* and *inam*, and is cultivated with the help of scheduled caste agricultural labourers by the absentee landlords or nobles. In the *zamindari* taluks of Kalahasti (Chittoor district) and Venkatagiri (Nellore District) the proportions of scheduled caste persons are as high as 24.14 and 45.63 respectively. With per capita agricultural holdings of more than 3.6 acres (as compared to 2.1 acres of the State) the need for a large number of agricultural labourers becomes obvious. Further, in the *zamindari* lands the large capital available for investment has resulted in the digging of numerous wells for irrigation; the proportion of well-irrigated land in this area is about 18% as compared with 12% for the state. Now, well irrigation again is labour intensive and calls for large labour participation¹⁷.

Considerable areas of unoccupied arable land and culturable wastelands existed in the taluks of high pro-

portations of Scheduled caste persons where they were either allotted the lands or acquired them. Such possessions were more marked in the interior upland taluks where dry cash crops are dominant.

In Rapur and Gudur taluks (with the proportions of 45.63% and 51.19%) a large number of scheduled caste persons are employed in the complex and elaborate processes of mining of mica, separation, cobbing, splitting, trimming, sizing, and grading.

Finally, in Nellore, Gudur and Kavali taluks the farmers maintain large livestock herds for their skins. Curing of hides and tanning of leather engage a considerable number of scheduled caste persons.

Godavari Deltaic plains is the second area in the Andhra Coastal Region containing five taluks of high and very high proportions of Scheduled caste persons in the total population. Both in extent and proportions this area is far less prominent than the Nellore Plains. Here, the proportions range from the minimum of 21.05% in Chintalapudi Taluk to the maximum of 29.13% in Amalapuram taluk. The total number of Scheduled caste persons is 2,20,385 and their density per square mile ranges from 61 in Chintalapudi to 349 in Kothapeta. In general the density of scheduled caste population corresponds to that of the general rural population. This is explained easily by the fact that almost 95% of the scheduled caste population is rural and in the taluks of Chintalapudi and Kothapeta it is entirely rural. Hence, the distributional pattern of the scheduled caste population conforms, to a large extent, to that of the general rural population.

In all the taluks the scheduled caste population is concentrated along the main & Secondary distributaries of the Godavari River, as well as many small streams and their tributaries. In particular, the main groupings have tended to be located on the low, flattish, interfluvial uplands. Back slopes of the natural leaves are favoured locations. The number and distribution have been influenced, to a very large extent, by the factors which determine the extent of cultivation and productivity of agriculture. Linear patterns paralleling the streams and based on prosperous agriculture are quite marked. On the other hand, the littoral zones of brackish soil, ill-drained land, and swamps have remained negative areas. In the interior taluk of Chintalapudi scheduled caste population has located itself mostly in the tank villages flanking the sluggish, wide-valleyed streams. About 15,000 scheduled caste persons live in small urban places and are engaged in commercial and agricultural labour.

Of the many potent factors involved in the formation of high and very high proportions of the scheduled caste persons in the total population in the area none is more important than the high productivity of agriculture¹⁸ based on very high percentage area of three crops of rice in net area sown (82% as contrasted with 31% of the state and 36% of the Andhra Region), rich, alluvial, loamy soil, widespread facilities of irrigation, and high participation of agricultural labour. Rice is a labour-intensive crop, its transplantation needing a large labour force which is comprised in a large measure of the landless scheduled caste persons. Tobacco and coconut are the other two labour-intensive crops of the area. Further, in many taluks a considerable proportion of the net

*This association is still more marked in the Taluks of Gudur, Kavali and Nellore where tank irrigation is practised widely with its concomitant intensity of the use of labour.

17. Similar suggestion is also put forth in Techno-Economic Survey of Andhra Pradesh, N.C.A.E.R., New Delhi, 1962, p. 19.

18. According to Prof. M. Shafi this is one of the areas of highest degree of food production efficiency. See M. Shafi (1969). "Can India Support Five Times Her Population," Science Today, Vol. 3 No. 9, pp. 21-37, ref. p. 24-25.

area sown is under vegetables and gardens which again, need and employ a large number of agricultural labourers. As a matter of fact the ancient classical name of the district of East Godavari was *Konasima* (a country of gardens). A voluminous force of agricultural labourers is also needed in the large extent and proportion of area used for irrigated multiple cropping. Besides agricultural activities the scheduled caste persons are also engaged in large numbers in the ubiquitous household industries such as rice-husking, jaggery making, basketry, hide curing, leather tanning, and tobacco curing.

Throughout the 19th and early years of 20th centuries an important occupation of the scheduled caste persons was the making of indigo dyes. After the discontinuance of indigo, there was a transference of skill so acquired to the cultivation and preparation of sun-hemp which has a considerable acreage in the area. The relative preponderance of cottage industries in East Godavari and its association with the scheduled caste persons has been noted by Ramanadhan (p. 107)¹⁹.

In addition to the functional elements which explain the high proportions of scheduled caste population in the area, the social and cultural lineaments play an important role. Godavari Deltaic plains has 97% of its total population enumerated as Hindus. Among the Hindus, more than among any other religious group, the scheduled caste population forms an integral part and a large proportion. Hence, the high proportion of the scheduled caste population is incorporated in

the very high proportion of the Hindus in the general population.

During Muslim rule and the early years of British administration the area was parcelled out into *zamindarish*²⁰ in which cultivation was practised with the employment of a large number of landless scheduled caste agricultural labourers under the supervision of the landlord (*zamindar*). In the *asara* and *Visapadi* revenue systems which followed the *zamindari* system around 1850, a lump assessment was imposed on each village, the incidence on particular holding being settled by the cultivators themselves. In effect the few cultivators responsible for the entire revenue demand were like the landlords and, could not cultivate the entire arable land by themselves, and hence, needed to maintain a large work-force of agricultural labourers. This condition continued to exist in subsequent periods when *ryotwari* revenue system became prevalent and in which the farmers paid the land revenues individually. The *zamindari* way of living and the socio-economic organization of agriculture continued for long sustaining the employment of a large population of scheduled caste agricultural labourers.

Further, the earliest settlements of Europeans in India were all established in the Godavari Deltaic plain. The Scheduled caste persons were employed in large numbers in domestic and menial jobs in these settlements, as also in the European factories. With the decline and abandonment of these settlements agricultural labourers gradually drifted again into the rural areas.

During the pre-European periods land grants were generously

given to Brahmins to establish villages. But the Brahmins traditionally have been indifferent and inefficient cultivators and hence had to employ large number of agricultural labourers who have continued to remain concentrated in the area. It is relevant to note that, in this area Brahmins, who are more numerous than usual, form nearly 5% of the Hindu population.

In the taluks of Chintalapudi and Kovvur considerable extent of arable land was settled in the earlier year of the 20th century by families of higher castes with the help of the Scheduled caste persons. There is every possibility that either the waste or undeveloped land was settled with surplus *sudra* population, for the old farmers would not like to shift from settled areas. Also the aboriginal cultivators were eventually enrolled as *sudras* in Brahminical Social Organisation.²¹

And lastly, it is suggested that the role of Christian missionaries in converting the Scheduled Caste persons to their faith and thus in reducing their numbers has been of little consequence. This suggestion is amply supported by the low proportion of Christians (only about 0.2 to 0.4% of the total population) in the deltaic taluks as compared to 7% and 10.5% in the neighbouring districts of West Godavari and Krishna respectively.

In Telengana there are two areas of high proportions the Hyderabad Tract in the South and Jangaon-Sirpur Belt in the centre and north. The two tracts are separated by the low value taluk of Gajwel interposed between them.

The map reveals immediately that in the state the two Telengana regions cover the largest area of high value, some 5,780 sq. miles in as many as 12 taluks, and forming on almost continuous belt they separate the mainly agricultural western strip from the large agricultural - mineral - industrial block in the east. Basically a Hindu Telugu culture area, it reveals a thin veneer of Muslim influence. The entire area formed a part, till as recently as 1956, of the erstwhile princely state of Hyderabad where although Hindus formed the bulk of population the Muslims were the local chiefs, nobles, jagirdars, zamindars, and landlords and held large chunks of lands in more less permanent possessions. Within the belt there are a large number of urban, mining, and industrial centres with the associated concentration of labourers.

With a total scheduled caste population of 2,97,348 persons the Hyderabad Area contains about 6% of the total scheduled caste population of the state. The intraregional variation in the number of 20,101 from the maximum of 37,122 in Kalvakurti to the minimum of 17,321 in Hyderabad East taluks is considerable.

Throughout the area the scheduled caste persons are, in an overwhelming majority, rural inhabitants. However, in the taluk to Hyderabad west containing the Hyderabad Town group there is an enormous concentration of urban scheduled caste persons numbering 1,50,723 comprising about 12% of the total urban population, and about 5% of the total scheduled caste population of the Hyderabad.

19. Ramanatham, V. V. (1959). The Economy of Andhra Pradesh, Bombay: Asia Publishing House.

20. Petty, local, landlord estates.

21. Recent researches in human genetics of the various caste groups in India provide solid support to this suggestion. Refer "Genetics of Castes and Tribes in India" v.D. Sanghvi, pp. 17-29. Science Today, Vol. 5, No. 2, August 1970.

Area. In the district of Hyderabad the rural and urban proportions are 53% and 47% respectively. In the town-group itself most of them are engaged in miscellaneous services, and as domestic and office workers, menials, scavengers, lowgrade artisans, and industrial and construction labour. Not less important is the "way of life" of a large majority of population who, influenced by the court traditions, still tend to maintain a large number of domestic servants, most of whom are Scheduled caste persons and have flocked in from the villages where they had been condemned to a life of drudgery of field labourer. It is relevant to note that six out of the twelve taluks comprising the Hyderabad area are entirely rural.

There is an interesting positive correlation between the absolute numbers of rural persons and rural scheduled caste persons, the correlation coefficient being as high as +0.951 (much more than +0.777 required at 1% confidence level). Large rural population creates a correspondingly voluminous demand for labour to be engaged in numerous services, important among which are the village and field activities.

Because the majority of the scheduled caste population is rural, it is but logical to expect that its distributional pattern would have a close correspondence with that of the rural population. Although dendritic lineation paralleling the drainage lines which have been banded at several places to create irrigation tanks is marked throughout the area, there is a considerable degree of sprinkling of village and hamlets in the interior parts of the inter-fluvial upland where irrigation by wells is more common. Immediately surrounding the Hydera-

bad—Secunderabad urban complex are to be found extensive barren patches associated with granite tors with their infertile bare rock or *nurram* (red mantle layer) aprons where rural population is sparsely distributed and the number of scheduled caste population is likewise small and scattered. Similarly the Amrabad Plateau in Achampet taluk and Krishna trough in Kollapur taluk are almost devoid of any population. Although rural by residence and agriculturist by occupation, a considerable number of scheduled caste persons is engaged in non-agricultural occupations, the principal among them being the household industry.

For the area as a whole the density of scheduled caste persons per square mile is about 46 which is almost the same as that of the state (47), but it varies considerably from the minimum of 18 in Achampet to the maximum of 67 in Medchal taluks. Out of 12 taluks six have high and six have low and very low densities of rural scheduled caste persons. There is a close correspondence between the densities of rural population and of the rural scheduled persons, the correlation coefficient being as high as +0.868. In the taluks of Hyderabad East, Hyderabad West, and Medchal the density of rural population is low but the density of scheduled caste persons is high, a discordance, which can be explained by the fact that in these three taluks both the general population of the Scheduled castes are almost entirely urban.

Scheduled caste persons form about 23% of the total rural population of the Hyderabad Area. The proportion varies from the minimum of 18.37% in Kollapur to the maximum of 24.74% in Achampet taluks, both of them located adja-

cent to each other in Mahbubnagar District. Both the minimum values are higher than the state average of 13.82%, but throughout the area the values are less than those occurring in the Nellore Plains. Further, there is only one taluk, Achampet, where the proportion is very high. The high proportion area is comprised of two belts extruding from Achampet to Medchal in the south-north direction and from Kodangal to Medchal in the west-east direction, like two arms of a triangle meeting at Gajwel boundary.

In the Hyderabad Area the high proportion of scheduled caste persons is everywhere complemented by the very low proportion, or even, absence of Scheduled Tribe persons. Only in Achampet do we find about 3.4% of the population enumerated as tribal persons. There is every possibility that the aboriginals (Scheduled Tribes) who accepted the overlordship of the Indo-Aryans and had entered into the Hindu system were placed as scheduled castes²². This would certainly result in a smaller number of Scheduled Tribe persons and a larger number of Scheduled caste persons. It has also been suggested that the older culture groups could provide labour power with which the Aryans could carry on agriculture²³. On the other hand it is interesting to observe that in the district of Hyderabad, most of whose area falls in the region under study, Muslims form about 27% of the total population (much higher than the State average of 7.6%) and the Hindus 73% (much less than the State average of 90%). The correspondence, and the explanation thereof, between the large Muslim and Scheduled Caste population have been mentioned in an earlier

section. It must be pointed out that almost the entire scheduled caste population belongs to Hindu religious groups, although traditionally and functionally it is associated with both the religious groups.

In the environs of Hyderabad Secunderabad urban complex, traditionally and locally termed *atraf-i-balda* (suburbs of the city), a large number of scheduled caste persons is employed as field labour in the crown (*sarf-i-khas*) and *jagir* lands. The two most numerous scheduled caste groups here are the *chamars* and the *dher* or village menials. *Atraf-i-balda* also contains extensive tracts of gardens and orchards (*baghat*), and here groups of villages are farmed to revenue contractors, both requiring intensive labour participation provided by the scheduled caste persons. Not less important is their employment in large numbers in rural household industries, many of which are based on the non-food crops grown extensively in the area. In Hyderabad and Mahbubnagar more than 25% of the net area sown is given to non-food crops, which include, among others castor seed and groundnut. In the crown lands large landholdings possessed by the erstwhile *jagirdars* could be cultivated only with a large team of cheap scheduled caste labourers.

Fanning out to the north and east of Gajwel taluk and supported by the long handle of Jangaon the large block of high proportions is comprised of 14 taluks located in the districts of Hyderabad, Warangal, Karimnagar, Adilabad, and Nizamabad, thus revealing that except for two districts of Nalgonda and Khamman every one has one or more

22. Similar suggestion is given by Ghurye in *Caste, Class and Occupation*, G. S. Ghurye, Bombay, Popular Book Depot, 1961, p. 169.

23. Sudras in Ancient India, R.S. Sharma, Delhi: Moti Lal Banarsa Dias, 1958, p. 14

taluks of higher than average proportions.

Living in this large block are 5,71,452 scheduled caste persons forming 11% of the state total of scheduled caste population and 20% of the total population of the area. From 22,785 in Manthani the number ranges upto the maximum of 6,47,18 in Karimnagar taluk. With a correlation coefficient of +0.737, the relationship between the total general population and the total scheduled caste population is clearly established. As in most other areas, here also the scheduled caste persons are overwhelmingly rural, and actually a little more so, as is pointed out by the fact that, 94% of their total population is enumerated as rural as compared with 90% of the state. The rural and urban scheduled caste persons number 5,36,762 and 34,690 respectively. Paralleling the correspondence between the total population and scheduled caste population noted earlier is the harmonious relationship between the size of the Urban places and the number of urban scheduled caste persons, provided that the functional natures are broadly similar. Hence, the relationship is most marked in a series of industrial or administrative towns. Karimnagar, the district and taluk headquarter town has total and scheduled caste populations of 31,554 and 3,840, the latter forming a proportion of 11%; while Siddipet, a taluk headquarter town has 18,719 and 1,851 persons in the corresponding population, and the proportion is 9%. In a smaller town, such as Chinnur (pop. 9,645), the proportion of scheduled caste persons is as high as 20%, and most of them are engaged in the wearing of widely known tasar silk. Bellampalli in Asifabad taluk of Adilabad district, an important industrial town has total and scheduled caste populations of 29,101 and 9,078

the latter forming 33% of the former. Other industrial towns, such as, Peddapalli, Siddipet, Kagaznagar, and Sirsilla have sizable scheduled caste populations, many of whom are engaged in industries themselves. It is clear that the towns having commercial and administrative functions have kept in employment a small or number of scheduled caste persons than those which combine these functions with the industrial ones. This has been made possible, in many cases, by the transference of skills possessed by the Scheduled caste workers and artisans from their traditional economy to the factory industries.

In the distributional pattern two distinct regions stand out in the map, the Godavari - Pranhita hill - flanks in the northern and eastern parts of the area and the Jangaon - Karimnagar Telengana Plateau tract. In the former almost the entire rural scheduled caste population is lineated along the drainage lines of various sizes flowing through dense teak-terminatia forests, and large inter-riverine tracts are bare of any population. The generally uninhabited appearance of the hill-infested taluks of Asifabad and Lakshettipet is particularly striking. There is a considerable intermixture of agricultural and non-agricultural occupation, particularly marked along the railway extending from Mancherial to Kothapet.

In the Jangaon-Karimnagar tract population distribution is both lineated and random in nature, associated mostly with the location of irrigation tanks, and hillgirt depressions having a surface cover of alluvium deep enough to support permanent agriculture, and thus enabling the employment of Scheduled caste landless persons in farm labour activities, and in associated non-agricultural occupa-

tions. The surrounding ridges are strikingly contrasted with the depressions by their blank and bleak appearance. On the whole there is a great deal of parallelism between, and correspondence with, the distributional pattern of general rural population.

An attribute that differentiates this area from other high proportion areas is its higher density of rural scheduled caste persons, 55 as compared to 42 persons per square mile (rural area) of the state. This density varies from the minimum of 27 in Manthani to the maximum of 98 in Huzurabad taluks. One can easily notice the striking difference between the northern half of the area with generally low densities from the southern half with high and very high densities. This is, at once, related to the low levels of utilization of potential natural resources and agricultural development. Added to these are the inhibiting environmental conditions, particularly the rugged, forested, hilly terrain. Rural population is small.

A visual comparison of the maps showing the density of Scheduled Caste persons, their proportion in the total population, and the density of rural population reveals a striking discordance, in the northern taluks, between the three parameters. Chinnur taluk has very high proportion of 30.59%, but moderate density of 42 of scheduled caste persons and very low density of rural population of less than 200. In the southern taluks, however, there is a fair correspondence; for example, in Huzurabad the very high density of 98 and high proportion of 20.54% of the Scheduled Caste persons match pretty well with high rural density of 479. Both the agricultural and non-agricultural sectors of economy are more highly developed

in these taluks than in the northern ones.

The proportion of the scheduled caste persons in the total population of the area is about 20% much higher than the state average of 13.82%, from the minimum of 18.60% in Siddipet it increases to the maximum of 30.59% in Chinnur taluk, with a range of 11.9% which is much less than the range of 32.50% in the Nellore Plains.

An interesting attribute of the trans-Godavari segment in Adilabad District is the concurrence of the high proportion of Scheduled tribe and scheduled caste persons; for example, Asifabad has 17.9% of its total population enumerated as scheduled tribes (contrasted with the state average of only 3.7%) and 21.96% as Scheduled caste persons. These taluks provide sharply differentiated ecological settings for the habitats of the two groups, the forested hills, and the fertile alluvial strips, the former for the Scheduled tribes, and the latter for the Scheduled castes. The entire area is predominantly Hindu, and it is suggested that their gradual penetration into it along the small river valleys enabled a considerable number of Scheduled tribe persons to adopt Hindu way of living, and be finally absorbed into the Hindu social system as the lowest stratum. In the cis-Godavari section the scheduled tribes are all but absent, except in the taluks of Jatial, Parkal, and Manthani, in the last the proportion is as high as 9.8%. All the three taluks are located in the well-defined tribal belt.

Although predominantly rural by residence and agriculturist by occupation, the scheduled caste persons have considerable numeri-

cal significance in non-agricultural functions in both the cis- and trans-Godavari tracts. The processing of non-food crops occupying about 27% and 17% of the net area sown in Adilabad and Karimnagar districts respectively employs a large number of scheduled caste persons. Important among these crops is cotton which occupies about 15% of the net area sown. Cotton ginning by hand is still popular in the villages, and was the only method in the recent past. In Karimnagar, oil crushers employ a large number of scheduled caste persons. All in all, in the same district, about 15% (contrasted with 9% of the State) of the workers are engaged in household industries. Labour-intensive crop such as paddy grown with tank and well irrigation in Sirsilla, Jangaon, Chinnur, Jagtial, and Lakshettipet, and the widespread household industry of making of leather buckets for well irrigation also engage a considerable number of scheduled caste persons. In particular, women are engaged in weeding and transplanting in rice cultivation, Chamars forming a large proportion of scheduled caste population are associated in Karimnagar district with a very high density of livestock and are engaged in curing of hides and tanning of leather. In these taluks the proportion of land comprising the *jagirs*, *zamindaris*, *samasthans* and *sarf-i-khas* is quite large. These are, almost everywhere, cultivated by the landless scheduled caste agricultural labourers for the absentee land owners. Even where *Jagir* villages are few, rice acreage and tank irrigation effect in impressive increase in the number of scheduled caste persons. Another explanation offered is that of the much larger holding of net area sown per cultivator

in Adilabad, 5.1 acres as contrasted with 3.8 acres for the state. An interesting feature revealed by Map 4 is the high proportion in all but one taluks of Karimnagar district. Among various causes suggested earlier, the most important appears to be the fact that more than 25% of the entire population is that of Brahmans who are the owners of villages originally granted by the Hindu and Muslim Rajas. Since the Brahmans are traditionally averse to taking up cultivation, the work had to be assigned to the Scheduled caste persons.

During 1957-1967 about 31,565 acres of land were allotted to the scheduled caste persons for cultivation in Karimnagar district. Similarly, quite some acres of rich irrigated land under the command of Nizam Sagar Canal System were settled by, and allotted to them in Kamareddy taluk.

A large volume of Scheduled caste agricultural labourers has moved from the Andhra Coastal Area into Nizamabad, Warangal, Karimnagar, and Adilabad districts in search of employment in non-agricultural activities²⁴.

Areas of Low Proportions (6 to 12 and less than 6%)

Two areas, both located outside Telengana, one in Andhra north of Godavari delta, and the other in Rayalseema prominently display low values. While in the northern sector the area includes both the interior hilly and coastal tracts, the southern counter-part is essentially comprised of hilly and plateau landscape with only a small area of coastal plains. Both areas are however, similar in their marginal productivity.

In the northern area are included practically the entire districts of Srikakulam and Visakhapatnam. The number of scheduled caste persons in the region is 399,128 which comprises about 8% of its total population. From as low as 783 in Chintapalle the number ranges upto the maximum of 36,563 in Palakonda taluka. With a correlation coefficient of +0.938 the relationship between the total general population and the total scheduled caste population is clearly established. Although it is overwhelmingly rural the scheduled caste persons living in the rural areas comprise 84% of the total scheduled caste population as compared to the state proportion of 90%. The rural and urban scheduled caste persons number 338,050 and 61,078 respectively.

Throughout the area, but particularly in the talukas comprising of

forested hilly tracts such as Chintapalle and Paderu the low proportions of scheduled caste persons are inversely correlated with the high and very high proportions of Scheduled tribe persons. (Fig. 5) Low level of development of primary and tertiary economic activities have severely restricted the possibilities, of earning even a meagre livelihood.

Since the scheduled caste persons are, by and large, rural inhabitants their distribution follows very closely the pattern of villages. Along the western flank in the forested tracts of the hills of Eastern Ghats they are conspicuously absent or are very small in number. Along the coast itself where fishing is the dominant economic activity the number is very small. But in the immediate hinterland and extending back to the base of the Eastern Ghats

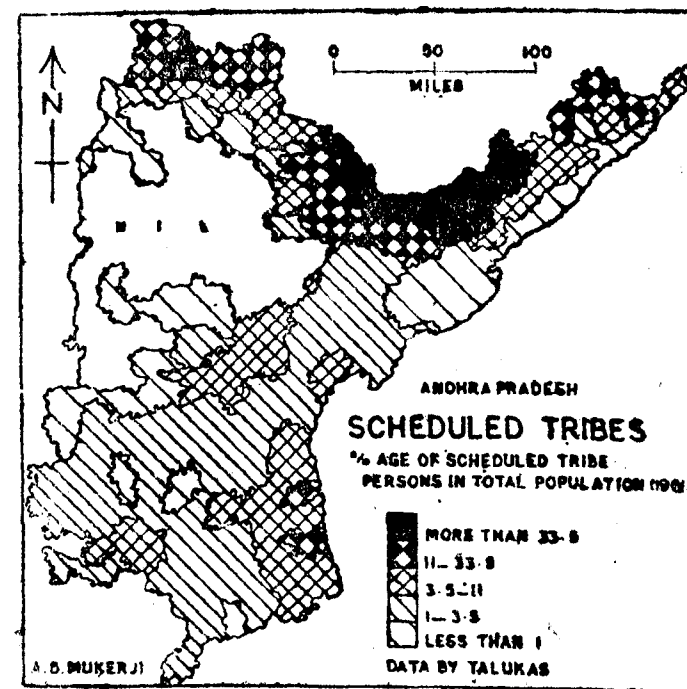


Fig. 5

²⁴ *The Economy of Andhra Pradesh*, Ramanadham, V. V. (1959), p. 21, Bombay: Asia Publishing House.

the area is packed with rural settlements and most of the scheduled caste population is concentrated here. The recurrent pattern is comprised of north-south valley alignments crossed by innumerable lines extending in northeast-south west direction in the belt in which poor, subsistence agriculture is the mainstay of living.

In the area the density of scheduled caste persons presents interesting and sharp areal differences. While for the area as a whole the density is about 30 persons per square mile (much less than the state density of 42), it varies from 60 to 80 in the dominantly agricultural piedmont plain to less than 20 in the wild and rugged flanks of the Godavari Gorge in the Eastern Ghats inhabited almost entirely by the scheduled tribe persons. From 0.8 in Chintapalle the density ranges upto 125 in Visakhapatnam talukas. On the whole, the areal variations in the density of rural scheduled caste persons closely correspond to those of the density of rural general population. The discordance between the low proportion and high density in the narrow piedmont plain is due to the facts that the tract forms only about 30% of the entire area, and the *zamindaries* of Vizianagaram, Bobbili, and Palakonda (in the talukas of the same name) with their absentee landlordism encouraged the concentration of landless scheduled caste persons as agricultural labourers.

The Rayalseema-Guntur area of low proportion of scheduled caste persons is interestingly flanked on the east and west by linear tracts of medium and large proportions, and is comprised of as many as 33 talukas, of which some 24 are located in the dry, hilly, plateau and interior areas. From the mini-

mun of 2.83% in Vinukonda the proportion ranges upto 11.98% in Podili talukas. There is an interesting increase in the proportions from the outer toward the interior talukas. Barring the predominantly tribal areas in the Northeastern parts of the state, some of the lowest proportions occur in Guntur district. In most parts of Guntur, Kurnool, and Cuddapah the low proportions of scheduled caste persons is primarily due to the fact that a large number of them have been converted to Christianity during the British regime. Guntur has been the centre of considerable proselytising activities of American Evangelical Lutheran Mission²⁵. In these districts the proportions of Christians in the total population are much higher than that of the state. In Cuddapah and Kurnool a considerable number of Scheduled caste persons has also been converted to Islam thus swelling the number and proportion of the Muslims. The districts of Guntur, Kurnool, Cuddapah, and Anantapur have the least proportions of Hindu population in the state. In the interior talukas of Rayalseema, the high recurrence of famines results in a precarious agriculture, and hence, acts as a fresh factor; the worst affected are the landless scheduled caste agricultural labourers.

In the distributional pattern large almost empty areas are prominent, and are associated with the barren hills of Erramala and Nallamala. The scheduled caste population is overwhelmingly rural, hence, their distribution follows closely that of general rural population. Similar correspondence can be observed between the densities of scheduled caste persons and of general rural population. Lowest densities of less than 20

scheduled caste persons per square mile occur in the unproductive hilly talukas of Eastern Ghats and in the highly rugged flanks of the Krishna River.

Large landholdings promoting extensive cultivation, marginal productivity of land, dry farming, low yields, and one-crop cultivation have not been conducive to the employment and maintenance of scheduled caste persons as agricultural labourers in the Rayalseema region. Further, this region is the least industrialized in the State.

In addition to the two areas discussed above, there are a few scattered talukas of low proportions in Telengana, Andhra Coastal Region, and Rayalseema. In some of them the proportion of scheduled tribe persons is high, agriculture is unproductive, and industrial employment is very low.

Areas of Moderate Proportions (12 to 18%)

Most of these areas are concentrated in Telengana while a few also occur in western Rayalseema and in Andhra Coastal Region. In Telengana the talukas having moderate proportions have had smaller number of Zamindari villages, and are agriculturally not developed. Extensive cultivation in poor murum soil has not been conducive to the employment of large number of scheduled caste labourers. A considerable volume of male-selective outmigration of the rural scheduled caste persons is suggested by their high sex ratio. This has resulted from a poor rural economic base, particularly a lack of tertiary activities. Lastly some conversion to Buddhism also was effected in the western talukas of Nizamabad, Medak, and Adilabad which adjoin the Marathi speaking areas of Maharashtra where the neo-Buddhist movement attained its peak intensity.

Dry cultivation and recurrent famines impoverishing the country,

side in Western Rayalseema have also pushed the scheduled caste groups out of the region. The proportions in this area are lower than those occurring in the Telengana region reflecting mainly a difference in the relationship between land-ownership and method of cultivation.

Conclusions

With a population of 4,973,616 scheduled caste persons forming about 14% of its total population the state of Andhra Pradesh ranks fifth among the States in India in terms of number. The proportion and density of scheduled caste persons reveal wide and interesting spatial differences, and their distributional pattern closely correspond to that of the general rural population.

Three broad areas can be identified on the basis of Proportion: Telengana with high and moderate, Andhra Coastal and Hilly Region with high and low, and Rayalseema with moderate and low proportions.

The elements of spatial pattern are associated with (i) those characteristics of agriculture, industry, and tertiary economic activities which are conducive to large employment Potential of scheduled caste persons; (ii) proportion of Hindus in the total population (iii) volume of conversion of scheduled caste persons to Islam and Christianity; and (iv) proportion of scheduled tribe persons in the total population. Antithetical concentrations of scheduled tribe and scheduled caste persons are marked throughout the state reflecting the gross differences in the entire gamut of complexes of attributes of habitats, habits, and histories of the areas. Finally, all the elements of spatial patterns are meaningfully related to the socio-economic complexes of the areas.

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GEOMORPHOLOGICAL ANALYSIS OF LANDFORM FEATURES OF PALI DEVELOPMENT BLOCK FROM AERIAL PHOTOGRAPHS

By
S. SINGH and D. S. KAITH*

Introduction

In the present age, the knowledge of geomorphology has become an essential tool for preparing the inventory of the natural resources of arid and semi-arid regions of the country. This integrated information is very essential for the development planning of the under-developed parts of the country. This information can only be accomplished through the systematic analysis of the photographic images of the ground features because the landforms are the most conspicuous features which can be seen in three dimension under stereoscope. The landform mapping by analytical geomorphological method can also be applied to natural resources inventories. Thus the chief aim of geomorphology is to analyse, classify and to map the various geomorphological features in their correct position and mutual relationship for assessing their physical properties and economic potentialities.

Keeping in view the practical application of photo-geomorphology, the authors in the present paper have discussed the genetic classification, analysis and mapping of various landform features of Pali Development Block. It constitutes 1400 sq. km area and stretches between latitudes 25°30' to 25°56' N and longitudes 73°0' to 73°34' E. It forms a part of semi-arid Western Rajasthan with average annual rainfall of 500 mm. January and May are the coldest and the hottest months respectively. The mean maximum temperature is 38° C and mean minimum temperature is 9° C. The general physiography

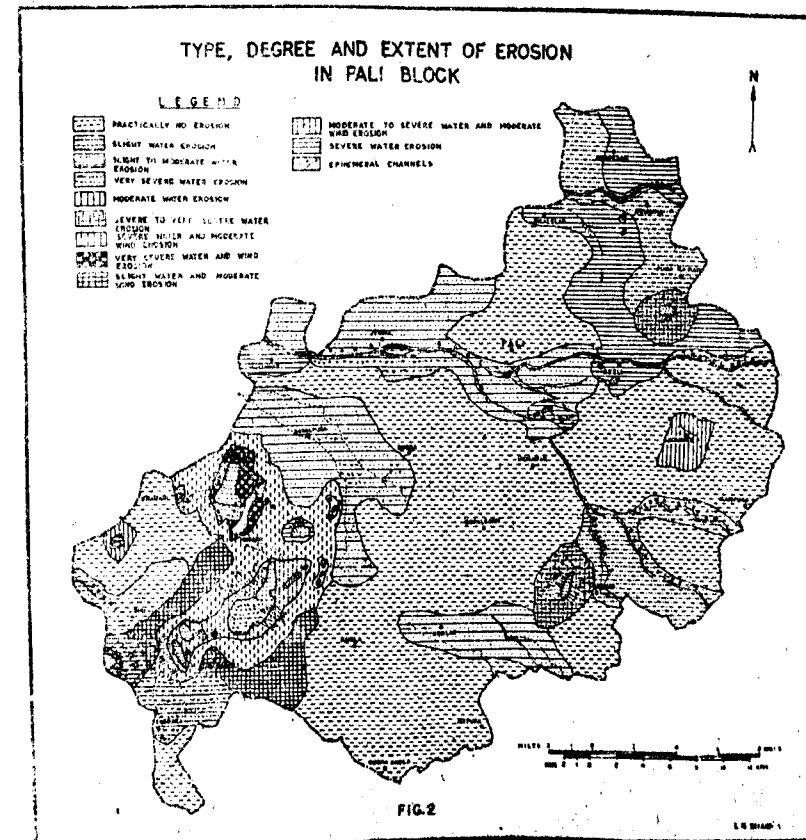
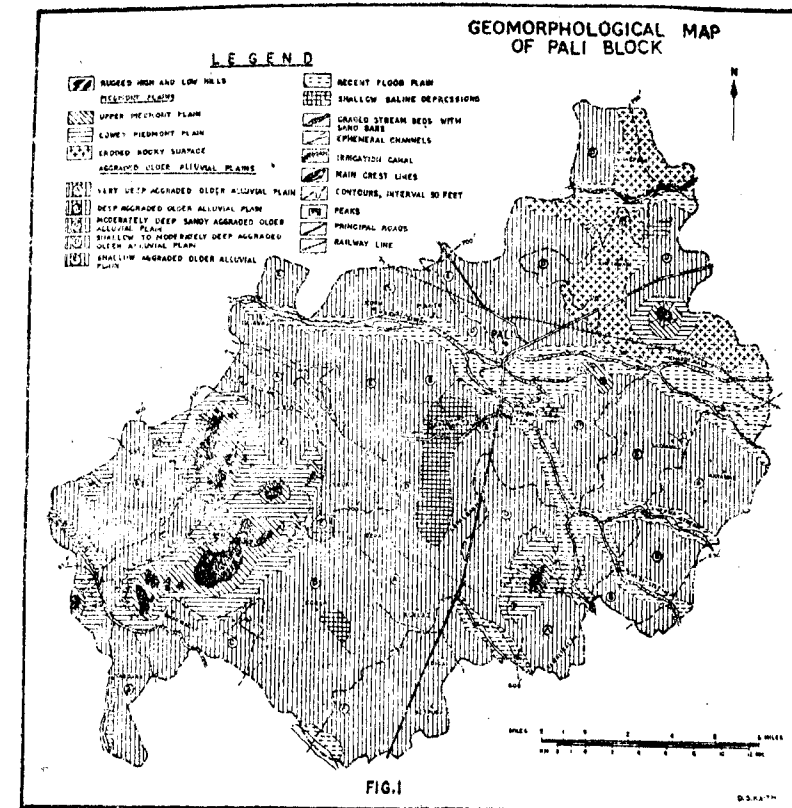
of the region is simple except few residual hills in the western, south eastern and north eastern parts. The Bandi, Khari and the Phunpharia are the main streams. Numerous ephemeral short channels are also radiating from the existing hills which die out before they meet their master streams.

Methods and Materials

The aerial photographs of 1:31000 scale were quickly scanned and laid down in respective runs to get a compositive view of the entire landscape. Each pair of photograph was systematically analysed and interpreted and the traverse routes were selected. The boundaries of all cultural and cultivated areas, rivers, different type of plains, rock outcrops, depressions and associated erosion types were marked on the air photos. The detailed geomorphological field survey of the area was carried out and the information already collected from the photo-interpretation was checked and corrected in case of discrepancy. In the laboratory the boundaries of different landform features and associated erosion types were transferred by Zeiss sketchmaster on a base map of 1:63360 scale by the method described by Ghose and Singh (1966). The final geomorphological and erosion maps (figures 1 & 2) were prepared on 1:120,720 scales. After mapping and analysis of field data, the geomorphic description of each unit was written.

Geomorphological evolution of landform features

The geomorphic history of the region is quite old and dates back



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to Archaean era. The present landform features (fig. 3) have been formed through various evolutionary stages of different geological periods by orogenic, erosional and depositional processes. The sediments of Aravalli system mostly argillaceous were laid down in a syncline existing at that time among the gneissic Archaean. The period

is followed by a period of orogenies due to which the sediments were metamorphosed developing slates, quartzites, phyllites and schists in the form of compressed tight folds. After the depositional phase the Aravallis were uplifted and put to weathering agencies for denudation and peneplanation. After the Delhi period (early Algonkian) the igneous activities produced the Erinpura granite. These also suffered metamorphism as the orogenic movement has not stopped till then. The Aravallis were eroded to such an extent that the Algonkian land surface composed of Erinpura granite, pegmatites and quartz veins were exposed to subaerial denudation. The igneous activities in Algonkian era created the orogenic upheaval of Aravalli ranges and the second cycle of erosion started and ran fully. During this period of second cycle of erosion, the low lying areas of eroded surfaces of Aravallis were deeply weathered and uplands were unaffected.

During Lower vindhya period another igneous activity took place and formed the intrusive and extrusive rock masses of Jalore granite and Malani rhyolite. The drainage system developed on the newly formed land surface carved it out into extensive level plains except

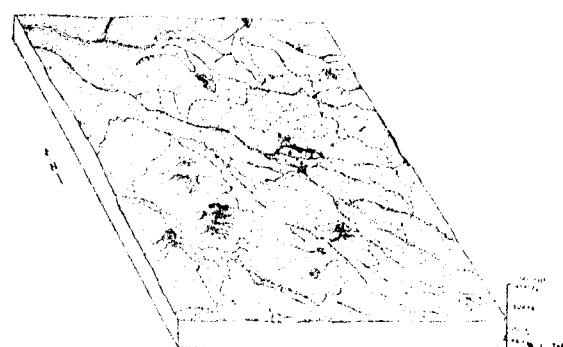


FIG. 3. BLOCK DIAGRAM OF THE AVALLI BLOCK AND ITS SURROUNDINGS
--- THE BOUNDARY OF PALI BLOCK

Fig. 3

few residual hills in western, north eastern and south eastern parts of the block. During the Quaternary era the older alluvium, coarse deposits like cobbles, pebbles, sands, gravels, younger alluvium and aeolian sands have been deposited in the block by fluvial and aeolian geomorphic processes.

Description of the geomorphological characteristics of the landform features

The region under study has been divided into the following geomorphic units and sub-units and their characteristics have been described below:—

1. Rugged high and low hills: The hills of Archaean and Palaeozoic eras comprising the rocks of quartzite, phyllite, slate, granite and rhyolite are situated in the western, north eastern and south eastern parts of the block. The heights of these hills vary from 289 to 573 m. The rocks of quartzite and granite are more resistant to weathering than others. The rhyolitic hills occupy the larger area and are situated near Sali and Bhaonagar villages. The hills are disintegrated due to mechanical weathering and their slopes are covered with rock fragments of 15 to 30 cm dia. The scree formations

are associated with the hill slopes. The rhyolites are generally fine grained to glassy texture and of reddish brown to dark brown in colour. They constituted quartz and orthoclase minerals and are characterised by vertical and horizontal joints, beddings and fractures which are clearly visible on the air photographs. The hills are trending in SW-NE direction. The Jalore granite constituting quartz, orthoclase, biotite and hornblende minerals occur near Hemawas village, Kalaki Dhani and west of Madri village. It is hard, compact and massive and is of pink to red colour. The pot holes of 15 to 25 cm dia. have been formed due to chemical action. The vertical joints, foliations, beddings and fractures are associated with it. The Jalore granite has intruded Erinpura granite forming veins of about 0.5 m thick. The boulders of 1.5 to 2.5 m dia. have been detached from the main body and are lying on the slope of the hills. The photo tone of the hills vary from dark grey to dark.

The hills of Aravalli phyllite and slate are situated near Punaka Math and Akeli villages. Due to high diurnal range of temperature spalling and 'peeling' of rock masses are extensive. The rocks are soft, friable and have well developed cleavages due to which these are badly weathered and dissected. The slopes of the hills vary from 40 to 60 per cent and are covered with rock fragments of 5 to 15 cm dia. The Aravalli quartzitic hill trending NE-SW occurs near Sowdawas village. The quartzitic is fine grained and composed of mostly quartz with little proportion of feldspar. It is well bedded, sheared and dipping 30° to 35° south. The quartz reef is associated with it. The photo tone of this hill is light and that of phyllite and slate is dark grey to dark.

These hills are affected by very severe water erosion which has created the gullies of 1.5 to 2.5 m depth and 3 to 5 m width.

2. Piedmont plains: These plains are situated in the foot hills of Archaean and Palaeozoic eras and constitute 12.1 per cent of the total area. Unlike Beaty's piedmont plains (1963) the piedmont plains of the region under study have been formed due to scarp retreat and lateral erosion. The plains are composed of heterogeneous sediments like coarse sands, gravels, cobbles and pebbles. According to the nature of slope, type and thickness of deposits and erosion characteristics, this unit has been further subdivided into the following sub units:—

(a) Upper piedmont plain: This plain surrounds the upper parts of rhyolite, granite, phyllite, slate and quartzite hills. This part is erosional and its slope varies from 5 to 10 per cent. The plain associated with volcanic hills is more extensive than that of the Aravalli formations. The deposits of this plain are very thick and their thickness varies from 10 to 25m. It consists of rock fragments of 2 to 15cm diameter mixed with coarse sand transported from the hills by the torrential rains. The plain has also been degraded by aeolian action resulting into the formation of active dunes of 1.5 to 5m heights. The stabilised dune of 12 m. height in north east of Miniari village has been formed and its surface is covered with lime nodules of 1 to 15 mm dia. About 75 per cent sand grains are of 0.06 to 12 mm dia. and

remaining 25 per cent are of 0.15 to 2 mm dia. It has been affected by moderate to very severe water and wind erosion. The water erosion has badly dissected the aeolian and colluvial deposits and the uncrossable gullies of 2.5 to 17 m depth and 7 to 33 m width have been created.

The upper piedmont plain associated with Aravalli phyllite, slate and quartzite is not affected by wind erosion. It is covered with detritus and rock fragments of 2 to 15 cm dia. The depth of sediments vary from 10 to 15 m and they are calcareous. It has been subjected to very severe water erosion which has created gullies of 1 to 1 m depth and 1.5 to 17 m width in SW-NE and WSW-ENE directions.

- (b) **Lower piedmont plain:** This plain lies in the lower parts of Aravalli and volcanic hills. It is an aggradational plains and constitutes finer sediments than upper piedmont plain. It consists of coarse sands, gravels, coarse loamy sand to sandy clay loam. It is not much affected by aeolian action and the sand deposits are in the form of sand sheets. The slope is gentler than upper one i. e., 3 to 5 per cent. Due to gentle slope the corrosive power of the short channels passing through this part is less and thus dissection is also not vigorous. The condition of subsurface water is better than upper piedmont plain and agriculture is practised. It has been affected by moderate to severe water erosion which has created numerous gullies

of 1 to 2.5 m. depth and 3 to 5 m. width in NW - SW, W-E, NW-SE and SW-NW directions. The photo tone due to moisture content is dark.

3. **Eroded rocky surface:** This unit covers 5.8 per cent of the total area and lies in the northern part of the region. It is an eroded and weathered surface of Aravalli quartzite, phyllite and slate. It consists of weathered mantle and at places solid rock have been exposed due to subsequent erosion of weathered product. The surface consists of coarse sands, gravels and due to granular disintegration it is covered with rock fragments of 5 to 20 cm dia. The rock outcrops of Aravalli formation with 2 to 3 m. heights are found here and there. The deposits in the pocket are deep and the cultivation is done. The slope of the surface is irregular. Numerous short channels of 1 to 1.5 m. depth and 2 to 5 m width are trending in NE-SW direction. It is affected by severe water erosion.

4. **Aggraded Older alluvial plains:** These plains occupy more than half of the total area of the block and are situated in north and south of the Bandi river. They are nearly level with 0 to 1 per cent slope. The sediments of the plains have been developed in part by stream transportation and in part from the *in situ* weathering of bed rock. The sediments are subrounded to subangular and are composed of feldspar, hornblende, biotite, iron and quartz. The sediments are underlain by weathered material and *kankar* pan at 8 to 10 cm and 30 to 180 cm depth respectively. On the basis of slope, erosion characteristics, depth and texture of the sediments the unit has been further subdivided into the following subunits:—

- (a) **Very deep aggraded older alluvial plain:** This subunit is nearly level with 0 to 1 per cent slope and comprises 14.9 per cent of the total area. It lies in the southern and northwestern parts of the block near Chawda Ki Dhani, Konlaol Tawali, Kalan and Digai villages. The surface texture varies from clay loam to loam. The *Kankar* pan has been encountered at 120 to 180 cm depth. The sediments are calcareous except near Jetpura and Digai villages. At some places it is affected by slight to moderate water erosion. The photo tone of the irrigated and cultivated fields is dark grey to dark and that of fallow fields light grey to grey.

- (b) **Deep aggraded Older alluvial plain:** This plain lies in the north and south of the recent flood plain of the Sukri stream and in between the Khari stream and Khardi Nala. It is nearly level and free from erosion except near Sagdara and Sakrawas villages, where it has been effected by slight and severe water erosion. The surface texture varies from sandy clay loam to sandy loam. The depth of the sediments varies from 90 to 120 cm. and they are slightly calcareous. The condition of subsurface water is good and the water is found at 15 m. depth.

- (c) **Moderately deep sandy aggraded Older alluvial plain:** This subunit comprises 3.1 per cent of the total area and lies in the south western part of the block. The mode

of the formation of this plain is similar to other alluvial plains but later on the alluvial surface has been degraded by aeolian activities resulting into the formation of sand sheets and active dunes of 60 to 1 m heights. The sands are fine to medium grained, well rounded and well sorted by wind action. The sands are loose, yellowish brown in colour and non-calcareous. The sand grains are consists of quartz, mica, feldspar and nodules of calcium carbonate. The sands are underlain by sandy loam to sandy clay loam mixed with pebbles of 2 to 2.5 mm dia. The slope of the plain is 1 to 2 per cent. The *Kankar* pan has been encountered at 50 to 75 cm depth. It has been affected by moderate wind and slight water erosion. The photo tone varies from light grey to white.

- (d) **Shallow to moderately deep aggraded Older alluvial plain:** This subunit constitutes 23.5 per cent of the total area and lies in the east and west of the eroded rocky surface. moderately deep sandy aggraded Older alluvial plain and recent flood plain associated with the Khari river. It is nearly level with 0 to 1 per cent slope. The surface texture varies from loamy sand to sandy loam and in pockets sandy clay loam. The shallow deposits of 8 to 20 cm depth are underlain by weathered granite and moderately deep sediments of 40 to 50 cm depth are underlain by *kankar* pan. The thickness of *kankar* pan is 8 m and below that weathered rock has been found.

It has been affected by slight to moderate water erosion. The photo varies from grey to dark grey.

- (e) **Shallow aggraded Older alluvial plain:** This is almost a level plain with 0 to 1 per cent slope and constitutes 9.3 per cent of the total area. It lies in the extreme north western part of the block on either side of the recent of flood plain of the Bandi stream. The sediments have mostly been developed *in situ* on granitic surface and their texture varies from loamy sand to sandy loam and also loam. The granitic out crops of 60 cm to 1 m heights are exposed by erosion to the surface near Jeoria and punaita villages. The depth of the sediments, varies from 8 to 25 cm underlain by granitic weathered material and by *kankar* and at some places. It is free from erosion except near Muliawas village where it has been affected by severe water erosion. The photo tone is grey to white.

5. **Recent flood plain:** This plain lies on either side of the Bandi, the Sukri, the Khari, the Khardia and the Phunpharia streams in a narrow strip. The plain constitutes 11.4 per cent of the total area and has been created by single and multiple channel flow. It consists of the unsorted and unconsolidated sediments of sands, gravels, coarse silt and sandy loam. The thickness of sediments varies from 4 to 5 m and after that *kankar* pan has been encountered. The shapes of the sediment grains are subrounded to rounded. The plain is characterised by the point bars and meander scrolls which have been identified on the air

photos. The levels are also associated with it and their deposits are coarser on the upper part and finer on the lower part. The plain of the Sukri river has been degraded by aeolian action resulting into the formation of sandy hummocks of 60 to 90 cm heights. The plain at some places has been affected by slight to moderate water erosion which has created the gullies of 60 to 1 m depth and 1 to 2 m width. The condition of subsurface water is better than other geomorphic units. The irrigated fields exhibits dark grey to dark tone.

6. **Shallow saline depressions:** This geomorphic unit is situated in the middle part of the block and constitutes 2.5 per cent of the total area. It is nearly level and free from erosion. The sediments of the unit are heavy textured varying from silty clay to clay. According to Ghose (1964) and Ghose and Singh (1968) the formation of the saline depressions is associated with the courses of the prior drainage channels. The sodium chloride has been deposited near the confluence and then calcium carbonate and calcium sulphate in the upper reaches of the channels due to their differential solubilities. These saline depressions are situated between Katdhara and Gopalgarh villages and also near Kurla village. The surfaces of the depressions are highly saline, compact and impervious and thus are unsuitable for any plant growth. The depth of the sediments varies from 10 to 20 cm underlain by weathered Aravallis. The photo tone is dark.

7. **Graded stream beds:** The beds of the Bandi, the Sukri, the Khari and the Phunpharia streams are completely graded. The beds are covered with gravelly sand to loamy sand. The majority of

sediment grains are of 2 to 10 mm dia. The sediments are underlain by weathered material at 4.5 m depth. The banks have been dissected by stream floods during torrential rains. The amount of dissection varies from 2 to 6 m. The quartzites and granites have been exposed by vertical bank cut erosion along the banks of the Bandi and the Phunpharia streams. The other deposits exposed due to bank erosion are subrounded to rounded rock fragments of 40-90 mm dia., gravels, pebbles, grit, silty clay and gravelly sands with alternate layers of calcium carbonate of 3 to 5 mm and 0.02 to 0.06 mm dia.

The sand bars of 45, 20 and 25 metres lengths and 6, 2.5 and 3.5 metres width have been formed in the beds of the Bandi, the Sukri and the Phunpharia streams respectively. The average width of these streams beds is 85 m. The longitudinal gradients of the Bandi, the Sukri and the Phunpharia streams are 1:500, 1:500 and 1:550 respectively. The condition

of subsurface water in these beds is good and several wells of 15 m depth have been dug for irrigation and drinking purposes. The sand bars on the air photos appear as continuous dark ridges.

Geomorphological units and erosion

All the geomorphological units except shallow saline depressions are subjected to soil erosion of different intensities. The water erosion is more conspicuous and widespread than wind erosion. The piedmont plains, rugged hills and eroded rocky surface are badly dissected by erosion which has created shallow to very deep uncrossable gullies. The rills and gullies are also present in recent flood plain and shallow to moderately deep aggraded Older alluvial plain. Water erosion has also dissected the stream banks and the amount of dissection varies from 2 to 6 m. The areas affected in different geomorphological units by water and wind erosion are given in table 1.

Table 1: Type, degree and extent of erosion in Pali Block.

S. No.	Geomorphological units and sub-units	Type of erosion	Degree	Extent in sq.km.	Percentage
1	Aggraded Older alluvial plain, recent flood plain, shallow saline depressions and graded stream beds.	Practically no erosion		685.5	49.
2	Deep and shallow to moderately deep aggraded Older alluvial plains and recent flood plains and graded stream beds.	Water	Slight	123.6	8.8
3	Very deep, deep and shallow aggraded Older alluvial plain, recent flood plain and graded stream beds.	do	Slight to moderate	247.5	17.7

Table 1: Type, degree and extent of erosion in Pali Block—(contd.)

S. No.	Geomorphological units and sub-units	Type of erosion	Degree	Extent in sq.km.	Percentage
4	Moderately deep sandy aggraded Older alluvial plain.	Water & wind	Slight & moderate	43.3	31
5	Deep aggraded older alluvial plain and lower piedmont plain.	Water	Moderate	16.0	11
6	Lower piedmont plain.	Water & wind	Moderate to severe and Moderate	81.2	5.8
7	Upper piedmont plain.	Water & wind	Severe and moderate	20.6	1.5
8	Eroded rocky surface shallow aggraded Older alluvial plain, upper piedmont plain and graded stream beds.	Water	Severe	115.2	8.2
9	Upper piedmont plain.	Water	Severe to very severe	32.7	2.3
10	Upper piedmont plain.	Water & wind	Very severe	12.0	0.9
11	Rugged high and low hills	Water	Very severe	22.4	1.6

From the table it appears that 49 per cent of the total area of the block is free from erosion. Remaining 51 per cent area has been affected by slight to very severe water and slight to severe wind erosion which have damaged the productive land to a great extent.

Summary

The geomorphology and geomorphogeny of Pali development Block situated in semi-arid environment

have been described. It covers 1400 sq. km area and extends between latitudes 25°30' to 25°56' N and longitudes 73°0' to 73°33' E. The average annual rainfall is 500 mm. The landform features have been developed by orogenic, depositional and erosional geomorphic processes through various evolutionary stages of different geological periods. The block consists of different geomorphic units and subunits namely, 1. Rugged high and low hills, 2. Upper and lower piedmont plains,

3. Eroded rocky surface, 4. Shallow to very deep aggraded Older alluvial plains, 5. Recent flood plain, 6. Shallow saline depressions, 7. Graded stream beds. About 51 per cent area of these geomorphic units has been subjected to soil erosion of different intensities. The wind erosion has degraded the western part of the block and the dunes of 1 to 12 m heights have been formed. Water erosion has badly dissected the piedmont plains, piedmont dunes, hills and eroded rocky surface and the gullies of 1

to 17 m depth and 3 to 33 m width have been created.

Acknowledgement

Authors are grateful to the Director, Head of Basic Resource Studies Division and Geomorphologist of Central Arid Zone Research Institute, Jodhpur for critically going through the manuscript and valuable suggestions. Thanks are also due to Shri L. N. Sharma for help in analysing the data.

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POTENTIALITY OF ENVIRONS OF GROWTH CENTRES IN INDIA*

BY

DR. B. K. ROY**

INTRODUCTION

Traditionally three approaches towards regionalisation are recommended¹ viz., on i) homogeneity of geographical regions; ii) nodal locations and regions around them; and iii) administrative boundaries.² Besides, there are ramifications of these systems³ such as farming types regions, and regions based on hierarchy and population characteristics etc. In India, the application of such methods has been used extensively. Special studies on cities, towns and service centres have also been taken upto a great extent, but potentiality of environs of such centres have not been determined in its true perspectives.

Tripartite Relationship of Agricultural Systems and Lapses in Planning

Generally the evaluation of agricultural and industrial resources besides, manpower and financial implications are considered for formulating basic planning programmes. Since the beginning of the planning (1950-51) programmes in India, a considerable development has taken place in various spheres of economy. Besides the phased programming of the plans, there are certain lapses in our basic resources due to manifold factors of Government policies, social and economic behaviour of the people.

Table I

Lapses in Relationship of basic resources of agriculture in percentages

Selected States	Change over 1950-61 & 1955-56	Change over 1955-56 & 1960-61	Change over 1960-61 & 1964-65	Change over 1950-51 & 1967-68	Change over 1964-65 & 1967-68
West Bengal	+ 3.6	+ 2.38	+ 2.57	+ 2.36	+ 2.59
Uttar Pradesh	+ 1.70	+ 1.34	+ 2.53	+ 2.31	+ 2.29

1. $\frac{\text{Gross cropped area}}{\text{Net cropped area}} \times 100$ and the percentage calculated according to data of $\frac{j\text{th year} - k\text{th}}{k\text{th year}} \times 100 = \% \text{ shift } (+) \text{ or } (-)$

considering the tripartite relationships of net cultivated, double cropped and irrigated areas in two problem areas or northern India,

for example, it is seen that development of basic resources of agriculture has not been of progressive nature.

* Paper presented in the All India Seminar on Balanced Regional Development, Institute of Economic Geography, India, Calcutta on March 8th, 1970.

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It is worthwhile to remark that only during the first plan period maximum development could be obtained and it continued in the Second Plan in above two States. But, thereafter, the rate of progress became weak and static because of possibilities of additional irrigated facilities could not be created with the same rate in general in both the States. Such strong weaknesses in basic resources of agriculture system to these regions pose a serious problem in creating a strong potentiality for growth centres and regional development throughout the country.

On the contrary the urban fields of all classes of cities and towns are spreading on account of concentrated development around them. This has no doubt represented a small proportion of degree of development which is very much localised to space area in various

regions of the country. Hence, the rural/urban relationships are comparatively weak. Considering further the three resources viz., forest, pasture and agriculture Statewise, it is seen that rank size rule according to actual distribution has a logical basis in establishing industrial location based on them. Very naturally thirteen States namely Kerala, Uttar Pradesh, West Bengal, Tamil Nadu (Madras), Mysore, Maharashtra, Gujarat, Madhya Pradesh, Andhra Pradesh, Orissa, Rajasthan and two Union Territory i.e., Delhi, Laccadive, Minicoy & Amindivi, falling in the various ranges of population density are concentrated in the agrarian sector. Two States namely Assam and Jammu and Kashmir and Union Territories of Andaman and Nicobar Islands, Manipur and Tripura lie in the forestal sector and only Himachal Pradesh represents its position on the margins of pastoral, forest sectors (Fig. 1).

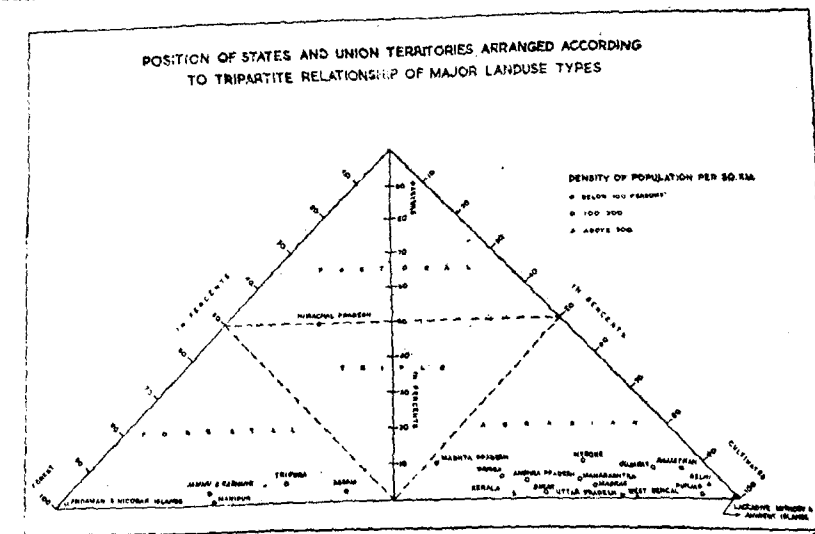


Fig. 1

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distribution and Land Use relation, and micro-relief besides the factors referred to earlier, a major portion of northern plains of India, for example, is very weak in potentiality and infra-structure.⁸ Such problem areas are numerous in the country for immediate development. This trend is an unhealthy sign of development on the above considerations of these areas of India where potentiality of growth centre for regional development have to be created on sound lines. Probably the most fundamental approach to the problems is the healthy town and country planning systems⁹ based on regional functions,¹⁰ need for arable adjustments for planning of environs¹¹ and social reformation.

Need for further Research & task ahead :

Classification of other regions at lower orders are under examination. These regions of first order will now again be divided into second and third order regions on the basis of industrial potentials of large centres in terms of competition of sub-centres and network of central places and occupational characteristics of regions. These factors will be chalked out further to suit mapping on large scales in various regions which may reveal problem areas for diagnostic/surveys, socio-economic and regional development studies and other planning programmes.

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BOOK REVIEW

PHYSICAL GEOGRAPHY Arthur N. Strahler, 3rd edition, First Wiley Eastern Reprint 1971. Published by A. R. Kundaji for Wiley Eastern Private Limited, J. 41, South Extension, New Delhi 49; and printed by Sudhir Balsaver at Usha Printers, 6 Tulloch Road, Bombay 1. Pages ix + 707, Price Rs. 16.50.

This book has been published with the assistance of the Joint Indian-American Text book Programme. This book is not to be sold outside India and Ceylon.

This book covers a wider field incorporating some aspects of Cartography, the earth as a planet, meteorology, Climatology, Oceanography, pedology, plant Geography as well as Geomorphology. This wide coverage does provide a useful source of material for the students of physical geography. It is suitable as a text book for the students of undergraduate classes.

There are few major changes in this book compared to the previous 2nd edition. There are thirty-four chapters grouped into four major parts. The part I is being devoted to the study of "The Earth as a globe". There are six chapters in this part with an addition of a new chapter on "Location and direction on the globe". The part II includes other Six Chapters on Atmosphere and Oceans. There is a new introductory Chapter describing the earth's atmosphere and magnetosphere in the light of the latest discoveries from space probes. The part III includes chapters on climate, soils and Vegetation. In the chapter devoted to the climatic classification and climatic regime, the new thermohyet diagrams are included. The structure and environment of vegetation and distribution of natural vegetation are the new additions in this book. All these are broad world description, that give a clear but generalised view of the world distribution patterns.

The last thirteen chapters in the part IV are devoted to geomorphology. In this part also there is an addition of entirely new chapter on Quantitative analysis of erosional landforms. At the end of the each chapter exercises are given.

There are four appendixes on (1) Map reading (2) World climate data (3) Soil orders of the United States (4) Quantitative Analysis of Geographic Variables.

The book is very well illustrated by many diagrams (474) and striking photographs (202). Most of the examples are drawn from the U.S.A. At the end of the book five coloured world maps of (1) Precipitation (2) Climatic Classification (3) Soils (4) Natural Vegetation (5) Land Forms, are included. The bibliography and index are given.

Throughout the book the approach is largely descriptive. The explanations are clear but divergent views are not given.

Mrs. SUSHILA DESAI,
Dept. of Geography
UNIVERSITY OF MADRAS
MADRAS

THE INDIAN GEOGRAPHICAL SOCIETY ANNUAL REPORT

The Forty Fifth Annual Report of the Indian Geographical Society for the year 1970, January - December.

The Council of the Indian Geographical Society has the honour to present the following report for the period January 1st 1970 to December 31st 1970.

Members and Institutions are particularly reminded that they will be helping the Society if they remit the current dues and arrears of subscription if any, as early as possible.

MEMBERSHIP:

The present strength of the Society is shown below :-

1. Life Members	...	...	42
2. Ordinary Members	...	...	34
3. Institutions Indian 150 } Foreign 95 }	...	...	245
4. Exchange Journals	...	...	33

The Committee Members of the Indian Geographical Society for the year 1970-71 were the following:

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(2 Vacancies)	

The Society is grateful to the authorities of the University of Madras for the annual grant of Rs. 150/-. The Society takes this opportunity to thank Thiru N. D. Sundaravadivelu, the Vice-Chancellor of the Madras University for allowing the Society to function in the University Department of Geography.

FINANCE

Financial Statement for the year ending 31st December 1970 is set-forth in the auditor's Statement.

The income for the year under various heads amount to Rs. 3267.06 together with the previous years balance of Rs. 1847.47 gives a gross amount of Rs. 5114.53. The expenditure has been Rs. *3432.73 leaving a balance of Rs. 1713.80, Rs. 1664.58 with State Bank of India, University Branch; Rs. 67.15 with the Secretary; and Rs. 0.07 with the Treasurer. *The auditor's fee of Rs. 50/- for the year 1969-70 has been included under expenditure but has not yet been paid to them, pending the submission of their bill. The actual money drawn for expenses is Rs. 3432.73 - Rs. 50/- = Rs. 3382.73.

ACTIVITIES

Under the auspicious of the Indian Geographical Society

- (1) Dr. (Miss) A. R. Irawathy, Ph. D. (London) delivered a lecture on her visit to U. S. A. and U. K. at the Department of Geography, University of Madras.
- (2) On behalf of the Society the President and few members warmly welcomed the Australian Geographers who were on Study Tour in India. The Australian Geographers led by Mr. Shah visited the Department and had very lively discussion on the various aspects of Geography with a few members of the Society.

University Centenary Buildings,
Chepauk, Madras-5.
Dated : 29th March 1971

A. RAMESH
Hony. Secretary.

The Indian Geographical Society

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UNIVERSITY CENTENARY BUILDINGS,
CHEPAUK, MADRAS-5. S. INDIA.

Edited and Published by Dr. A. RAMESH, University Centenary
Buildings, Chepauk, Madras-5. Printed by A. V. Rao,
at the Manorama Press, Madras-14.