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DEMOGRAPHIC TRANSITION IN SMALL COUNTRIES

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Half of the world's 200 countries have less than 3.37 million inhabitants, and many of these small countries are often assumed to experience rapid demographic transition. This is true of many of the small island populations of the developing world, especially those with largely immigrant and pluralistic populations, unusual family structures and rapid economic development. Smallness of population alone, however, is not sufficient to ensure rapid demographic transition and many small countries of mainland Africa have experienced little.

The populations of a number of small countries in the developing world are said to be experiencing more rapid demographic transition from high to low birth rates and death rates than those of larger countries. How true is this generalization ? What are the explanations ? And to what extent is separate political status a significant factor ? These are not easy questions to answer, but we can offer some indications.

State Populations

The state is the primary areal unit of demographic consideration, so demography still has a strong element of political arithmetic, a term by which it was formerly quite well known. The reasons for the importance of the state in population study are varied :

(a) almost the entire surface of the earth is now divided among states (and a growing proportion of its waters) ;

(b) everyone is required to be a citizen or national of a state (though some have dual nationality) ;

(c) censuses of state populations are more common than for any other population ;

(d) state boundaries are to a greater or lesser extent demographic divides impeding the free flow of people and separating population systems;

(e) states have direct and indirect policies which influence the dynamics, distribution and composition of population; and

(f) international comparisons of populations are extremely common, and are greatly facilitated by the data collection and analyses of international agencies, such as the UN.

Following widespread decolonization and political independence during the second half of the twentieth century, states have proliferated greatly and now vary enormously in population size, structure, dynamics and distribution. If one considers population size alone, the range is immense. No list is absolutely comprehensive, but the 200

countries for which the US Bureau of Census volume *World Population, 1979* provides demographic data range from 1, 012,197,000 (China) to 6,000 (Saint Pierre and Miquelon), yet this excludes some smaller populations, such as those of Asuncion, Tristan da Cunha, Falkland Islands, the Holy Island Christmas Island, Cocos Islands, Johnston Island, Midway Islands, Nive, Norfolk Island, Pitcairn Island, Tokelau and Wake Islands, some of which have less than one thousand inhabitants. But with these very small populations the annual frequency of births and deaths is too low and variable to be a reliable index of fertility, so analysis in this paper will be confined to the list of 200 countries. Their frequency distribution of population size is of course markedly skewed (Fig. 1). At one end of the scale, 7 countries each with more than 100 million inhabitants account for 57.8 per cent of the world's population, while 144 each with less than 10 million inhabitants contain only 8.0 per cent of the world total, and 74 each with less than one million people comprise only 0.4 per cent of the total (Table 1).

Table 1

World Distribution of Countries by Population, 1979

Population of countries (in millions)	Number of countries	Total population (in millions)	Per cent of world population
More than 100	7	2547	57.8
10 — 100	49	1509	34.2
1 — 10	70	333	7.6
0 1 — 1	44	17	0.4
0.01 — 0.1	25	1	—
Less than 0.01	5	—	—
	200	4407	100.0

Source : U.S. Department of Commerce Bureau of Census, *World Population 1979, Recent Demographic Estimates for the Countries and Regions of the World*, Washington D. C. 1980.

The median population of the 200 countries in 1979 was only 3,372,000, between that of Benin and Ireland. So most state populations are small, and account for only tiny proportion of the world population.

Small Countries

The profusion of small state population has only in recent years been registered as significant demographically (Benedict, 1967; Kosinski and Webb, 1976; Vittachi, 1977), possibly because demography evolved largely among the mesopopulations of European states like Britain, France, Germany and Italy. Yet population size has been shown to influence the relative significance of external migration to total population change, smaller

populations experiencing more external migration than larger ones; many small populations are either preponderantly immigrant, like, Kuwait and Bahamas, or greatly affected by emigration, such as Lesotho and Martinique. Similarly, smaller populations usually exhibit less regular or balanced age-sex structures than larger ones, and are more prone to rapid population changes, in terms of natural change and migration (Clarke, 1976, pp. 21-29). It has been often suggested that both mortality and fertility are susceptible to more rapid decline among smaller populations, partly because the pattern of locality sizes is simpler and diffusion of birth and death control more rapid. Some are little more than city-states where internal migration is merely intra-urban migration. It has been also postulated (Roberts, 1976, pp. 37-46) that small populations show little differentiation, at least in occupations, but, as we shall see, this needs qualification because frequently small populations have received so many immigrants that they are ethnically diverse, a fact which may be closely connected with their rapid demographic change.

What constitutes a small state population ? Views vary. Robinson (1960) considered that scalar effects were evident in populations with less than 10 or 15 million, but according to the 1979 list of 200 countries, some 167 or 83.5 per cent would be regarded as small. Surely this is a macro-centric view of population size. A much more micro-centric view by the Caribbean demographer Roberts (1976) takes 2 million as an appropriate threshold. a level which would incorporate 84 countries or 42 per cent of the 1979 total number. No threshold is universally acceptable, but perhaps the demographic characteristics of smallness suggest a threshold somewhere between the above two levels to include countries like Jamaica, Central African Republic, Singapore and Albania, which would be excluded by a threshold of 2 million inhabitants. So for purposes of analysis, we consider those 100 populations below the 1979 median of 3,372,000 though we accept that it is a purely arbitrary dichotomy.

Demographic Transition

Demographic transition takes place in association with a number of social and economic changes. and there can be little doubt that population size of a country is no more than a contributory factor. Nevertheless, it is postulated that it has some relevance, and in order to illustrate the relationship between population size and demographic transition, use is made of a modified version of the transition pathway proposed by Heenan (1980) which relates diagrammatically birth and death rates for either a particular year or a period of years. Heenan's generalized demographic transition pathway (Fig. 2A) identified three phases of demographic transition by three quadrants, which appear rather more arithmetic than realistic

	Crude death rate	Crude birth rate
Phase I	15°/oo plus	30°/oo plus
Phase II	Less than 15°/oo	30°/oo plus
Phase III	Less than 15°/oo	Less than 30°/oo

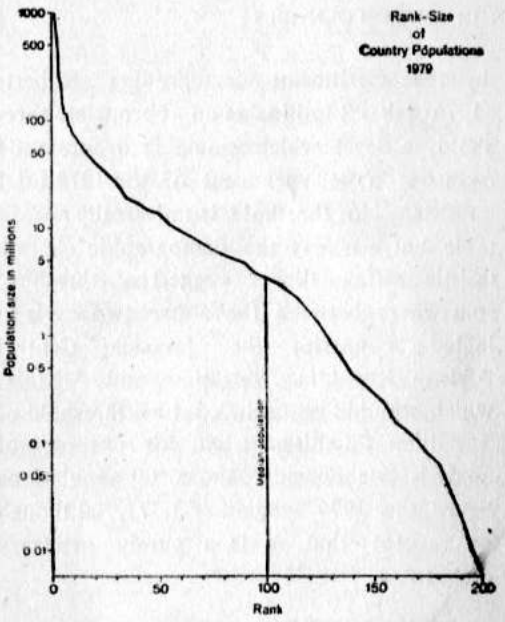

Fig. 1 Rank-size of 200 country populations, 1979.

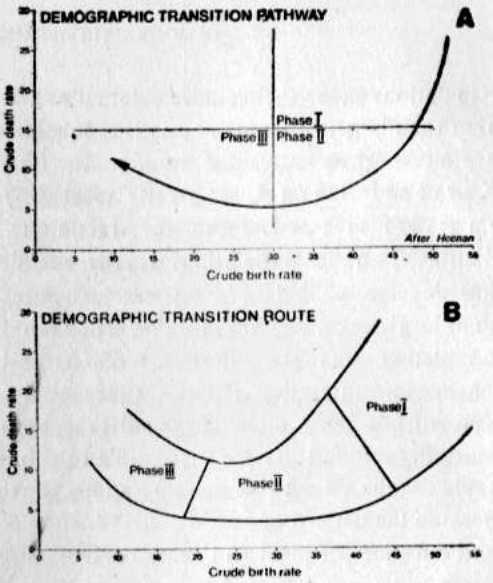

Fig. 2. A The demographic transition pathway as proposed by Heenan, 1980

B The demographic transition route as proposed by Clarke

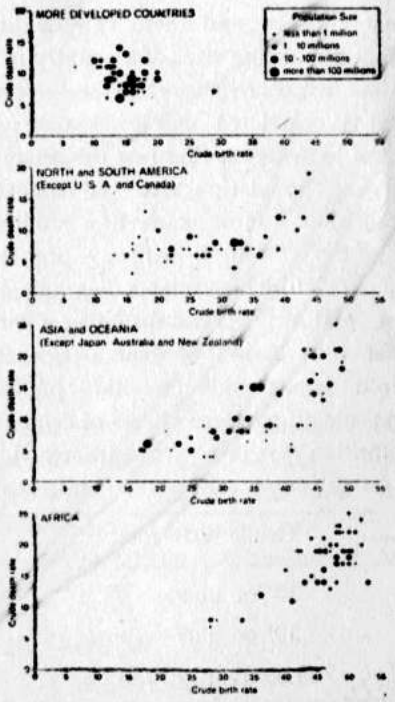

Fig. 3. Stages of demograhic transition reached in 1979 by 200 countries divided into four groups with four sizes of population.

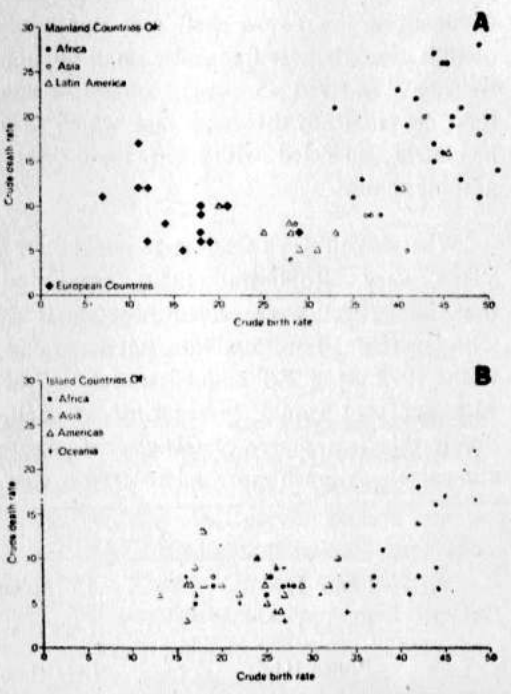

Fig. 4. Stages of demographic transition reached in 1979 by 100 countries below the median population size of 3.3 million.

A Small European and small main-land countries of Africa, Asia and Latin America.

B Small island countries of Africa, Asia, the Americas and Oceania.

Instead, it seems more appropriate to refer to a broad demographic transition route (Fig. 2B) along which countries proceed, as Heenan shows, by different pathways; the phases are merely segments of this route.

Superficial scrutiny of a relationship between the population size of 200 countries and their demographic transition indicates no close correlation, there being large and small countries at all phases of demographic transition (Table 2). More clear are the overall contrasts in transition.

Table 2
Demographic Transition and Size of Population

Population of countries	Phase of demographic transition			
(in millions)	I	II	III	Total
More than 100	—	3	3	6
10—100	15	18	15	48
1—10	40	18	14	72
Less than 1	15	38	21	74
Total :	70	77	53	200

Note : The phase is determined by reference to Figs. 2B and 3 between the more developed countries and the three broad continental groups of the Americas (except USA and Canada), Asia and Oceania (except Japan, Australia and New Zealand) and Africa (Fig. 3). While in Africa there are few countries which have reached phase II, about two-thirds of those in Asia and Oceania have done so, and an even higher proportion in the Americas, including an unusually high proportion of small populations, which are obviously worthy of closer examination.

Demographic Transition of Small Populations

From the viewpoint of location, the 100 small populations fall into three main categories :

(a) 14 European countries, including a number of islands;
(b) 38 mainland countries of Africa (17), Asia (12) and Latin America (9) ;
(c) 48 island countries of the Americas (20), Oceania (17), Asia (4), and Africa (7).

Figure 4 demonstrates that the three categories have different characteristics of demographic transition. Whereas the small European countries have generally attained phase III of demographic transition (an exception being Albania), the mainland countries of Africa are largely still in phase I, some of those of Asia are in phase II, and most of those of Latin America are in phase II. In short, whether or not the countries in groups (a) or (b) have achieved demographic transition depends more on location than on size (Fig. 4A).

In contrast, nearly all of the 48 small island countries or the developing world have progressed to phase II or III (Fig. 4B) and in

particular they have achieved low mortality. Death rates are generally 3-10 per thousand, the only obvious exceptions being Monserrat, the Comoros, the Maldives, New Hebrides and Papua New Guinea (Table 3). Fertility decline among the island countries is much less consistent, and birth rates range from 13 to 45 per thousand. Nevertheless half are below 27 per thousand, and these countries have growth rates comparable with some of the more developed countries. Moreover, the location of the island countries seems to matter much less to the measure of demographic transition. So islands do appear to have demographic distinctiveness.

Vittachi (1977) has noted how "islands and small non-island states account for a remarkably large share of the world's 'success stories' in reducing population growth", and suggested that an 'island approach' could be applicable in countries with much larger population problems. He referred to a number of the common characteristics of island populations : the feelings of insularity and claustrophobia; the fact that many are city-states; their accessibility to external influences; their high level of literacy; the changed status of women; and the policies of governments including the socialist policies of some, like Cuba. Certainly all these are relevant influences upon the process of demographic transition, but surely also important is the fact that many island populations are not indigenous but have high proportions of recent immigrants of diverse ethnic origins, brought in as slaves or as indentured labourers to work in colonial plantation economies. Many of the so-called "sugar islands" of the Caribbean, Indian Ocean and Pacific Ocean have very pluralistic populations. At the beginning of the nineteenth century, some islands like Singapore and Mauritius, had very few inhabitants, and were very male preponderant for most of that century and even until well into the twentieth century. In Singapore, for example traditional family structures had little time to evolve before the processes of demographic transition got under way, particularly after the second world war (Fawcett and Siew-Ean Khoo, 1980, pp. 549-79). In short, the social structure of many small island populations are quite different from those pertaining in long-established communities, a fact which is more relevant to an explanation of rapid demographic transition than smallness of population size alone. Certainly this helps to explain why, for example, the more traditional populations of the Maldives, New Hebrides and Papua New Guinea have experienced so much less demographic transition than the populations of Mauritius, Singapore and Martinique.

On the other hand, analysis of the demographic transition pathways of these latter three island populations during the period 1948-78 reveals considerable diversity (Fig. 5). The populations of Mauritius and Martinique, like that of Jamaica, experienced initial rises in birth rates along with declines in death rates, followed by substantial declines in birth rates but little change in death rates. Singapore, however, underwent much more overall decline in birth rates, while Monserrat exemplified the rapidly changing rates of a very small population (only 11,000). New Zealand is included in Figure 5 as a characteristic small developed country which has experienced initial stability of rates but recent decline in birth rates.

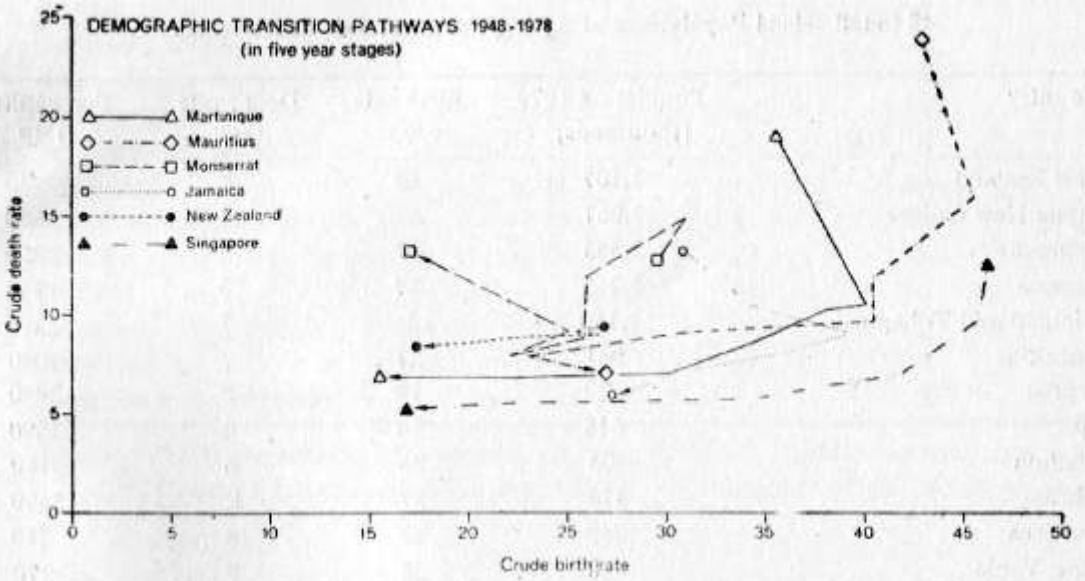

Fig. 5. Demographic transition pathways (in five-year stages) of six small island populations, 1948-78.

Transition is particularly striking in islands with rapid economic development, but detailed analysis is prevented by lack of GNP data for the smaller islands (Table 3) — accepting the imperfections of such data as an index of economic development. Enough data are, however, avaliable to suggest that the correlation between per capita GNP and demographic transition is not very close at this or any level of population size. China has shattered the modernization theory of demographic transition. Consequently, while Table 3 reveals that in general there is an inverse relationship between per capita GNP and demographic transition, there are some islands with high per capita GNP and modest transition (e.g. Bahrain, Netherlands Antilles and French Polynesia) and others with much lower per capita GNP and greater transition (e.g. Jamaica, Mauritius, Cape Verde, Barbados, Grenada, Dominica and Seychelles). Many of the latter have undergone more profound social changes than economic development.

In sum, smallness of population in itself is not sufficient to ensure rapid transition, but it is often associate with a recent demographic history, complex ethnic composition and unusual family structures which are peculiarly conducive to such transition.

Table 3

48 Small Island Populations of Africa, America, Asia and Oceania

Country	Population 1979 (thousands)	Birth rate o/00	Death rate o/oo	Per capita GNP
New Zealand	3,107	16	8	5940
Papua New Guinea	3,067	44	16	650
Singapore	2,363	17	5	3820
Jamaica	2,215	27	6	1240
Trinidad and Tobago	1,150	25	7	3390
Mauritius	941	27	7	1040
Cyprus	620	19	8	2940
Fiji	618	26	4	1690
Reunion	503	25	6	4180
Bahrain	370	37	8	5460
Comoros	359	42	18	210
Cape Verde	328	28	7	270
Guadeloupe	312	18	7	3260
Martinique	310	16	7	4680
Barbados	279	16	7	2400
Netherlands Antilles	240	29	7	3540
Bahamas	236	25	5	2780
Solomon Islands	222	44	9	430
Samoa	155	37	7	—
Maldives	150	42	14	200
French Polynesia	144	34	7	6350
New Caledonia	136	27	7	—
Pacific Islands	131	42	8	—
Saint Lucia	121	37	7	780
Guam	117	27	3	—
New Hebrides	114	45	17	—
Saint Vincent and the Grenadines	111	33	10	490
Grenada	105	25	8	630
U. S Virgin Islands	99	26	4	—
Tonga	96	33	8	—
Sao Tome and Principe	82	38	11	450
Dominica	78	22	6	410
Antigua	74	20	7	—
Seychelles	64	25	8	1400
Bermuda	63	13	6	—
Saint Christopher Nevis-Anguilla	57	24	10	—

Kiribati	57	31	6	—
American Samoa	32	34	4	—
Cook Islands	19	27	9	—
Gayman Islands	17	16	3	—
British Virgin Islands	12	17	6	—
Monserrat	11	18	13	—
Wallis and Futuna	10	40	10	—
Nauru	8	22	5	—
Tuvalu	7	41	6	—
Turks and Caicos Islands	7	26	9	—
Saint Helena	6	19	7	—
Saint Pierre and Miquelon	6	17	9	—

Source : U. S. Department of Commerce, Bureau of Census, *World Population, 1979, Recent Demographic Estimates for the Countries and Regions of the World*, Washington D. C., 1980.

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A GEOGRAPHICAL APPROACH TO SOME DEMOGRAPHIC FEATURES OF THE MOSLEM COUNTRIES

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The paper considers some demographic aspects of the world's Moslem Population. Main sources of information are evaluated and a definition is laid down for a Moslem country. Proportions of Moslem population are given for some 20 Asiatic and 30 African countries. Geographical distribution of Moslem countries as well as of the total world population are studied in some detail with due attention being devoted to Moslem minorities in non-Moslem countries such as China and the USSR. Population density, annual growth rate, life expectancy, age and language distributions are amongst demographic features discussed comparatively at country and continent levels. Special attention is given to urbanization in the Moslem world. Finally future trends are discussed by using the usual statistical methods. It is thus established that by the year 2000 the proportion of world's Moslem population will rise to 22.4% as compared with 18.3 in 1975 and that the pressure on natural resources of the Moslem countries will be more than twice as in 1975 which is an alarming fact. It is hoped that the study will assist Moslem leaders in adopting sound population policies in their respective countries.

According to reliable sources and formal opinions, it took all history to produce, by 1840s, a world population of one billion. It took less than a hundred years to add the second billion and merely thirty years to add the third, and, unless something happens to change the present tide, it is estimated that by the year 2000, there will be no less than seven billion to feed in this world.

The rapid growth of population in our time is the most important factor affecting the present, as well as the future national and regional developments. In the last century the rate of growth of population has been accelerated tremendously by the great advancement in medicine, hygiene and nutrition all over the world. Death rates, particularly infant mortality rates, have been reduced so that today more children grow up and themselves form families with still more children to grow up.

The growing awareness of human population growth and mobility is reflected in the fact that today population has become focus of attention, not only for demographers, but also for biologists, sociologists, planners, economists, medical scientists, anthropologists, geographers and many other scientists.

The present writer has no claim at being an expert in any of the varied fields of know-

ledge closely concerned with the question of population, but as a geographer, he proposes to approach the matter in relation with the Moslem countries of the world with an outlook that, he hopes, may bring into light some aspects of the issue in which present day Moslems of the world are all, more or less, concerned.

This concern arises from the fact that today no problem is more urgently important to the welfare of mankind than the question of population growth. It is a problem the effects of which are worldwide, demanding attention of all nations whether rich or poor or, so called, developed or undeveloped. However, it is in the geographically less favoured areas of the world, such as the habitat of most Moslem people, that the question is more serious and deserves immediate attention.

Population Geography has recently emerged as a distinctive branch of the wide field of geographical enquiry, focussing attention on population as a starting point of reference from which all other points are observed, and examining and interpreting the spatial patterns of population distribution, composition, migration and growth in relation to human activities and the nature of places.

Much as this branch of geography concerns itself with population, it is in the field of demography that the population problems are duly and adequately dealt with. The basis for most demographic research lies in the population censuses and vital statistics, but a population census is not an easy job. It is, on the other hand, a gigantic and costly operation that involves collecting considerable amounts of information from all the inhabitants of a country over a brief period of time which is ideally cut down to one day. Furthermore, some demographic information must be obtained from each individual independently, thus making the whole operation more qualitative in nature and consequently much more difficult than is usually presumed.

Demography finds many applications in social and economic fields. Census returns are not only basis for the present economic and social plannings, but population projects are considered essential as a basis of forecast of school population, number of households, structure of labour market, medical requirements and scores of other problems that are vital to the well being and future development of every society.

Sources of Data for the Present Study

It is a well-known fact that not all countries of the world possess long records of systematic census and, unfortunately, most Moslem countries are not exception to this rule. Consequently in a study of the nature of the present one has to be content with the estimates of population, official and otherwise available. Similarly figures for surface area are not often exact specially in the case of newly created countries where frontier disputes make even accurate estimates rather difficult.

Throughout this study, all figures,whether pertaining to country, areas or populations, have been taken from the United Nations *Demographic Year Book* for 1975. However, in few cases where more recent information has been available or, in cases where certain figures have been absent altogether; the figures have been updated and replaced by the more recent ones or, the missing

figures have been worked out either through statistical methods or simple interpolation. On the whole 1975 may be safely taken as the year, and the United Nations *Demographic Year Book* as the source for the present study.

Definition of a Moslem Country

Islam has now found its way into almost all countries of the world and there is hardly a territory or a country where Moslems are not found. However, the number of Moslems in any one country may vary from a mere few to a large proportion of the total population or, in some cases the whole populace.

The United Nations *Demographic Year Book* provides no information about religions but a general geographical atlas named *Complete Atlas of the World*, published in Persian by Gita-Shenasi Institute of Tehran, Iran, as recently as in April 1978 provides information about the Moslem proportion of population in every country of the world. The present study is based also on the information thus provided. This information appeared to be quite reliable and accurate in all cases where other figures were available for comparison.

Table 1 shows all countries of the world that have an Islamic population element of more than 5%, but throughout the present study only countries with more than 75% Moslem population have been considered as Moslem countries. In other words, an Islamic country, according to our definition, is a country that has no more than 25%, non-Islamic elements in the structure of its population.

However, throughout this study, specially when discussing population totals, adjustments have been made by means of deductions on account of non-Moslem elements in the so called Moslem countries, as well as additions in respect of Moslem minorities in non-Moslem countries.

Table 1

List of Countries with More Than 5 Per Cent Moslem Population.

Name of country	Percentage of Moslem population
Asia	
Afghanistan	100
Bahrain	100
Bangladesh	85
Indonesia	90
Iran	98
Iraq	95
Jordan	95
Kuwait	98
Lebanon	60
Malaysia	75
Maldives	95
Oman	100
Pakistan	97
Qatar	98
Saudi Arabia	100
Syria	95
Turkey	98
United Arab Emirates	100
Yemen (Dem.)	99
Yemen (Rep.)	99
Africa	
Algiers	99
Chad	70
Congo	7
Egypt	92
Eq. Guinea	40
Ethiopia	40
Gambia	85
Ghana	13
Ivory Coast	25

Kenya	6
Libya	97
Malagasi	10
Malavi	35
Mali	90
Mauritania	95
Mauritius	18
Morocco	99
Niger	90
Nigeria	60
Senegal	80
Sierra Leone	25
Somali	99
South Africa	20
Sudan	75
Tanzania	31
Togo	7
Tunisia	99
Uganda	7
Upper Volta	20

Geographical Distribution of Moslem Countries

Islam has been considered predominantly a religion of the dry lands of the world. This statement is true to a certain extent since the bulk of Islamic territories coincides with the dry and semi-dry climatic zones of the world, covering most of North Africa and South West Asia. All these areas suffer from low rainfalls and all the consequences that result from this geographical aspect. Out of the thirty-two countries recognized as Islamic countries in this study, only three namely, Indonesia, Malaysia and Bangladesh enjoy tropical or monsoon climates that are, geographically speaking, characterized by high summer rainfall, rice culture, dense population and many other problems emanating from such conditions.

Islam is similarly considered an exclusively Old World religion because the total number of Moslem people living outside the Old World, hardly reaches 1% of the total world Moslem population. Within the Old World, the bulk of Moslem population is to be found in Asia which accomodates more than 70% of the world total with Africa holding almost the remaining 30%. In Europe the only country with a considerable Moslem element, but not large enough to be included in the present study, is Albania with roughly 60% Moslems out of a total 2.5 millions.

Just as Islam is considered to be an exclusively Old World religion, so it is geographically limited to the Northern Hemisphere, since all the Moslem countries of the world lie to the north of the equator with some exceptions in the case of Indonesia that extends southward till about the ten degrees south latitude. The northern most dominion of Islamic world is to be found in Turkey where the northern boundaries of this Islamic country, or the southern shores of the Black Sea, are seen a little above the forty degrees north latitude.

World's Total Moslem Population

According to our definition there are twenty Moslem countries in Asia and twelve in Africa as listed below in order of area and population. However, it must be mentioned at once that there are no less than 120 millions, or roughly 1/6 of the total world's Moslem population, living in India, China and the USSR, which do not fall into our definition and are not considered as Moslem countries. It must also be noted that within the above so called Moslem countries are sometimes considerable proportions of non-Moslem elements that have to be accounted for in the discussion of Moslem population on a world scale.

Table 2

Moslem Countries of Africa

In order of area (in sq. kms.)		In order of population	
Sudan	2,505,790	Egypt	38,000,000
Algiers	2,381,729	Sudan	18,300,000
Libya	1,759,529	Morocco	18,000,000
Niger	1,267,000	Algiers	17,000,000
Mali	1,204,015	Mali	6,100,000
Mauritania	1,172,493	Tunisia	5,850,000
Egypt	1,001,442	Senegal	5,300,000
Somali	637,655	Niger	4,750,000
Morocco	624,767	Somali	3,400,000
Senegal	197,160	Libya	2,550,000
Tunisia	163,610	Mauritania	1,400,000
Gambia	10,639	Gambia	540,000
Total	12,925,429	Total	122,590,000

Table 3

Moslem Countries of Asia

In order of area (in sq. kms)		In order of population	
Saudi Arabia	2,149,690	Indonesia	140,000,000
Indonesia	2,042,024	Bangladesh	73,746,000
Iran	1,648,000	Pakistan	70,560,000
Pakistan	803,943	Turkey	40,197,000
Turkey	779,452	Iran	35,000,000
Afghanistan	649,504	Afghanistan	19,500,000
Iraq	446,711	Malaysia	12,600,000
Malaysia	329,745	Iraq	11,600,000
Yemen (Dem.)	287,683	Saudi Arabia	9,700,000
Oman	212,475	Syria	7,800,000
Yemen (Rep.)	195,000	Yemen (Rep.)	6,471,000
Syria	185,160	Lebanon	3,300,000
Bangladesh	142,776	Jordan	2,800,000
Jordan	97,740	Yemen (Dem.)	1,800,000
U. A. Emirates	77,000	Kuwait	1,100,000
Kuwait	20,000	Oman	800,000
Qatar	11,000	U. A. Emirates	655,000
Lebanon	10,400	Bahrain	300,000
Bahrain	622	Qatar	180,000
Maldives	298	Maldives	128,000
Total	10,089,223	Total	438.237,000

In the present study the total world Moslem population has been calculated on the basis of 1975 United Nations estimates shown in the above tables and on assumptions as follows :

Table 4

World's Total Moslem Population

Asia :	Total of twentyMoslem countries	438,237,000	
	Plus India @ 60, China @ 30 and the USSR @ 30 million	120,000,000	
		558,237,000	
	Less non-Moslems of Islamic countries		
	Indonesia @ 10%	14,000,000	
	Bangladesh @ 15%	11,061,000	
	Malaysia @ 28%	3,170,000	530,006,100
Africa :	Total of twelve Moslem countries	122,590,000	
	Plus Moslem elements in non-Moslem conntries	84,421,000	
		208,011,000	
	Less non Moslem elements in Moslem countries	10,348,000	197,663,000
	Rest of the world including Albania, the Phillipines etc.		5,000,000
	Grand Total		732,669,100

It should be noted that since the number of non-Moslem elements in the population of the twenty Islamic countries of Asia is negligible, no deduction has been made on that account.

According to the United Nations estimates, the total world population of 1975 was 4 billion. Thus the followers of Islam comprised 18.3% of the total world population. On the other hand the thirty-two Islamic countries of the world, although not accomodating all Moslems of the world, have a combined area of 23,014,672 sq. km which make up 15.5% of the world's surface area.

Out of the above total world Moslem population roughly 200,000,000 or 28%, made up as follows live in non-Moslem countries as defined here :

India	60,000,000
China	30,000,000
USSR	30,000,000
Non-Moslem states of Africa	84,421,000
Rest of the world	5,000,000
Total	209,421,000

Asia, the greatest and the most populous of all the continents shows the highest accumulation of Moslem people. It is in Asia that we find 70% of the total world Moslem population, spread in twenty out of forty political units of this large continent.

Africa accomodates a little less than

30% of the world's total Moslem population but whereas the 530 million Moslems of Asia comprise 21% of the total population of this great continent, the 197 million African Moslems make up 56% of the total population of the continent, making Moslem domination of African population quite evident.

As far as area is concerned, Saudi Arabia is the largest Moslem country of Asia, having a total surface area of no less than 2,149,690 sq. km. Next come Indonesia and Iran having 2,042024 and 1,648,000 sq. kms. respectively. The remaining nine Moslem countries of Asia are each less than 1,000,000 sq. kms in area and it is in Asia that one finds the two smallest Moslem countries namely, Bahrain and Maldives having respectively surface areas of 622 and 298 sq. km. only.

It is in Africa that we find the largest and the most extensive of Islamic countries. Out of the twelve Islamic countries (Table 3), two have areas exceeding two million and four having areas exceeding one million square kilometre. Sudan, with more than 2.5 million sq. km. boasts of being the largest Moslem country in the whole world. Next comes Algiers with 2.3 sq. km. followed by Libya, Nigey, Mali, Mauritania and Egypt having areas of more than a million sq. kms. each. The smallest Moslem country of Africa is Gambia with a surface area of no more than 10,689 sq. kms.

Excluding India, China and the USSR, the twenty Moslem countries of Asia have a combined area of 10,089,223 sq. kms. or 23% of the total land surface of this large continent. The twelve, so called, Moslem countries of Africa with a combined area of 12,925, 429 sq.km. on the other hand make up no less than 43% of the area of Africa. All Moslem countries combined occupy 18.3% of the total land surface of our planet as already pointed out.

As far as population of individual countries is concerned, that of the continents having been already dealt with above, it is quite natural that the populous Moslem countries be found in Asia. It is in Asia that one finds not only the most populous of all Moslem countries, namely Indonesia with 140 million (almost 3/4 of the total Moslem population of Africa), but three other countries i. e. Bangladesh, Pakistan and Turkey with populations higher than the most populous of African Moslem countries, namely Egypt with 38 million. There are in Asia four more countries with populations of above 10 million and seven that have populations ranging from one to ten million. There are however five political units with less than a million each including Bahrain, 180,000, and Maldives, 128,000, being the smallest Moslem nations of the world.

On the whole the Moslem countries of Africa appear to be more balanced as far as population is concerned. Just as Bangladesh in Asia has about 50 % of the first populous country namely Indonesia, so in Africa Sudan with the population of about 50% of Egypt is second on the list of Moslem countries of Africa.

The population of remaining African Moslem countries fall gradually to less than a million in Gambia, but it is interesting to note that in Africa we encounter only one Moslem country with a population of less than a million, as compared with five in Asia.

From the geographical point of view, it

is interesting to note that the three Islamic countries of Indonesia, Bangladesh and to a certain degree Pakistan have abnormally high populations probably due to their different climatic and geographical conditions already referred to above.

Population Density

Geographers and demographers often speak of population density which is the ratio between the number of people and the area of the region they live in. Many scientists believe that this ratio is not of much significance because the number of geographical factors at work in any one region are so many that the mere man-land ratio may mean nothing as far economic and living conditions are concerned. Nevertheless, it is of interest to have a look at the population density throughout the islamic world since it may serve as guideline for future development potentialities.

It can be said at once that the Moslem countries of Asia with the higher proportion of overall Moslem population have higher densities too. Taking all countries together, we come up with the figure of 43 persons per square kilometre which, of course, is of little significance or value. It is however noteworthy that it is in Asia that we find unusually high densities in the Moslem world. Disregarding the two tiny states of Bahrain and Maldives, with densities of 426 and 429 persons per sq. km. respectively, it is in Bangladesh that we encounter the high density of 500 person per sq. km. which is almost six times higher than the next density figure of 88 person per sq. km. which relates to Pakistan. Indonesia, with 71 persons per sq. km. comes next with Kuwait, Malaysia and Syria and the Republic of Yemen coming after with densities ranging from 30 to 40.

The lowest density figures come from Saudi Arabia, which with an area of 2, 149 690 sq. kms (the highest in Moslem countries of Asia) and a population of 9,700,000 shows the low density of only 4.5 persons per sq.km.

Africa presents a different picture as far as density of population is considered. Here the highest figure comes from the smallest and the least populated country, namely Gambia with 50 persons per sq km. Egypt. with a total population of more than 38 million and an area just exceeding one million square kilometres tops the list of remaining Moslem countries of Africa showing 38 persons per sq. km. However it is a well known fact that with some 65% of Egypt's population being crowded in the delta and the remaining portion in the narrow valley of the Nile, the effective density of population in Egypt is one of the very high ones all the world over. Niger (37), Tunisia (36) and Morocco (29) are the next countries that show relatively high densities. The remaining Moslem countries of Africa have all lower densities but the lowest of all comes from Mauritania that with a population of 1.4 million and a surface area of over a million sq. kms. comes up to the abnormally low figure of 1,2 persons per sq. km. Next from the bottom of the list come Somali with 5.3 and Sudan with 7 persons per sq.km.

Annual Rate of Population Growth

The difference between the birth rate and the death rate is an important demographic factor on which the future increase of population and all plannings for a better life and higher standards of living are really dependent. It is a known fact that due to

introduction of medical care and other welfare measures there has been a considerable drop in death rates and specially in infant mortality all over the world. This is more true of the countries where due to lower standards of living and unfavourable economic conditions, chances of survival for the newborn were little. Birth rates are controlled by means of education in its widest sense but there are numerous cultural and religious factors at work that influence the results of this factor in Islamic countries.

In Asia, excluding Kuwait, where the abnormally high growth rate of 5.6% per annum should be considered due to economic opportunities offered to immigrants, high natural growth rates come from Bahrain 3.5, Iraq 3.4, Jordan and Syria 3.3 and the united Arab Emirates 3.2. Disregarding the small state of Maldives where seclusion and lack of economic opportunities may be responsible for the unusually low growth rate of 1.6 per annum; Turkey with 2.5 has lowest annual growth rate with Indonesia, where birth control measures have apparently been effectively enforced, coming next having a growth rate of 2.6%. The remaining Moslem countries of Asia have annual growth rates ranging between 2.6% and 3.2%.

Surprisingly enough, the annual rate of increase of population amongst Moslem countries of Africa appears to be more balanced than in Asiatic Moslem countries. Here the highest figure of 3.5 comes from Morocco and the lowest 2.4. from Senegal with all other countries between these extremities.

Life expectancy

Expectancy of life is generally considered to be the best index of economic prosperity and cultural and material progress in any nation of the world. The highest figures of life expectancy come from North West European countries, particularly from Scandinavia.

In the world of Islam as a whole, i.e. taking all Moslem countries together in each continent, Asia comes up with the average life expectancy of 50 years, whereas the corresponding figure for Africa is 5 years less or 45 years. Amongst the Moslem countries of Asia, excluding Lebanon, which incidentally because of its 60% Moslem population has not been included in our list of Moslem countries, and shows the high life expectancy of 62 years; Syria tops the list with a life expectancy of 56 years. Next come Turkey with 54, Iraq and Malaysia with 53, Pakistan with 52, Kuwait and Jordan with 52, Iran with 51 and all others, with the exception of Bangladesh having a life expectancy of 50 years. The lowest figure of life expectancy in Moslem countries of Asia comes from Bangladesh where a newborn baby, on the average, cannot expect to live more than 44 years.

In Africa, life expectancy amongst Moslem countries is, on the whole, lower than in Asia as already indicated. Here, excluding the island state of Mauritius which corresponds to Maldives of Asia and shows a similar life expectancy of 62 years, the highest figure of life expectancy is shared by Egypt, Algiers and Morocco, all showing the figure of 52 years. The only other Moslem country of Africa with a life expectancy of over 50 years is Tunisia with 51 years. At the other end of the life expectancy scale lie Niger and Mali with 38 years. Senegal and Mauritania have both an equal figure of 39 years whereas all the remaining

Moslem countries of Africa show life expectancies of between 40 years and 50 years.

Age Distribution

Demographically speaking, age distribution is an important factor in the structure of any population since it can serve as an index of working force and consequently productive capacity of the population group concerned. By age distribution is meant the spread of population percentagewise amongst various age groups, normally taken as decades from birth to death. In the case of individual nations or regions this can be best represented in the form of population pyramids which are very much used by demographers in their various approaches to the population problems. In advanced countries with high standards of living and literacy, population pyramids assume a more or less cylindrical shape with an even distribution of population in all age groups. In such societies the number of old people such as pensioners may be of the same proportion as children of less than ten years of age. In less advanced countries, on the other hand, the population pyramids appear to be quite conical, which indicates that there may be a large proportion of low aged persons at the bottom of the scale and only a few aged ones at the top.

In the present study no specific attention has been paid to this demographic feature basically because of almost complete absense of adequate statistical data from all countries concerned. However one can presume from the rapid growth rates to which some reference has already been made, and also from sporadic information at hand, that age pyramids in most of Moslem countries of the world are conical. In other words all Moslem countries have young populations as compared with the European and North American countries. Generally speaking, it can be said that 50% of the peoples of Moslem countries are of less than 20 or even 18 years of age, which are normally non-productive and have to be taken care of by their parents. If we add to this the number of women, who for social and traditional reasons, cannot be fully productive in most Moslem countries, it can be seen that the very age distribution becomes an economic liability and creates a situation under which fewer numbers of people are obliged to secure a living for a large number of mouths. In other words, it is evident that too rapid a population growth and too young a population hinder the Moslem nations both in Asia and Africa to progress and to satisfy the growing demands of their people for a better life. Furthermore such conditions, according to certain economists, consume much of the economic growth and automatically condemn people to continued poverty.

Language

It is a well established fact that Arabic is the religious language of all Moslems of the world where ever they may happen to live. It is equally accepted that the Holy Koran is still read in Arabic by millions of Moslems that may not even comprehend that language. Nevertheless since language is an all important factor in social contacts among people, it is interesting to have a casual look at the languages spoken by the Moslems of the world.

Statistically speaking more than 700 million Moslems of the world speak perhaps dozens of languages and hundreds of vernaculars but the Table 5 has been prepared just to show the main language groups and their relative importance in the world of Islam.

Table 5

Languages of the Moslem Countries

Language	Main areas	Number	Total	%
Arabic	Africa	122,590,000		
	Asia	43,206,000	165,796,000	22.6
Persian	Iran	35,000,000		
	Afghanistan	19,300,000		
	USSR (Uzbakistan)	13,950,000		
	USSR (Tajikistan)	3,470,000	71,720,000	9.8
Turkish	Turkey		40,197,000	5.5
Malayan	Indonesia	140,000,000		
	Malaysia	12,600,000	152,600,000	20.8
Bengali etc.	Bangladesh		73,746,000	10 0
Urdu	Pakistan		70,560,000	9.6
Chinese	China		30,000,000	4.1
Others	All over		8,049,000	9.4
Hindi	India		60,000.000	8.2
Total			732,668,000	100

Urbanisation

Most Moslem countries have old time urban traditions that in the case of some South West Asian regions go far back into the beginning of agriculture. Generally speaking the distribution of population in South West Asia has followed a pattern of dense settlements in fertile river valleys where soils were suitable for perennial, irrigation that sustained large numbers of people in extensive permanent settlements. In the Middle Ages the urban development of Moslem countries resulted in large and populous cities that served as political centres, trading posts, religious places etc. Today these traditional patterns are still in existence, despite the emergence of another pattern representing the continuous migration from the rural to urban areas or the change of life from rural to urban. This ever increasing tendency, as is now well-known, is due to the relative decrease in the need of labour in primary occupations such as agriculture and animal breeding, itself caused by introduction of modern technology, in favour of secondary (industrial) and tertiary (services) occupations. As a result of this tendency underemployed rural population often migrates to cities, with the inevitable depression in rural areas. Furthermore, rapid urban developments, specially in Moslem countries that own oil and other underground resources, serves as an attraction to rural inhabitants. Similarly industrialization and high wages as well as urban health and schooling facilities, leave alone, normal living facilities, often serve as strong pull factors of population of rural areas. On top of all these in some Moslem countries of the dry semi-desert regions of the world crop

failures and near famines contribute to the growth of urban population at the cost of rural areas. In this continual drift of population from villages into cities and towns, rather unfortunately, it often happens that the shortage of suitable jobs results in many unskilled village farmers, who come to the city in search of work and a better life, ending up in slums, a social phenomenon of great importance, so typical of the peripheral areas of large cities.

Before further discussion of urbanism in Moslem countries, it might serve well to have a glance at the present status of urban-rural elements in the population structure of these countries.

Table 6

Distribution of Urban Population in the Moslem Countries 1975

Country	(Urban percent)	Country	Urban (percent)
Asia		*Africa*	
Afghanistan	15	Algiers	43
Bahrain	78	Egypt	42
Bangladish	10	Gambia	16
Indonisia	20	Libya	30
Iran	43	Mali	10
Iraq	64	Mauritius	45
Jordan	45	Mauritania	22
Kuwait	99	Morocco	40
Malaysia	30	Niger	—
Maldives	12	Senegal	30
Oman	15	Somali	—
Pakistan	26	Sudan	20
Qatar	10	Tunisia	45
Saudi Arabia	21		
Syria	45		
Turkey	43		
U. A. Emirates	—		
Yemen (Dem.)	33		
Yemen (Rep.)	10		

From the Table 6 it can be seen that, taking all countries together, the proportion of urban population in Moslem countries of Asia is slightly higher than that of the African ones. In Asia almost 35% of the Moslem people lead an urban life against 65% that make a living out of rural occupations. In Africa the same proportions are 30% and 70% respectively.

Disregarding Kuwait that, owing to exceptional circumstances, shows an urban population of 99%, the most urban Moslem country of Asia is Bahrain with 78% urban population. Next comes Iraq, with an urban element of 64%, followed by Syria, Jordan,

Turkey and Iran, all having urban populations ranging from 40% to 45%. The least urban Moslem countries of Asia, appear to be the Republic of Yemen, Bangladesh and Qatar that have only 10% of their people living in cities. Afghanistan and Oman come next with 15% urban populations whereas the remaining countries include urban proportions ranging from 15% to 40%.

Generally speaking, urbanization has not yet overtaken most of Moslem countries of Africa where Tunisia and Mauritius, with highest urban elements of 45% are way behind their Asiatic counter parts. Other African Moslem countries with urban populations of above 40% are Algiers 43%, Egypt 42% and Morocco 40%. The least urban country amongst Moslem countries of Africa is Mali that has only 10% of its population in urban areas.

It should be remembered that the term "urban" does not have a universally accepted definition and is therefore interpreted differently in different countries. Some countries consider an agglomeration of 5,000 persons an urban centre whereas in other countries 20,000 and even 50,000 persons are required to form an urban centre. With this limitation in mind, it is worth-while having a glance at the distribution of notable urban centres in Moslem countries of Asia and Africa.

Table 7

Distribution of Major Urban Centres in Moslem Countries

Country	Number of cities with more than 1,000,000 people	Number of cities with more than 100,000 people
Asia		
Afghanistan	—	3
Bahrain	—	1
Bangladesh	1	3
Indonisea	4	7
Iran	1	15
Iraq	1	4
Jordan	—	1
Kuwait	—	1
Lebanon	1	2
Malaysia	—	3
Maldives	—	1
Oman	—	2
Pakistan	3	8
Qatar	—	1
Saudi Arabia	—	5
Syria	1	3
Turkey	2	17
United Arab Emirates	—	2
Yemen (Dem.)	—	1
Yemen (Rep.)	—	2
Total	14	81
Africa		
Algiers	1	3
Egypt	2	15
Libya	—	2
Mali	—	2
Mauritania	—	2
Mauritius	—	1
Morocco	1	9
Senegal	—	3
Somali	—	2
Sudan	—	3
Tunisia	—	4
Niger	—	3
Total	4	49
Grand total	18	130

It can be seen from the Table 7 that the Moslem countries of the world have, altogether 18 millionaire cities and no less than 130 urban agglomerations of 100,000 inhabitants and above. *The World Almanac* 1976 enumerates 112 cities, the world over with a population of more than one million each and 371 urban centres of more than 100,000. Accordingly the world of Islam claims 16% of the first and 35% of the second category urban centres. Within the Islamic world, however, Asia includes no less than 77% of Islamic millionaire cities and 62% of the Islamic cities having a population of above 100,000 persons.

It is paradoxical that although Asia surpasses Africa in the total number, percentage urban population, greater number of millionaire cities and larger number of cities with 100,000 and above inhabitants throughout the Moslem world, it is in Africa that we find the largest urban agglomeration. It is here that we have Cairo, undoubtedly, the largest conurbation within the Moslem world with an estimated population, of no less than 5.8 millions As far as population is concerned, Cairo is surpassed by 16 more populous millionaire cities that are all in non-Moslem countries of the world. The next large cities of the Islamic world are, in order of importance, Jakarta (5.0), Tehran (4.5) and Karachi with (3.49) million inhabitants. Turkey, with 2 millionaire cities and 17 cities that exceed 100,000 peoples each appears to be the most urbanized Islamic country. There are a number of smaller Moslem states such as Bahrain, Jordan, Qatar, etc. that do not possess more than one city with 100,000 inhabitants or above.

Future Trends.

We live in a world where there is very little stability of any sort. Change is preeminent and this applies to population more than anything else. Consequently it can be safely said that at no time in the past has mankind been so conscious of its growing population and to a certain extent, of its mobility. In many countries elaborate systems and statistical machinery have been devised to ascertain the state and dynamics of population, especially for the purpose of planning, although, as already stated earlier in this study, over much of the world and particularly in the countries of our concern, the quantity and the quality of demographic data leave much to be desired, a fact which affects the accuracy of predicting future population changes tremendously.

Uncertainty about future population numbers and their relation to the environment and resources have provoked a variety of attitudes and policies concerning changes in population numbers at various levels. However, in most communities such attitudes are conditioned by factors sueh as religion, culture and standards of living and this applies more to Moslem countries where religious ideas play an important part in population policies. One thing appears to be quite certain in all Moslem countries, namely, the fact that the massive reduction in mortality, special in the case of infants, and a less widespread reduction of fertility, make the increase in population almost inevitable.

Unfortunately, techniques for forecasting the future population, even simple numerical totals, are exceedingly crude, although elaborate formulae have been devised by statisticians that cannot be easily applied

in many regions due to lack of adequate statistical data. Considering all such limitations and, utilizing the best techniques and information available, the United Nations Population Division has come up with certain predictions, included in the *Demographic Year Book* for 1976, that can serve as a starting point in our discussion of population trends in Moslem countries.

Table 8

Projected Population of Moslem Countries

Country	Population in 1980	Population in 2,000
Asia :		
Afghanistan	22,038,000	38,260,000
Bahrain	350,000	561,000
Bangladesh	84,803,000	153,669,000
Indonesia	154,800,000	270,000,000
Iran	38,492,000	70,500,000
Iraq	13,214,000	25,626,000
Jordan	3,177,000	6,167,000
Kuwait	1,438,000	3,573,000
Malaysia	14,181,000	24,418,000
Oman	900,000	1,716,000
Maldives	132,000	295,000
Pakistan	82,950,000	156,461,000
Qatar	200,000	580,000
Saudi Arabia	10,451,000	19,471,000
Syria	8,536,000	16,591,000
Turkey	45,363,000	76,564,000
U. A. Emirates	770,000	1,460,000
Yemen (Dem)	1,930,000	3,585,000
Yemen (Rep.)	7,690,000	12,600,000
Total	491,415,000	882,097,000
Africa :		
Algiers	18,839,000	38,534,000
Egypt	42,400,000	67,367,000
Gambia	564,000	893,000
Libya	2,644,000	4,978,000
Mali	6,480,000	11,521,000
Mauritania	1,4·9,000	2,347,000
Morocco	22,000,000	33,385,000

Niger	5,313,000	9.932,000
Senegal	5,693,000	8,556,000
Somali	3,658,000	6,791,000
Sudan	21,629,000	41,769,000
Tunisia	6,589,000	11,508,000
Total	138,248,000	237,581,000
Grand Total	629,663,000	1,119,678,000

Considering the adjustment made in the figures of Table 4 showing World's Total Moslem Population, we can safely add here 250,000,000 to the anticipated figure of 1,119,678,000, bringing the aggregate number of followers of Islam for the year 2000 to 1,369,678,000. Now according to the predictions used here the world's total population in the year 2000 is estimated to be 6,110 millions, under which assumption, in that year the Moslems of the world will make up 22.4% of the total population of our planet as against 18.3% of the year 1975.

There will be not much change in the order of magnitude of Moslem countries as far as population is considered and the order shown in Table 2 will still hold good but the fact that pressure on natural resources of the Moslem countries will be more than twice as much as in 1975 is rather alarming and provides ground for the Moslem planners to find ways and means of alleviating the unsurmountable difficulties of their next generations as far as possible.

In conclusion it is hoped that the present study will enable the leaders of the Islamic World to adopt such population policies that would eventually direct their respective nations to the ideal goal of optimum population under which the welfare of the Moslem people, as measured by economic prosperity and Islamic ideals and teachings, will be best secured.

SOME ECONOMIC IMPLICATIONS OF POPULATION DISPERSION IN CANADA

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In New Brunswick, as in the rest of Atlantic Canada, the quality of life is highly prized, and for many inhabitants this means a rural lifestyle. New Brunswick (with the exception of Prince Edward Island) is the most rural of the Canadian provinces. In addition, over time it is becoming more rural. This paper examines some of the economic implications arising from the rural lifestyle. The provincial government also has expressed concern over rural dispersion in New Brunswick, hence this paper will be predominantly policy-oriented. It argues that social costs are considerable, and advocates increased emphasis on user-pay pricing. The intention is not to prohibit rural non-farm residence, but merely to charge rural dwellers a portion of the social costs they impose. The political feasibility of such a policy is open to question, but the alternatives may be increased tax rates or a reduced level of service, and these may be even more politically unpopular.

New Brunswick's population is predominantly and increasingly rural. Households have decided to take advantage of a rural lifestyle and live outside the towns and cities even though they incur higher transport costs in commuting to work. For the evidence shows that the largest increase in rural dwellers are those who are not involved with agricultural activities; but instead are rural-urban commuters. This paper argues that such population dispersion is costly to society and can be detrimental to economic growth. Hence it suggests user-pay as one solution since that would discourage further population dispersion while forcing rural commuters to pay part of the social cost; and yet leave individuals with the right (which in any case is a qualified right) to live where they wished. Of course this ignores political feasibility, but fiscal pressures may force the provincial government to adopt unpopular measures especially if the alternatives are reduced services/higher income tax rates.

The first section of the paper describes population dispersion in the province. The second section delineates and attempts to quantify social costs and benefits of population dispersion while the third section briefly examines user-pay. Based on the benefit principle, user-pay is a sadly neglected topic in fiscal theory and has not been widely applied by policymakers.

1. The Extent of Population Dispersion

New Brunswick is the least urbanised of the Canadian provinces (with the exception of Prince Edward Island). Moreover over time, it is becoming less urbanised. Using census figures there was a proportional and

an absolute increase in the rural population between 1971 and 1976. In 1976 almost half the population (48 per cent) of the province lived in rural areas (see footnote) and this had increased both proportionately and absolutely as shown in Table 1.

Table 1

Urban Rural Populations and Proportions for New Brunswick and Canada : 1971 & 1976 (Adjusted for Boundary Changes)

	Total Population	Urban	Rural[1]		
			Farm	Non-Farm	Total
New Brunswick(1971)	634,560	345,960	16,800	271,800	288,600
		54.52%	2.65%	42.83%	45.48%
Canada (1971)	21,568,319	16,399,920	1,162,145	4,006,245	5,168,390
		76.04%	5.39%	18.57%	23.96%
New Brunswick (1976)	677,250	354,420	11,685	311,250	322,830
		52.33%	1.73%	45.94%	47.67%
Canada (1976)	22,922,605	17,366,970	1,034,560	4,591,070	5,625,635
		75.53%	4.50%	19.97%	24.47%

Source : Statistics Canada, Census Tracts; Feldman Association, *Study on Sprawl in New Brunswick*, Phase I Report, 1978.

Moreover as shown, the majority (96 per cent) of rural residents are non-farm, which suggests that their location is not determined by their occupation. Presumably many of these rural residents commute to urban centres for employment.

The rural dispersion of population has many causes. Historically New Brunswick has not enjoyed continuous growth. Large scale immigration into the province would be succeeded by stagnation and even net out migration as farming became impoverished, or the attractions of urban areas in central Canada a or in the USA proved too strong (Dumas, 1976 pp. 11-30) Land would be abandoned leaving a sparsely scattered population. More recently the widespread use of automobiles, and rising real per capita incomes have enabled those who had lived in urban areas to relocate to semi-rural or rural areas and commute to work. The improved transport and higher incomes reduce the "friction" of distance. Since land values tend to fall with

1. Rural is non-urban where urban refers to cities, towns, and villages (incorporated or unincorporated) of 1,000 people and more, and to the urbanised fringes of centres of more than 10,000 and more.

distance from the city centre, improved transport by increasing accessibility to outlying areas, enables families to move to outlying areas where land is cheaper. One study of fringe areas in New Brunswick found that 61 per cent of the sample population lived at least six miles from their place of work, but more than 90 per cent were not considering moving to the city and therefore closer to work. (Community Planning, 1978). Even if property taxes were to increase to parity with city property taxes, most respondents would not move. Presumably they preferred the large lots and rural atmosphere, the two major attributes that the respondents thought "very important".

2. Economic Implications of Population Dispersion

This residential dispersion has implications for taxpayers. The individual will weigh the private costs of locating outside the central city (i.e. increased travel to work, reduced access to urban amenities) against private benefits (i e. better housing at the same private costs, or equivalent housing at lower costs). However "it is well known that there will be a tendency, upon the part of individuals who do move, to subsequently demand public services and amenities to a standard equivalent to or greater than those formerly available to them" (Economic Council, 1978, p 113). In addition those who "move" may pressure the public authorities to reduce the travelling time/cost of their new location (Economic Council of Canada, 1978). Thus the individual's decision to move, while a private decision in itself, also has social costs. In the first place traffic congestion, pollution and social segregation will increase. Secondly, the expansion may destroy valuable agricultural land and thirdly, the central city will face a fiscal squeeze as the tax base fall. Moreover all provincial taxpayers may incur a cost as facilities are abandoned in the central city and new facilities are demanded in the fringe areas. This section attempts to delineate and, where possible, quantify some of these costs.

A. *Social Costs of Dispersion : The Impact on Economic Development.*

In its recent study, the Economic Council of Canada partly attributes the poor economic performance of Atlantic Canada to the lack of urbanization (Economic Council of Canada, 1979). As noted in the first section New Brunswick is barely urbanised -only 52 per cent lived in urban centres in 1976. Nor is the province metropolitanised. Less than 20 per cent of the province live in a metropolitan area (100,000 or more) compared with more than 70 per cent in British Columbia, Ontario and Quebec. The Economic Council argues that greater urbanisation (and metropolitanisation) could contribute to raise living standards in Atlantic Canada. For urbanisation should increase for a number of reasons. Firstly agglomeration economies can be obtained in larger centres. Economies of scale (lower unit costs of production), economies external to the firm but internal to the industry (perhaps increased specialisation as in the automobile industry in Detroit) and economies external to the firm and the industry (access to a pool of skilled labour force on financial institutions, should theoretically lower costs (raise productivity) in larger centres. Empirically this appears to be the case. At least in centres of up to a million, value-added in manufacturing increases with city size. A second reason for

higher value-added in larger urban centres is the location of industries particularly tertiary industries with their skilled and highly paid personnel in large centres. Head offices for example usually locate in the largest centres. These variables explain the correlation between income per capita and urban size. One further explanation is the higher labour participation rates were 56.2 in a city of 10,000, 56.5 in a metropolis of 100,000 and 59.2 in the centres of one million. The size of the centre is particularly important in explaining the participation rate of women.

A less direct (and quantifiable) impact of urbanisation is that of technological innovations. The argument has been made with illustrations even from the agricultural sector that technological innovations are primarily an urban phenomenon and percolate later into rural areas (Jacobs, 1969). According to this argument a rural society will not engender, or keep abreast of, new technology.

B. *Social Costs of Dispersion : The Loss of Agricultural Land*

The increase in rural non-farm and the decrease in rural farm populations suggest that agricultural land is being converted into residential usage Between 1966 and 1971, 4,500 acres were converted into urban usage in New Brunswick, an increase of 20 per cent compared with 17 per cent for Canada as a whole (Gierman, 1977) Around Saint John the increase was 2,700 acres or 26 per cent. This increase was greater than the population growth and urban land density decreased by 20 per cent around Saint John compared with a decrease of 12 per cent for New Brunswick. Most (58 per cent) of the urban encroachment occurred on forest lands but almost a quarter was on improved agricultural land. More than 200 acres of improved agricultural land a year on an average are converted into urban usage throughout the province. Between 1951 and 1976 the amount of improved land in agricultural use decreased from 219,000 hectares to 172,000 hectares (Agricultural Canada, 1978).

In addition to the loss of agricultural land there are indirect effects that urbanisation produces. These indirect effects can be entitled the impermanence syndrome. Rising land prices have induced farmers to sell to developers; or alternatively higher property taxes have forced farmers to sell. Land speculation is a major contributor to the impermanence syndrome. (Berry, 1978, pp. 2-8) Even when the land is not sold, it may remain idle or be switched from operations requiring fixed capital (i.e. dairying) to other operations. There are also spillover effects. Farmers become a smaller proportion of their community and suburban interests dominate. Farming activities become regulated even prohibited, taxes rise to pay for urban amenities, and the principle of eminent domain may be imposed.

C. *Social Costs of Dispersion : The Cost of Services.*

Population dispersion clearly creates social costs when the cost of services and utilities increase with distance. According to a recent study road maintenance costs are approximately $1,500/mile/year and snow removal costs are the same (New Brunswick Telephone, 1980). In addition, there are culverts to be installed at each residential driveway; an approximate cost of $467 for each culvert. Similarly water, sewage and power costs increase with low

density settlement. These costs are therefore directly correlated with distance and population dispersion.

D. *Social Costs of Dispersion: Tax Erosion*

A further cost is the tax erosion of urban centres. An example of this is the largest urban centre in New Brunswick, Saint John. The City has been losing population to the Census Metropolitan Area (CMA). While the City lost some 3000 people between 1971 and 1976 the CMA gained 6000. Over the five years this loss has averaged—0.7 per cent a year and conforms to data for US Metropolitan areas. Central cities of US metropolitan areas were losing population between 1970 and 1975 at an average of −0.6 per cent a year (Chinitz, 1980)

One of the consequences of this outmigration is the loss of property tax which for Saint John City accounts for more than a third of all revenues and approximately two-thirds of revenues-own-sources. Erosion of the tax base could therefore be detrimental to the level of government services, or might force the City to raise tax rates further accelerating outmigration. One measure of this erosion of the tax base is the concept of tax elasticity. The tax elasticity is estimated by assuming constant tax rates, and measuring how the base changes with income. To reflect inflation money incomes (Gross Provincial Product) in current dollars are divided into tax revenues (at constant tax rates). For New Brunswick municipalities as a whole, tax elasticity was estimated at 0.55, which is low but which conforms to other studies that show inelasticity of the proper tax. (Ridler, 1976, pp. 238-253). This implies that the property tax base has not risen as rapidly as Gross Provincial Produce. For Saint John City the elasticity is still lower reflecting the erosion of the tax base. For Saint John the property tax has an elasticity of 0.44, which is 20 per cent below that of all provincial municipalities as a whole.

3. **Government Action and User-pay.**

Given the social costs of population dispersion the provincial government may be forced to act. Traditionally the government has argued that people have the inalienable right to live where they please; however rising social costs and growing awareness that provincial revenues are limited has prompted a study to assess the reasons for, and policies to counter, population dispersion. This section proposes a user-fee principle that is economically efficient and probably politically feasible. Low density settlement clearly affects costs of many services such as road maintenance, busing, power, water and sewage, and telephones. The pricing of these services could correspond to their cost, particularly social costs. Thus a household would pay the extra social cost as well as private cost, of these services. The aim would not be to prohibit rural residence as through zoning, planning or "green belts", but rather force those who wish to live in the countryside to pay the full costs. The effect might be to reduce population dispersion as households, weighing up the costs and benefits of residential location, find the weighting move against rural location.

Some utilities in the province already charge rural residents part of the social costs. Residents in rural areas pay $2.82 more per month for the first 100 kilowatt hours than urban users, and $1.22 more per

month than town and village users. When new capital equipment is needed to service a customer, a levy is charged that will cover the difference between expected revenues and the capital cost Similarly New Brunswick Telephone levies a charge if a customer is located more than a certain distance from existing telephone structures.

The practice of charging for services rendered could be applied to other services. Busing for example cost provincial taxpayers almost 11 million dollars in 1976, practically double the cost for 1973. This was in part due to an increase in the number of miles operated. By 1976 taxpayers were paying a subsidy to the average pupil per day of more than 50 cents. There is no efficiency/economic argument when parents should not pay a part of the cost. The existence of externalities suggest that the full cost should not be borne by parents; however busing does not meet the strict criterion of a public good (i.e. non-exclusion principle, and benefits shared by all), whereby user-pay is inequitable and impracticable (Bird, 1976). Parents thus could be obliged to pay part of the cost, preferably in relation to their distance from the school. Similarly fuel taxes should continue to rise not merely to reflect world prices but also costs of road maintenance, etc. The ideal would be charges levied on individual motorists (as for example toll roads), but prohibitive collection costs make a general levy, as through gasoline taxes, a second best solution. Indirectly it is a means of forcing users of facilities (i.e. roads, etc.) to pay the full social costs.

Conclusion

New Brunswick's population is sparsely scattered with a very high proportion of rural—non-farm residents. After weighing up the private costs and larger lot sizes, households have decided to locate in the country-side and commute to work. In the future there will be centrifugal and centripetal forces which will influence locational decisions. Improved tele-communications will reduce the attraction of urban centres. Shopping, education and banking may be available through tele-communications facilities within the home. Thus transport cost will fall, and further population dispersion will occur. Similarly high incomes and population growth are centrifugal forces. On the other hand, the "energy crisis" may result in gasoline shortages or very high costs for transportation. The result would be a reversal of previous trends and net immigration towards urban areas. This paper has argued that population dispersion imposes costs to society and has suggested one solution, user-pay.

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RECENT POPULATION GROWTH IN INDIA

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Although the year 1921 provides a significant "divide" in the history of population growth in India, 1951 is the starting point of a substantially stepped-up acceleration in the process of population increase in the country, associated largely with consistently falling rate of mortality with birth rate descending only a little. The staggering rise in numbers resulting from this trend has tended to neutralise the achievements in economic and social spheres during the post-Independence period which by themselves have been outstanding. With 41% of the population below 15 years of age and a large scope still available for fall in death rate, there is little likelihood of any considerable decline in the rate of natural growth in the immediate future.

Apart from a generalised discussion on the trends of population growth in India during the post-Independence decades and its socio-economic implications, the purpose of this paper is to examine in some detail the spatial patterns of population change in India during 1971-81. The discussion is mainly based on what has emerged on three maps depicting percentage change in general, rural and urban population in India during this decade.

While areas of rapid growth of population continue to be associated with net in-migration resulting from : (a) development of manufacturing industries, mining, trade and miscellaneous services, all leading to acceleration in the process of urbanization, (b) development of irrigation and reclamation of land bringing about increased intensity and extension in farming, and (c) infiltration from neighbouring countries, particularly from Bangladesh, the areas of relatively low growth are mostly those which have suffered net out-migration induced by pressure of population and paucity of resources or a desire to seek better avenues of employment elsewhere. Super-imposed on this is the new trend of declining rate of natural increase, such as in Kerala and Tamil Nadu, which has played its own role in bringing down the overall growth rate. Likewise there are areas, such as in Uttar Pradesh, Bihar and Rajasthan, where recent break-through in the mortality rate with birth rate staying at a high level, has stepped up the process of demographic dynamism. A comparison of the spatial patterns of 1971-81, outlined above, with those witnessed in previous decades brings out important changes in these patterns which are occurring as a result of the various areas of the country getting into different phases of the second stage of the "demographic transition". With a view to bringing the benefits of socio-economic progress to the door steps of all sections of the society in all parts of the country, it is necessary to bring about substantial decline in birth rate without any further loss of time. Any delay in this effort is full of disastrous implications.

Among the problems which India faces today, none is so stupendous in magnitude and so disturbing in implications as population growth during the post-Independence decades and the possibility of a similar trend continuing during the remaining years of the present century. Compared with other countries of the developing world, the problems arising from accelerating growth in India are marked by their own grimness in terms of social and economic consequences.

The purpose of this paper is to examine the dynamics of population numbers in India during 1951-81 in the context of the past nine decades, alongwith their broad implications, and to attempt a detailed spatial analysis of the growth during 1971-81. Such an analysis will yield not only an understanding of the contemporary demographic situation in the country but will also provide clues about the likely trend in this regard in the years to come. This, in turn, will give a measure of the social problems which the country and its regions will be called upon to solve.

Population Growth in India as a Whole

During 1951-81 India's population increased by nearly 90 per cent — from about 360 million in 1951 to about 683 million in 1981— a rate which is without any parallel in demographic history of the country. An absolute increase of 323 million during a short period of thirty years is indeed most staggering, it being about the size of the combined populations (mid-1981 estimates) of Pakistan (89 m) Bangladesh (90 m.) Sri Lanka (15 m.) Nepal (14 m.) and Japan (117m.). If this increase of 323 million alone is equitably distributed over the whole of India, it comes to over 100 persons per square kilometre which is about four times the density of total population of the United States of America or about the average density of population of China. It is the existing massive base of India's population which is aggravating the situation, as even a moderately high rate of growth here means a spiralling increase in actual numbers.

This growth rate* assumes special signi-

*Any pin-pointing discussion of population growth in India is made difficult by the deficiencies of data on the three determinants of population growth—birth rates, death rates and migration. The registration of births and deaths being incomplete and there being wide variations in this matter from state to state, the information on vital rates given out by the Health Departments of the states is unreliable. The estimates prepared on the basis of sample studies, are fairly valid but are highly restricted in terms of areal coverage. Since the impact of migration on the overall growth of population in the country as a whole is wholly insignificant, one can safely base the analysis of national population growth on the two vital rates. But for a thorough examination of the spatial variations in population change the data on migration is a necessary pre-requisite. In India migrational studies can be based only on place of birth data which has its own short-comings. Under the circumstances, any analysis of spatial patterns of population growth in India becomes a challenging task. One has to draw information from a variety of socio-economic characteristics of different areas of the country to be able to infer the role of migration in regional population growth.

ficance when viewed in temporal perspective. The lack of detailed data on population for the period prior to 1891 restricts our consideration to the last nine decades (1891-1981) only. When examined closely, these ninety years reveal three distinct periods in the demographic growth of India : 1891-1921, 1921-1951 and 1951-1981. During 1891-1921 India's population growth was extremely slow and sporadic (-0.20% during 1891-1901 5.75% during 1901-11 and -0.31% during 1911-21) with several of the areas experiencing absolute decline. In these thirty years the net increase in the country's population was only about 12 million (Trewartha and Gosal, 1957). The demographic change in this period was essentially a story of calamitous happenings — like famines, epidemics etc. taking heavy toll of human life. High death rates tended to cancel out high birth rates (both estimated at well above 40 per thousand).

Table 1

India : Trends of Growth of Rural and Urban Population

Decade	Percentage general	Growth of Population	
		Rural	Urban
1891-1901	−0.20	N.A.	N.A.
1901-1911	5.75	6.4	−0.14
1911-1921	−0.31	−1.4	8.25
1921-1931	+11.00	10.4	19.08
1931-1941	+14.22	11.8	32.09
1941-1951	+13.31	9.6	41.49
1951-1961	+21.51	21.4	25.85
1961-1971	+24.80	21.8	37.91
1971-1981	+24.75	18.96	46.02

Note:- These figures have been compiled from the *Census of India* 1961, 1971 and 1981 publications.

In sharp contrast to this, the following thirty years, 1921-1951, recorded an increase of over 109 million (11% during 1921-31; 14.22% during 1931-41 and 13.31% during 1941-51). With increasing control over epidemic and endemic diseases, improvement in means of communication, and development in economy, particularly in agriculture, the crude death rate came down to about 27 per thousand by 1951 while the crude birth rate stayed on around 40.

The period 1951-81 has, however, far surpassed all previous records not only in terms of growth rates (21.51% during 1951-61, 24.80% during 1961-71, and 24.75% during 1971-81) but also in the increase of actual numbers. India's population in this period of thirty years has shot up by 323 million as a result of the impact of the various types of national and state activities under the five-year plans, conditions of food supply and medical services vitally improved

further, cutting down the death rate to about 14 by 1981. The decline in infant and maternity mortality rates was particularly noteworthy during this period. But notwithstanding continued interest in and implementation of the family planning programme, not much has happened to the birth rate, it still being estimated at about 34 per thousand in 1981. No wonder, the gap between the two rates has widened still further during this 30-year period, giving rise to unprecedented increase in population, both in relative and absolute terms.

It emerges from the above that the history of population growth in India thus far has been mainly a function of the changing pattern of the death rate. There is still vast scope for further decline in this rate in the years to come. Within India, in Kerala it has already fallen to about 7. In neighbouring Sri Lanka the crude death rate is 7 per thousand. In Japan it is about 6. On the other hand, even under favourable conditions, birth rate takes a comparatively long time to decline. It is most likely, therefore, that with the current trend, India's population will continue to grow at accelerated rates during the coming decades and it may very well be close to 1000 million by 2000 A. D. Moreover, the fact that about 41% of India's total population is below 15 years of age is going to delay any significant fall in birth rates immediately. With the death rate still having considerable room for descent, the gap between the two rates is, thus, not likely to narrow down in the near future to any material degree.

The implications of this trend of population growth during the post-Independence period discussed above have been rather harsh. Despite reclamation of most of the culturable waste land during 1951-71, and the consequent increase in net area sown from about 119 million hectares in 1951 to 139 million hectares in 1971, the per capita net sown land has declined from .33 hectare in 1951 to .25 in 1971. This clearly means a growing strain on the country's agricultural resources, causing deep anxiety for the future. There are no more culturable waste lands available in the country. The limits of the agricultural frontiers seem to have been reached under the existing economy and techno logy. In 1975-76, the net sown area was recorded as 142.2 million hectares which means that the per capita net sown land has further declined to about 23 hectare. No doubt some states have experienced the 'green revolution', and in the country as a whole the yield of wheat per hectare has been doubled and that of rice it has increased by more than 50%. Despite such commendable developments in agriculture, the per capita food production index for 1975-76 (average) was only 107 if 1961-65 is taken as 100. However, the index for 1975-77 (average) would come to 98 if that for 1969-71 is taken as 100 (Northman and Hofstatter, 1980). Obviously, the staggering increases in population numbers have tended to neutralise the achievements in agriculture which otherwise have been outstanding.

Similarly, although under the impact of the various educational programmes throughout the country the proportion of literate persons to total population has improved from 16.7% in 1951 to 36.1% in 1981 (male literacy increasing from about 25% to 46.7%, and female literacy from 7.9% to 24.9% during the period, the rise in the number of literate persons being from about 60 million to 244 million), the number of

illiterate persons in the country has grown by no less than 140 million (from about 300 million in 1951 to nearly 440 million in 1981) over the thirty years, thanks to the massive growth of population during the three decades. It implies that despite commendable achievements in the extension of literacy during the post-Independence period, India is starting with a 100 per cent illiterate population of the size it had in 1961.

It is obvious from the points made above, that the accelerated growth of population during the post-Independence period has not only retarded the socio-economic development which otherwise has been substantial, but it seems sure to be the main stumbling block in the country's future progress if the same demographic trend continues. It may further be brought out that, apart from the implications referred to above, such a demographic trend is bound to produce adverse effects on the environmental conditions of the land as well as the social psychology of the people in the long run.

Rural-Urban Differential in Population Growth

An understanding of the dynamics of population will be neither complete nor clear without making a reference to the differentials in the growth rates of its two vital components : rural and urban. Although the general population in India has experienced consistent acceleration in growth since 1921, the increase in rural and urban population reveals differing trends. While during 1921-51 the rural population was increasing at a practically uniform, medium rate of about 10 to 11 per cent, its urban counterpart grew at high rates which were rising regularly (19.1 per cent during 1921-31, 32.1% during 1931-41 and 41.5% during 1941-51). The urban rate, however, slackened during 1951-61 (25.9%), in sharp contrast to more than doubling of the rural rate (from 9.6% during 1941-51 to 21.4% during 1951-61) during the same decade. However, during 1961-71 the rate of growth of urban population shot up again to 37.9 per cent and to 46% during 1971-81, while the rural population increased by 21.8 per cent during 1961-71, which rate is about the same as during 1951-61, and by about 19% during 1971-81. But in actual numbers almost two-thirds of the total increase in India's population still took place in rural areas during the decade 1971-81. The doubling of the rate of growth of rural population during the post-Independence period, as compared to what prevailed during 1921-51, and the massive increase which it has given rise to in absolute terms has created serious problems of under-employment and unemployment in the countryside. It is now commonly agreed that despite a lot extensification and intensification of agriculture during the past thirty years, the stage has reached when farmland will not be able to absorb additional work-force in the villages any more. The rural economy must undergo structural changes and the non-agicultural sector must be so expanded and diversified that it becomes an important source of employment to extra workers in the villages. It is in this context, that among other objectives, decentralization of industrial development is suggested as a possible solution of the growing menace of unemployment in the villages.

A perusal of estimated birth and death rates of rural and urban populations for 1961-71 and 1971-81 leads one to the belief that well over 50 per cent of the population increase in towns during the two decade was due to migration from the rural areas. In

contrast to this, the rural-urban movement during 1951-61 was considered to be of smaller magnitude. Thus the period 1961-81 has witnessed a distinct re-activization in the tempo of urbanization. In fact, the last decade has recorded the highest ever rate of growth of urban population in the country. The proportion of urban population to total population has increased from about 17% in 1951 to about 23.7% in 1981. The latter figure, however, brings out that despite consistent acceleration in the process of urbanization, especially during the post-Independence period, India is still predominantly rural in demographic terms.

However, if a comparative study is made of the 1951-81 rates of population growth of towns belonging to different size-categories, the most interesting point that emerges is the increasing role of cities (with a population of 100,000 and over) and major towns. Ever since 1901, not only have the cities been accounting for the largest proportion of total urban population, but this proportion has been rising consistently, it having gone up from 25.71% in 1901 to 60.37% in 1981. The number of cities has increased from 74 in 1951 to 216 in 1981. The number of million cities has gone up from 5 to 12 during the same thirty-year period. During the entire period 1901-81, there has been little change in the percentage of urban population living in class II (50,000 to 99,999) and class III (20,000 to 49,999) towns, whereas there has been a substantial decline in the percentage of urban population living in class IV,V and VI towns (below 20,000 population), from 47.23% in 1901 to 13.63% in 1981. The share of the small towns, with less than 10,000 population, in the total urban population has come down from 26.31% to 4.11% during the eight decades. Apparently, apart from the common phenomenon of rural-urban migration experienced practically everywhere, people have been moving out from small towns to large cities. Many of the small towns have not even maintained the natural growth of their population. The process of urbanization has, thus, essentially been one of urban agglomeration and city-ward migration (Bose, 1973).

This implies that the fast growing cities and metropolitan areas have become the real centres of socio-economic development while the small towns which are growing only slowly, continue to be deprived of any major component of modern development. This pattern of urbanization has clearly widened the inter-town and inter-regional disparities in socio-economic progress. Moreover, the uncontrolled expansion of cities and metropolitan areas, apart from encroaching upon good agricultural land, has also created serious environmental problems. Even in the best of cities, slums have appeared increasingly and have caused considerable damage to environmental conditions. Social amenities, originally meant for small populations, have become grossly inadequate with the uncontrolled migration of people to the cities. With a view to keeping rural-urban disparities at the minimum and avoiding environmental deterioration in large towns and cities, it is necessary to evolve a suitable strategy of decentralization of developmental activities and to direct the migrational trends accordingly. The development of an intensive network of infrastructural facilities (roads, electrification, industrial training institutes etc.) in Punjab in recent years has initiated the much desired pattern of

decentralization of developmental activities involving not only cities, large towns and small towns in the process but also bringing in areas in the countryside within the orbit of modern development. As a result, towns of small size categories experienced fairly high rates of population growth in the state during 1971-81.

An analysis of the patterns of growth of urban population over the whole country in conjunction with the growth of rural population brings out that in many regions the growth patterns of rural and urban population are complementary, indicating local rural-urban migration as a major factor in urbanization (Maps 2 and 3).

The rural-urban differential in population growth varies from state to state (Table 2). While in several of the small peripheral states, like Sikkim, Manipur, Nagaland, etc., the explosive rates of growth of urban population and wide rural-urban differentials in population growth have resulted from the emergence of new towns and the upgradation of villages to towns, the large rural-urban disparities in this growth in states like Haryana, Karnataka, Madhya Pradesh, Orissa, Rajasthan and Uttar Pradesh reveal real trends of acceleration in the process of urbanization. In West Bengal and Tamil Nadu on the other hand deceleration of urban growth appears to be an established fact. In both of these states, in that order, the rural-urban differential in growth rate is the smallest in the country. The Calcutta conurbation, in particular, seems to have reached the plateau.

Spatial Patterns of Population Growth: 1971-81

However, average figures for the country as a whole and for its states, which are fairly large areal units, cannot adequately portray inter-regional, inter-zonal and local variations in population growth. It is, therefore, necessary to have a closer look at the problem to understand it in any reasonable detail. Before attempting a spatial analysis of population growth during 1971-81, it would be desirable to mention briefly the spatial characteristics of population change during the preceding two decades.

Although accelerated growth of population is characteristic of all the three decades of the post-Independence period, each decade showed up distinct spatial patterns of growth in the country, and there was change in the spatial patterns from decade to decade, more especially during 1971-81.

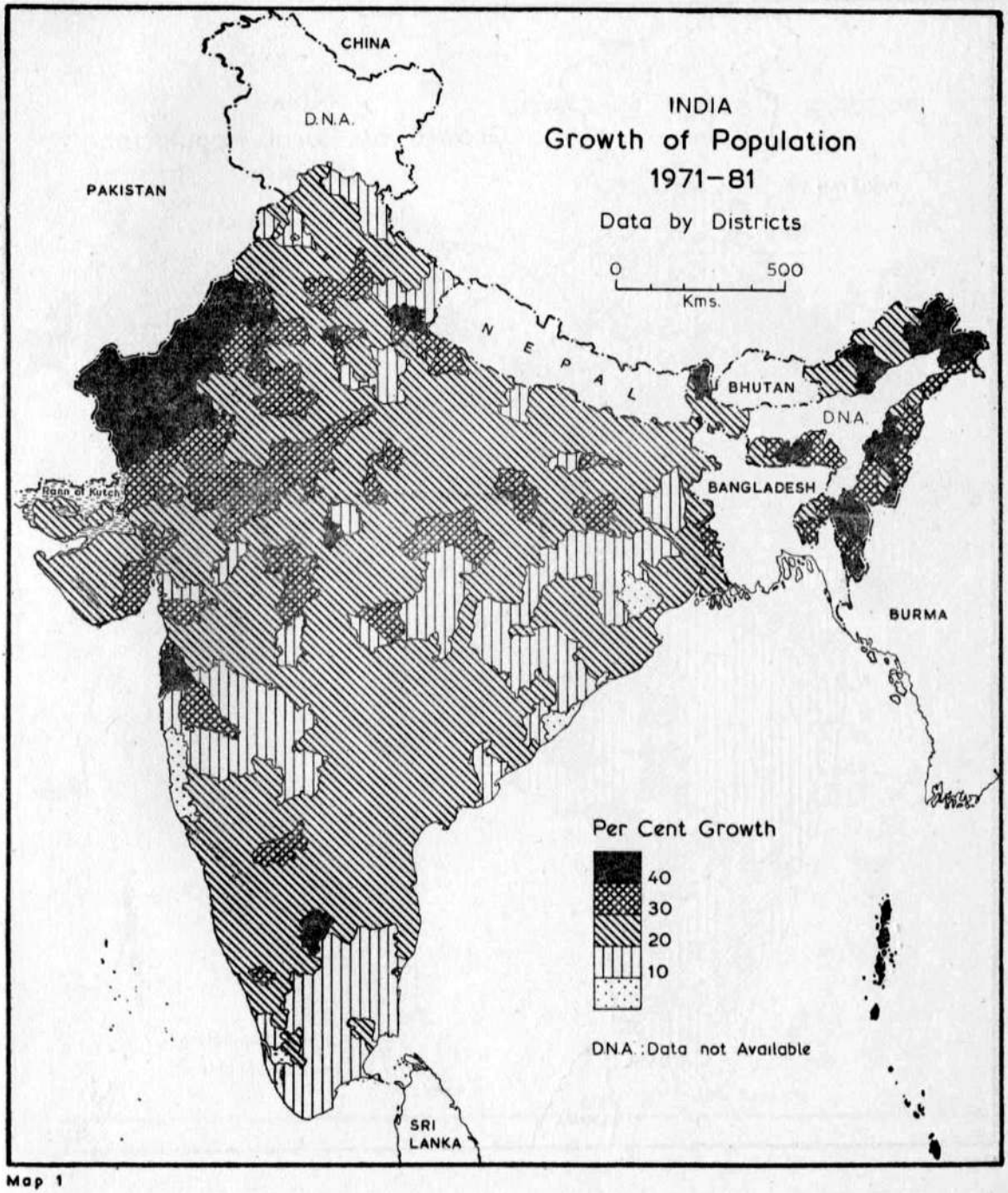
During 1951-61 areas showing rapid growth of population (30% and above) owed this trend to a considerable amount of net in-migration. They included : the Assam Plains and Tripura, most of the state of West Bengal and the adjoining areas of northeast Bihar; a large part of the Punjab Plain east of the Sutlej and the adjoining areas of Ganganagar district of Rajasthan; part of Gujarat and nearby areas of Rajasthan and Madhya Pradesh; and uplands of Mysore, Madras and Kerala. The in-migration resulting in fast growth of population in these areas was stimulated by one or more of the following factors : rapid development of industry, mining and general diversification of the economy, all leading to rapid urbanization; development of irrigation in semi-arid areas and reclamation of waste lands permitting extension of cultivation and new rural settlement; extension of cultivation to upland areas for plantation and general farming ; or the influx of people from

Table 2

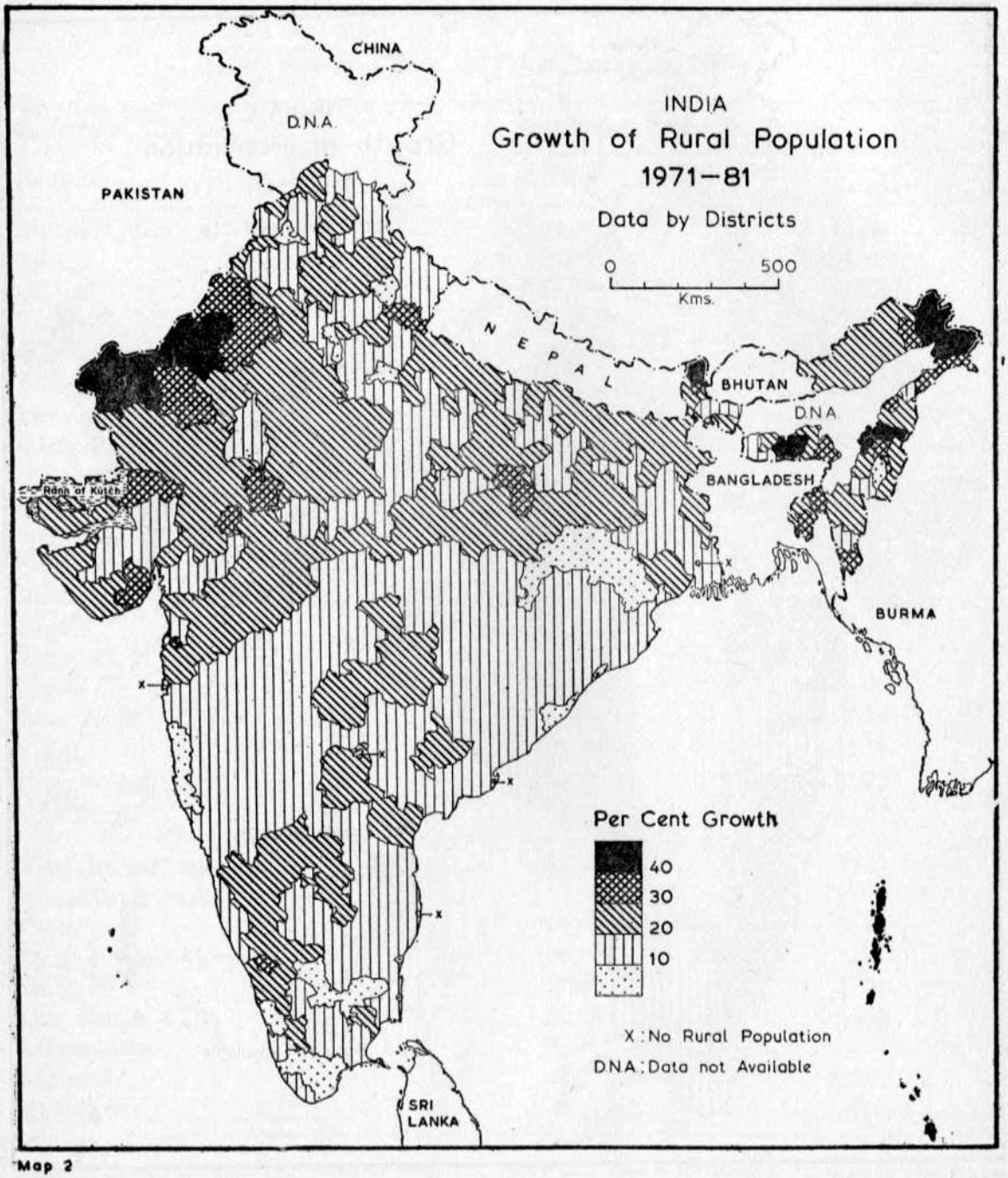
India : Growth of Rural and Urban Population, 1971—81

State/Union Territory	Percentage growth rate		
	Total	Rural	Urban
Andhra Pradesh	23.19	17.19	48.26
Bihar	23.90	20.51	54.40
Gujarat	27.21	21.89	40.82
Haryana	28.04	21.36	59.16
Himachal Pradesh	22.46	21.50	35.25
Karnataka	26.43	18.74	50.39
Kerala	19.00	15.39	37.63
Madhya Pradesh	25.17	19.16	56.07
Maharashtra	24.40	17.43	39.82
Manipur	31.56	11.48	163.77
Meghalaya	31.30	25.95	62.74
Nagaland	49.73	40.44	133.84
Orissa	19.72	15.26	68.29
Punjab	23.01	16.59	43.66
Rajasthan	32.38	27.07	57.15
Sikkim	50.11	38.76	159.86
Tamil Nadu	17.23	12.65	27.78
Tripura	31.55	30.74	38.51
Uttar Pradesh	25.52	19.70	61.22
West Bengal	22.96	20.11	31.61
Andaman & Nicobar Islands	63.51	55.90	89.33
Arunachal Pradesh	34.34	30.68	129.73
Chandigarh	74.95	18.49	80.84
Dadar & Nagar Haveli	39.78	30.46	...
Delhi	52.41	6.02	57.73
Goa, Daman & Diu	26.15	15.83	54.88
Lakshadweep	26.49	—32.08	...
Mizoram	46.75	23.89	225.13
Pondicherry	28.08	5.37	59.41

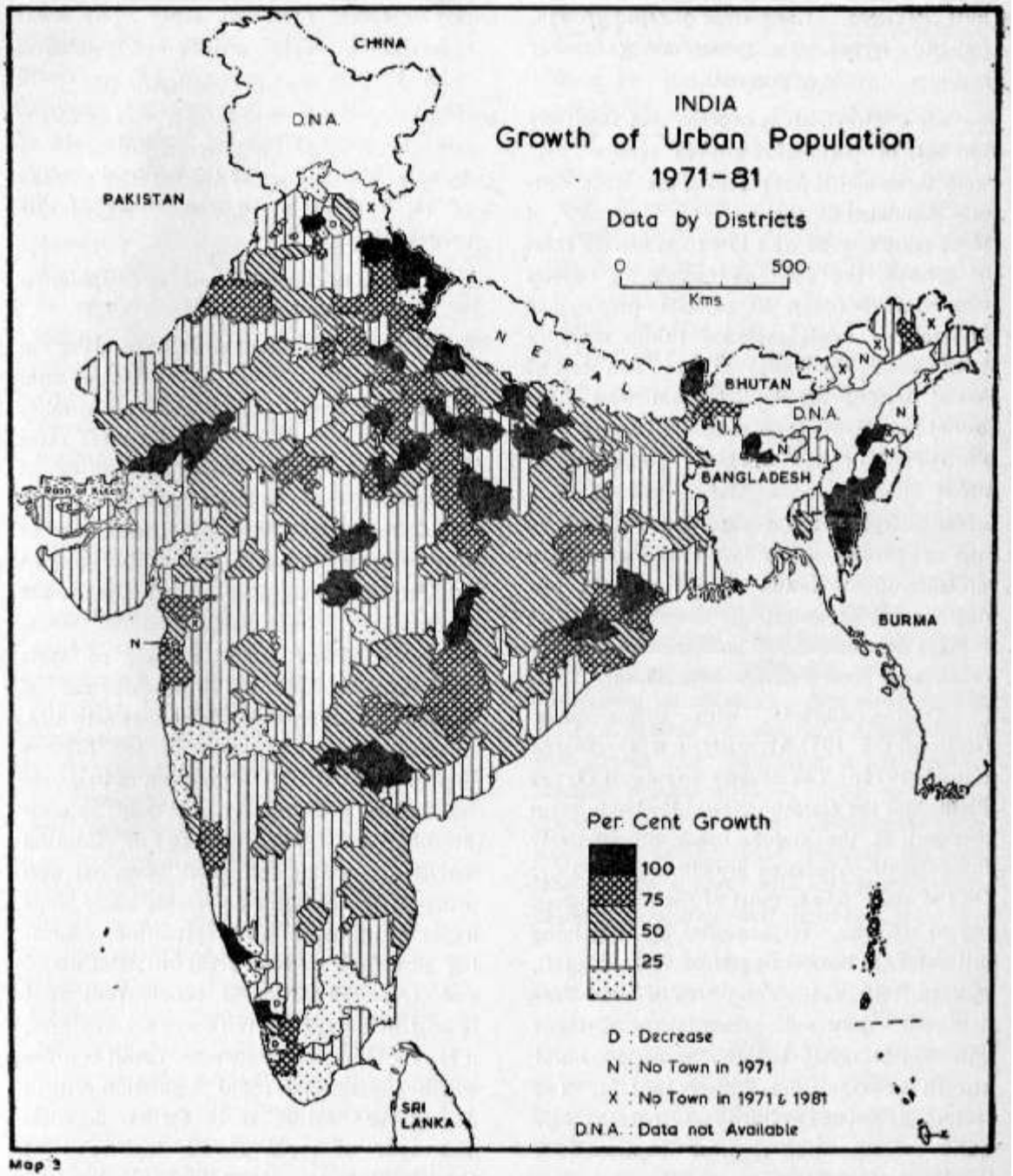
Source: *Census of India 1981*—Series I—India, Paper 2 of 1981—*Provisional Population Totals: Rural-Urban Distribution*, pp. 72-82.


CHINA
D.N.A.
PAKISTAN
INDIA
Growth of Population
1971–81
Data by Districts
0
500
Kms.
NEPAL
BHUTAN
D.N.A.
BANGLADESH
Rann of Kutch
BURMA
Per Cent Growth
40
30
20
10
D.N.A. : Data not Available
SRI
LANKA

Map 1


CHINA
D.N.A.
PAKISTAN
INDIA
Growth of Rural Population
1971–81
Data by Districts
0
500
Kms.
NEPAL
BHUTAN
D.N.A.
BANGLADESH
Rann of Kutch
BURMA
SRI LANKA
Per Cent Growth
40
30
20
10
X : No Rural Population
D.N.A. : Data not Available

Map 2


CHINA
D.N.A.
PAKISTAN
INDIA
Growth of Urban Population
1971-81
Data by Districts
0
500
Kms.
NEPAL
BHUTAN
D.N.A.
BANGLADESH
BURMA
SRI LANKA
Per Cent Growth
100
75
50
25
D : Decrease
N : No Town in 1971
X : No Town in 1971 & 1981
D.N.A. : Data not Available

Map 3

East Pakistan. These areas of rapid growth, by and large, were those having low or medium density of population.

By contrast, areas experiencing relatively low rate of population growth (below 20%) were those which were among the most densely populated in the country. In many of these regions even with low to moderate rates of growth, the absolute increase in density was massive (over 40 persons per square kilometre). Areas included in this category were : nearly the entire Ganga Plain west of West Bengal; the Punjab Plain west of the Sutlej ; most of the states of Orissa, Andhra Pradesh and Madras ; and scattered areas along the west coast. Most of these areas suffered net out-migration induced by one or more of the following factors : heavy pressure of population on farm land ; low degree of urbanization consequent upon meagre development of industries and commerce ; and poor resource base (Gosal, 1962).

During 1961-71, with a few modifications, the 1951-61 pattern was repeated (Gosal, 1974). The densely populated Ganga Plain and the eastern coastal lowlands again emerged as the major areas of relatively low rates of population growth (below 20%). On the other hand, most of the northeastern region (Assam, Tripura and the adjoining hill states, and eastern parts of West Bengal), western Rajasthan, Terai area of Uttar Pradesh and scattered areas in the northern part of Peninsular India experienced rapid growth of population during 1961-71. The factors associated with these patterns were quite corresponding to those mentioned for the decade 1951-61.

An analysis of the district-wise data relating to population change during 1971-81, reveals three types of areas : (A) areas experiencing rapid growth of population (with 30% or more increase), (B) areas with relatively slow growth (below 20% increase) and (C) areas witnessing moderate rate of growth (20 to 30% with the national average of 24. 75% almost in the middle of this range) (Maps 1-3).

(A) Areas of Rapid Growth of Population (30% and above)

These areas have shown dynamicity in demographic as well as socio-economic terms. Although the declining mortality rates and persistently high fertility rates have given rise to fairly high rates of natural increase in most parts of India during the decade, the areas belonging to this category owe their rapid growth additionally to considerable amount of net in-migration. In-migration in these areas, is associated with either of these or their combinations : (i) rapid development of industrial, mining and commercial activities, all leading to acceleration in the process of urbanization; (ii) expansion of irrigational facilities facilitating not only intensification and diversification of farming activity of existing cultivated lands but also bringing the available culturable waste lands under the plough, (iii) extension of farming to upland and marginal hill land areas, and (iv) infiltration of people from what is now Bangladesh. With a few exceptions, it is the low or moderate density areas which experienced rapid population growth during the decade, as in earlier decades. The areas of rapid growth include : (a) the Northeastern Region, (b) Western Rajasthan, (c) Terai Region of Uttar Pradesh, (d) Bombay-Poona urban tract,

and (e) a large number of scattered, highly urbanized districts.

(a) The entire northeastern region has emerged as the largest areal unit in the country experiencing rapid growth of population during 1971-81 (Assam 36% estimated; Nagaland 49.7%; Manipur 33.6%; Mizoram 46.7%; Meghalaya 31.2%; Tripura 32.3%; Arunachal Pradesh 34%). In nearby Sikkim the increase was 50% during the decade, attributable, among other factors, to a large influx of people from Nepal. During the preceding two decades also, the growth was fast in the entire northeastern region. In Assam the rate of population growth has been consistently very high throughout the post-Independence period - around 35% during each decade. The net outcome of this phenomenal growth is an increase in the state's density of population from 102 persons per square kilometre in 1951 to 254 in 1981. The average addition of 152 persons on each square kilometre of land in the state during the thirty years is indeed an extraordinary development. There are two factors which explain this phenomenon : (i) high rate of natural increase arising from fairly fast declining death rate with the birth rate staying on at a high level (crude birth rate estimated at 32.4 and death rate at 11.4 per thousand in 1979; the death rate having fallen from 14.9 in 1976 with hardly any change in birth rate during the same period), and (ii) continuing in-migration both from Indian areas and from what is now Bangladesh and Nepal on a substantial scale. The continued influx of people from Bangladesh areas during the previous decades comes out unmistakably by the unusually high rates of population growth in practically all Indian areas immediately adjoining Bangladesh in the maps showing intercensal population change. The war with China in 1962 and with Pakistan in 1965 greatly quickened the subsequent tempo of development of economic as well as defence activities not only in the Assam Valley but also in the hilly tracts of this region. As a matter of fact the entire region which borders with Burma, China and Bangladesh has assumed an altogether new significance in the recent context. The urban population, though still small in actual numbers, has almost exploded in recent years in terms of growth rates. Likewise, in the rural areas the population increase has been very rapid throughout the last three decades. Despite vast agricultural potentialities and nearness to the densely populated West Bengal, the Assam Valley remained a relatively thinly populated area till recently. But with growing rates of natural increase and heavy rush of in-migrants and infiltrators, it has been in a quick process of being filled up during the three decades after Independence. By now, this demographic situation has been found to be loaded with dangerous implications of political and social nature.

(b) The arid and semi-arid tract of western Rajasthan is another area which experienced unusually high rates of population growth during 1971-81 : Ganganagar district 44%; Bikaner 46%; Jodhpur 43%; Jaisalmer 42%. Obviously a large part of the total increase (one-third to half) is due to net in-migration. The extension of canal irrigation in Ganganagar and Bikaner districts has been inducing a lot of migration of ambitious and enterprising farmers from

the adjoining areas of Punjab throughout the post-Independence era. In the other parts of western Rajasthan, the development of minor irrigation projects, and the promotion of mining and manufacturing activity has been instrumental in attracting people from nearby areas. The eastern zone of Rajasthan has also been the scene of fairly rapid growth of population, though much less than its western counterpart. Here the growth rate ranged mostly between 30 and 35%. It may be noted that Rajasthan as a whole is in the early second stage of the "demographic transition" which has a characteristically high rate of natural increase arising from a rapidly declining death rate with a birth rate staying at a high level. (The estimated crude birth rate in Rajasthan in 1979 was 35.2 while its death rate had come down to 12.8 by that year). In the adjoining areas of Haryana the demographic situation is quite like the one prevailing in eastern Rajasthan. In addition, some of the industrial towns like Faridabad are receiving considerable migrant population.

(c) The Terai zone of Uttar Pradesh has also been the scene of accelerated growth of population for the past over three decades. Consistent with that trend, the population in Nainital, Rampur, Pilibhit and Kheri districts increased by 30 to 43% during 1971-81. It is interesting that such an area of agricultural potentialities remained thinly settled till recently despite heavy pressure of population in other parts of the Ganga Plain of which it is a part. It is the migrant farm population from outside-mostly from Punjab - which has largely been instrumental in settling it in recent decades.

It may be noted from (b) and (c) above that the availability of good cultivable land with possibilities of extension of irrigation is still a major attraction for a Punjabi peasant. In fact, among the cultivating classes of India, the Punjabi peasantry is the most widespread in the country. Similarly, among the trading classes, none is so dispersed in urban areas all over India as the Marwaris.

(d) In the Bombay-Poona tract where population increased by 30 to 46% during 1971-81, the population explosion is related to the continuing acceleration in the process of urbanization based on the development of industry. The improving and expanding infrastructural facilities (rail and road transport and electricity) are being instrumental in extending the limits of the urbanized tracts further and further.

(e) Lastly, there are a number of scattered highly urbanized districts in the country where population growth has been rapid during 1971-81 as in preceding decades : Delhi 52%; Bangalore 46%; Bhopal 56%; Hyderabad 35%; Patna 64%; Ahmedabad 32%; Jaipur 37.9%; Chandigarh 75%; Surat 39%; etc. With a population of 912,568 in 1981, the Surat urban agglomeration registered an increase of 85.10% during 1971-81. This explosion was the result of massive rural-urban and urban-urban migration from parts of Maharashtra, Telengana, Kathiawar, Uttar Pradesh, Orissa and Bihar areas attracted by the hand-loom industry and embroidery work for which Surat is so famous. Much of the increase in the other districts likewise, is due to rapid pace of urban growth which has attracted people from outside the districts/territories.

Thus, apart from high rates of natural increase, rapid growth of population is almost invariably attributable to net in-migration induced by acceleration in developmental activities in agricultural, trade, industrial or allied sectors. In the northeast, however, infiltration from Bangladesh as well as from Nepal has been a major factor in the demographic explosion. In general, areas undergoing accelerated growth of population are such as are characterised by only low to medium density.

(B) Areas of Relatively Slow Growth of Population

With some exceptions, areas experiencing relatively slow growth (less than 20%) coincide with those having high density of population, although not all areas of high density have experienced slow growth. Three major areas falling in this category are: (a) large parts of Kerala, (b) southern Maharashtra and (c) Tamil Nadu. In addition, there are a few scattered areas in Andhra Pradesh, Orissa, eastern Madhya Pradesh, southern Bihar, Himalayan tracts of Uttar Pradesh and Himachal Pradesh and northern Punjab where population growth was below 20% during 1971-81. Although it is difficult to state precisely the role of each of the three determinants of population growth in these areas, as detailed data are lacking, it is apparent that most of them suffered some loss of population because of net out-migration. These are the areas, particularly those in Kerala, Tamil Nadu and along the eastern Coast, where pressure of population on resources has been severe and, as a result, from where people have been continually moving out. Many of the areas in this class are inadequately developed industrially and have experienced only low degree of urbanization. To add to the migrational losses, there has also been some decline in the rate of natural growth in all the three main areas noted above, bringing down further the overall rate of population growth. In all of them rural as well as urban growth has been far below the national average during 1971-81. However, because of heavy base of population, even the below-average rates of growth have resulted in staggering increases in their density.

(a) With an average density of 654 persons per square kilometre in 1981 (the highest among all the states) and an increase of 19% in population during 1971-81, Kerala has emerged for the first time as an area of relatively slow growth of population. During 1961-71, the growth rate was 26.29%. A decline of more than 7 points in the growth rate in the ten-year period is the largest any state has experienced in the country. This has happened in all the districts without any exception. This sharp decline arises from two facts : (i) a significant decline in the birth rate (estimated at about 26 in 1979), and (ii) substantial emigration and out-migration of male-selective educated youth in search of skilled, semi-skilled and white collar jobs both outside the country (particularly in the Middle East) and within the country during the decade. The fall in birth rate, among other things, is largely attributable to rise in marriage age of girls and awareness of the need to restrict the size of the family in view of the limited resources and highest density of population in the state. The high rate of literacy in Kerala (69.17% of the total population, 74% of the males and 64.5% of the females, being literate) — the highest in

the whole country — has played its own role in the above development relating to marriage age and attitude toward family planning. The male-selective out-migration also has its own bearing on the birth rate. The male-selective out-migration/emigration has been instrumental in the rise of sex-ratio from 1016 to 1034 females per thousand males during 1971-81. However, despite a relatively low rate of population growth of 19% during 1971-81, the absolute increase comes to us much as 105 persons per square kilometre — thanks to the existing massive base of population in the state.

(b) The lowest growth of the decade was experienced, however, in Ratnagiri district of Maharashtra where the population increased by only 5.9%. During 1951-61 and 1961-71 also, Ratnagiri witnessed a similar situation with growth rates of 6.5% and 8.8% respectively. It is the continuing large scale out-migration to Bombay urban areas which is responsible for a demographic stagnation in Ratnagiri. The highly male-selective out-migration from the rural as well as urban areas of the district gives it the highest sex-ratio in the country : 1250 females per 1000 males. It is the poor resource base for the farm economy in the district as a whole and the existence of employment opportunities in nearby Bombay which partly explain this unusual situation - a situation which is without any parallel throughout the western coast.

In southern Maharashtra as a whole population growth during 1971-81 was below 20%. Here both in rural and urban areas it was below the national average, attributable to at least partly to migration to Bombay and other industrial complexes.

(c) With an increase of only 17.2% in its population, Tamil Nadu was another major area of slackening growth during the decade. In fact, among all the states, Tamil Nadu's was the lowest rate of population growth. With the exception of Nilgiri district, everywhere else the growth rate experienced a decline, bringing down the overall rate from 22.30% during 1961-71 to 17.23% during 1971-81. This growth was far below the national average both in rural and urban areas. As in Kerala, this trend in Tamil Nadu is related both to a decline in the rate of natural increase and a continuing (or even accelerated) tempo of out-migration and emigration in the context of severe pressure of population on land resources. The fall in natural increase arises from a decline in birth rate (estimated at 28.1 in 1979) resulting from rising age of marriage of girls in the state. Moreover, the family planning programme has also met with fair success here. In the southeastern parts of Tamil Nadu from where there has been a lot of male-selective out-migration/emigration over the decades, the females are in excess of the males.

(d) Likewise, in several of the coastal areas of Andhra Pradesh, tribal districts of Orissa and in eastern Madhya Pradesh the growth of population was less than 20% during 1971-81. It seems this is connected largely with the male-selective out-migration of labour population to mining and industrial areas within the region as it is corroborated by high sex ratio in all cases. There has been a lot of out-migration of unskilled labour from Andhra to other parts of the country as well. The continuing high death rates in those areas - higher than the national average - are also a contributory factor to

relatively low population increase.

(e) In northern Punjab, in the border district of Amritsar and in the Bist Doab districts of Hoshiarpur and Jullundur, population growth rate was below 20%. Although considerable decline has taken place in birth rate in these districts, as also in other districts of Punjab during the decade (the crude birth rate estimated at 29.3 in 1979), but a similar fall has also been experienced in the death rate (estimated to be 9.9 as in 1979) so that the rate of natural increase is only a little lower than the national average. What has brought about a relatively low rate of population growth in Amritsar district is the continuing impact of the border with Pakistan inducing people to move out as and when feasible.

In Hoshiarpur and Jullundur districts, on the other hand, it is the continuing rush of emigration, particularly in the 60's and 70's, which has brought down the growth rate. In view of the impending restrictions on immigration to U. K., not only new migrants left their hearths in the Bist Doab, but also the families of those who already had gone and settled followed suit during 1961-71. This is an area of long tradition of emigration, and as such it has been experiencing relatively low rates of population growth for several decades. In Jullundur and Hoshiarpur districts the rural population increased only by 9.4% and 13.8% respectively during 1971-81. It may be noted here that apart from the prevailingly small size of landholdings and heavy pressure of population on the farm land, the adventurous spirit of the people of the Bist Doab and their aspiration for prosperity are vital factors in their moving out of the native homes. This is in marked contrast to the out-migration from Andhra Pradesh, northern Biha and eastern Uttar Pradesh which is necessitated by the severe pressure on resources and conditions of scarcity and poverty.

In sum, areas of slow population growth during 1971-81 are mostly those which are less developed industrially and where urbanization has not made much headway. Also, many of them are such as : (i) have experienced decline in birth rate and/or have been the scene of considerable out-migration/emigration for different reasons, (ii) have high population density and are suffering from pressure of population on resources, (iii) have a sizable section of the population consisting of landless labourers which is prone to out-migration under conditions of scarcity.

(C) Areas of Moderate Population Growth Rates

Areas belonging to this category experienced 20 to 30 per cent population increase during 1971-81 — about 5 points higher or lower than the national average of 24.75%. Areas which had a growth rate ranging between 20 and 25 percent have, in many cases, some characteristics which are common to those of areas of relatively low rates of increase discussed above. On the other hand, regions which had a population growth rate ranging between 25 and 30 per cent share some similarities with areas of high rates of population increase. There are some areas which have entered the category of moderate increase rates from those of low growth during preceding decades, while there are others which have come down from a pattern of accelerated population change. Obviously, different areas of the country are

undergoing varying types of changes in their vital rates. But the changes in these rates are still within the range of the second stage of the "demographic transition". In other words, the spatial variations in the changes in birth and death rates reflect only different phases of the middle stage of the "demographic transition" rather than any fundamental difference of the stage itself. It needs to be clarified that what is termed as moderate growth rates here, is still high rate from the point of view of the pre-Independence decades.

(a) A large part of the North Indian Plain, comprising most parts of Bihar and Uttar Pradesh constitutes one major tract where population growth during 1971-81 ranged between 20 and 30%. Most of the areas in this tract have been experiencing low rates of growth (less than 20%) in earlier decades. Their coming up into the category of moderate growth rates is largely attributable to a major break-through in their mortality rates. In Uttar Pradesh and Rajasthan particularly the growth rate has materially improved (by about 5 points) during 1971-81 as compared to the preceding decade due largely to fall in death rate. A similar phenomenon has been witnessed in most areas of Bihar. The birth rates continues at a considerably high level in these states* - associated among other factors, with early marriage age and backwardness. Even child marriage is not uncommon in these areas. If the present trend of declining death rate with birth rate staying high continues, which it shows a probability of doing, this whole tract is likely to move up into the category of rapid growth in the years to come. Since these states account for a substantial part of India's total population, the anticipated trend of accelerated growth in them is likely to retard national efforts toward arresting increase in the country's population in the near future. Along with death rates, the birth rates must be brought down. This can be achieved by raising the age of marriage by educating the people about its advantages and through legislation, apart from propagating other measures of population control. Both for social and demographic reasons, early marriage must go.

The acceleration in growth rate in Bihar and Uttar Pradesh during 1971-81 is despite a lot of out-migration of landless labourers to rural as well as urban areas of other states, especially Delhi, Haryana and Punjab. Within Bihar and Uttar Pradesh, a wide disparity between the growth rates of rural and urban population also reveals considerable local rural-urban migration.

(b) In most of West Bengal also the population increased by 20 to 30% during 1971-81. But compared to earlier decades, the growth rate has assumed a downward trend in this state. It is attributable to three factors : (i) some decline in natural growth rate, (ii) slackening pace af industrialization and urbanization, and (iii) fall in the trend of in-migration. Among the major states, West Bengal had one of the lowest rates

* Among all the states of India, Uttar Pradesh has the highest crude birth rate, estimated at 39.6 in 1979. Although the crude death rate is also the highest here but it has come down to an estimated figure of 16.2 in 1979. The gap between the two has become wider than before.

of growth of urban population during 1971-81. Accordingly the rural-urban differential in its population growth was the smallest in the whole country.

Interestingly, within West Bengal, the districts adjoining Bangladesh had still higher rates of growth (25 to 30%) than those on the western side, suggesting continuing infiltration from that country into this state, a pattern which has been occurring in previous decades also.

(c) In southern Punjab, there is some improvement in growth rates during 1971-81 as against 1961-71, despite continuing out-migration and emigration of local people. This is very largely due to substantial in-migration from eastern Uttar Pradesh and northern Bihar tracts both to the rural and urban areas where there is shortage of labour practically in all sectors of the economy - agriculture, industry, transport, construction, etc.

(d) A large part of Peninsular India, excepting Kerala, Tamil Nadu and southern Maharashtra, also experienced 20 to 30% growth in its population during the decade but with contrasting temporal trends. Although in Gujarat and Madhya Pradesh there is a decline in growth rate by 2 to 3.5 points as compared to the preceding decade, the population increase was still in the range of 25 to 30% during 1971-81. In Maharashtra it has come down from 27.45% during 1961-71 to 24.36% in 1971-81. Only in the northern half of the state does the growth rate exceed 20%.

In contrast to the above trend, there is an improvement in the growth rate in Andhra Pradesh and Karnataka by about 2 points, largely owing to decline in mortality with birth rate staying on at the previous level.

It emerges clearly that although the above areas have been experiencing moderate rates of growth of population (20 to 30%), they are in different phases of the middle stage of the "demographic transition" and consequently have had different trends of population change in recent years.

Conclusion

With a continuing decline in death rate but birth rate changing far too slowly, population growth in India maintained a high rate of 24.75% during 1971-81 very much like the one experienced during the preceding decade of 1961-71, and not very different from that of 1951-61. Thanks to the heavy base of population, these rates have resulted in a staggering increase of about 323 million in absolute terms during 1951-81. If this trend continues in the years to come, which seems probable, India is in for a still more grim problem of population growth, both in relative and absolute terms. It is bound to neutralize much of the gains of socio-economic development which by itself has been quite impressive so far. It is a serious situation from which the country must get out before long. In priority, this problem can be bracketed only with the defence of the country, and has to be fought on a war footing if timely results are sought. There is no alternative to immediate population control. The birth rates must be brought down substantially. Whichever measures are acceptable in different regions should be adopted to achieve this goal. In addition, there is a strong case for raising the age of marriage in the whole country through educative publicity and legislation. In any case, child marriage should be eradicated, both for social and demographic reasons, especially in

the states af Bihar, Uttar Pradesh, Rajasthan and Madhya Pradesh.

As a result of the spatially varying background and processes of socio-economic development, different regions of the country are in different phases of the second stage of the "demographic transition". Superimposed on this pattern is the impact of internal and international migration, giving rise to significant spatial variations in population growth. In view of the fact that some of the most populous states have just entered the early phase of the second stage of the "demographic transition" the achievements towards population control in some of the small states which have moved into the later phases of this stage may not get reflected in the overall vital rates of the country in the near future.

As in previous decades so in 1971-81, the country witnessed significant spatial disparities in population growth, but with patterns now somewhat different from what was characteristic of 1951-61 and 1961-71. During 1971-81 the northeastern region, of course, repeated its earlier performance based largely on the continuing influx of people from Bangladesh. Elsewhere in the country rapid growth of population, involving considerable amount of net-in-migration, was associated with : (i) development of industries, mining, commercial activities, and miscellaneous services all leading to acceleration in the urbanization process ; (ii) extension of irrigational facilities into semi-arid and arid lands, as in Western Rajasthan, making it possible to bring new areas under cultivation and in the process attracting new migrants from other regions, (iii) reclamation of waste lands and intensification of agriculture in the lands already under the plough as in Terai tract of Uttar Pradesh, (iv) extension of farming into the upland areas and marginal hill lands, as in such areas in southern India. With a few exceptions, most of these areas have low to moderate density of population.

By contrast, the areas experiencing relatively low rate of population growth are such where pressure of population on resources has been severe and, as a result, from where people have been moving out. Several of the areas in this class are inadequately developed industrially and have experienced only low degree of urbanization. To add to the migrational losses arising from net out-migration and emigration, there has also been some decline in the rate of natural growth in these areas (Kerala and Tamil Nadu, etc.) bringing down the overall rate of population growth. In these areas rural as well as urban growth has been well below the national average during 1971-81. The Konkan coast is another major tract which has been experiencing very low rate of population growth as a result of massive out-migration. Despite their growing prosperity, parts of northern Punjab have been losing population consequent upon continuing emigration and out-migration of their adventurous people to be partly compensated only by in-migration of landless labourers from Bihar and eastern Uttar Pradesh. That way, Punjab is a unique area witnessing streams of out - and in-migration simultaneously.

It may be noted that Kerala which

has consistently been an area of rapid population growth in previous decades (1951-71) has moved down, for the first time, to the category of low growth during 1971-81 consequent upon fall in birth rate and accelerated emigration/out-migration. On the other hand, a large part of the Ganga Plain which in previous decades was regularly showing up low rate of population growth has gone up into the category of moderately high rate during the last ten years as a result of substantial fall in mortality rate with birth rate keeping at a high level. These constitute major changes in spatial patterns witnessed during 1971-81 compared to the preceding two decades.

Lastly, the processes of population control and economic development have to be accelerated simultaneously. The much desired fall in birth rates throughout the country cannot be left to a chance. The model of European economic-demographic history does not fit into the urgencies of India's needs.

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A PERSPECTIVE ON POPULATION GROWTH IN INDIA

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Population growth is widely heralded as a major problem of India. It will determine, to a large extent, the living conditions of people for decades to come. Therefore, it is of paramount interest to raise the following questions :

(1) When will the Indian population stabilize ?
(2) How large will it be when it is stabilized ?
(3) What will be the magnitude of efforts necessary to provide basic essentials to the growing population ?
(4) How will population growth impact upon the environment ?

This paper analyzes these inter-related questions. A deeper understanding and an open discussion of these issues will lead to better decision-making at the individual and societal level.

Estimation of the future demand for the basic necessities of life and planning for economic development requires an accurate projection of population size and its growth trends. But population projections should be taken as an estimate not as a prediction. An accurate projection of population requires information on the replacement level of fertility, the age structure and the age at marriage. All these variables are influenced by a number of socio-economic forces. Error is difficult to avoid in the estimation of the growth trends. The more long-term the projection, the greater the margin of error. Because of the socio-economic complexities involved in the population growth process, demographers have been more successful in making relatively accurate population projections for the short-term than for the long-term.

Table 1 projects India's population in the year 2000 A.D. on the basis of achieving replacement level fertility in three different years : 1985, 1995, and 2005. (Population Reference Bureau, 1970). Replacement level fertility, also technically termed Net Reproductive Rate of one (NRR=1) indicates the condition that occurs when child-bearing women, on the average, bear only enough daughters to replace themselves. Table 1 also shows India's population in the year 2000 under four different conditions. If replacement level fertility is reached in 1985, the population will be 882 million. If it is achieved in 1995, the population will be 982 million. If it is attained in 2005, the population will be 1097 million. If fertility remains, constant at the 1965 level, that is, a birth rate of 41.1 per thousand persons, and if the corresponding death rate of 18.9

per thousand persons remains constant, the population by the year 2000 will be 1,532 million (Government of India, 1975). Recent trends indicate a decline in the birth rate. Therefore, the projection that assumes that birth and death rates will remain constant at the 1965 level is unrealistic (Singh, 1977). Also it will be highly unlikely that India will reach replacement level fertility as early as 1985, given the fact that in 1977 the birth rate was 35 per thousand and the death rate was 14 per thousand persons. The most optimistic, but still probable, projections of population in the year 2000 are between 982 million and 1,097 million, corresponding to achievement of replacement level fertility between 1995 and 2005. In its 1979 World Population Data Sheet, the Population Reference Bureau projects 1,010.5 million in the year 2000 (Population Reference Bureau, 1979 and 1980). A year later, in 1980, they lowered the projected population to 976 million in the year 2000. The World Bank projects a population of 974 million in the year 2000 (World Bank, 1980).

Table 1

Projections of India's Population Growth

Replacement level of fertility reached by*	Projected population in year 2000: (in millions)
198	882
1995	982
2005	1,097
fertility constant at 1965 level	1,532

*Replacement level of fertility, technically termed Net Reproduction Rate of one (NRR=1) indicates child bearing women, on the average, bear only enough daughters to replace themselves.

Source :—International Demographic Statistics Centre, U. S. Bureau of Census in, "India : Ready or Not Here They Come" *Population Bulletin*, Vol. 26, No. 5 November, 1970, A publication of the population Reference Bureau, Washington, DC.

Even after India achieves replacement level fertility, population growth will continue for many years before it stabilizes. Thomas Frezka has made long range projections of population and its ultimate stabilization with various assumptions of achieving replacement level fertility (Thomas, 1973). Frezka's projections are shown in Table 2.

Table 2

India : Indices of Population Size (1970=100)

Year	NRR=1.0 Reached in 1970-75		NRR=1.0 Reached in 2000-05		NRR=1.0 Reached in 2040-45	
	Growth index	Estimated population (millions)	Growth index	Estimated population (millions)	Growth index	Estimated population (millions)
1970	100	540	100	540	100	540
2000	135	729	177	956	206	1112
2050	164	886	256	1382	455	2457
2100	167	902	263	1420	542	2927

Source: Frezka, Thomas, *The Future of Population Growth*, Wiley 1973. p. 118.

During the first 25 to 30 years after the achievement of replacement level fertility, the annual population growth drops to below 0.5. However, it takes approximately 100 years for the population to stabilize and reach a zero growth rate after it achieves and maintains replacement level (Tapinos and Piotrow, 1978). Table 2 provides projections of population for the year 2000, 2050, and 2100 corresponding to the achievement of replacement level fertility in 1970-75, or in 2000-05, or in 2040-45.

If replacement level fertility is achieved in the period 2000-05, (an optimistic but probable assumption) and it is sustained thereafter, India's population will stabilize around the year 2100 at 1,420 million people. This is 2.63 times greater than the population is 1970. The projection of the World Bank is that the size of the stationary population will be 1,645 million and that the population will achieve replacement level fertility in the year 2020 (World Bank, 1980, p. 142)). A delay of only twenty years in the achievement level fertility will result in 220 million more people at the stabilization point.

What are the prospects of reducing the birth rate quickly and of achieving replacement level fertility at the earliest period ? Demographic analysis identifies 1921 as the starting point of a period of rapid population growth. The decennial growth of population increased from 11. 0 percent in 1921-31 to a high of 24.8 percent in 1961-71 (Government of India, 1975, p. 7). This growth results from a declining death rate. For instance, from the decade 1921-31 to 1961-71, the birth rate declined slightly from 46.4 per thousand to 41.1 per thousand persons. During the same period, the death rate declined rapidly from 36.3 to 18.9 per thousand persons (Government of India, 1975, p 8). By 1978, the birth rate had further declined to 35 per thousand persons (World Bank, 1980, p. 144). In this initial period of fertility decline, the duration of a period of high population growth will be prolonged because there is a potential for the death rate to decline further to a world average of 11 per thousand persons (Population Reference Bureau, 1980). Rapid decline of birth rate in the next two or three decades can be achieved by expansion of general education and efforts to make birth control accessible and acceptable to a larger population (Freedman, 1979).

Urbanization

Population growth has a profound effect on cities and the living conditions of the city dwellers. Cities increase in number and size as population growth occurs. Urban history of the industrialized nations shows that urbanization and economic growth have been positively correlated. Many factors combined to produce large cities and a high rate of urbanization in the industrialized world. Examples of these factors are expanding economies, forces of the economy of scale, agglomeration of economic activity, and comparative advantage in trade, commerce and production. Population growth, though essential, played a secondary role. In the less developed countries population growth is the primary force producing large urban centers. A United Nations study, for example, succinctly points out this picture (United Nations, 1975, p. 61).

In 1960, nine of the world's ten largest urban agglomerations were in the industrialized countries. In the year 2000

only 2 of the 10 largest urban agglomerations will be from the industrialized world. Three Indian cities in 1960 were among the 50 largest urban agglomerations of the world. They were, with rank in parenthesis : Calcutta; (12); Greater Bombay (18); Delhi (34). In the year 2000 five cities are projected to be in this group. They will be : Calcutta (5); Greater Bombay (8); Delhi (17) ; Madras (27) ; Ahmedabad (49) ; and Bangalore (50). The concentration of population in large urban centers is also revealed by the census data. Only the urban centers over 100,000 persons have increased their share of the total urban population. In 1901, 22. 9 percent of the urban people lived in cities with population of more than 100, 000 persons. By 1971 the percentage had reached 55.7 (Tata Services Limited, 1978, p. 39).

The concentration of people in the ever-growing large urban agglomerations will aggravate the existing problems of over crowding, unemployment slums, sanitation and over burdened social and physical amenities (World Bank, 1972).

Employment

Creation of jobs is one of the important aspects of coping with population growth. In the organized sector, employment from 1972 to 1976 increased at an average annual rate of 2.9 percent (Tata Services Limited, 1978, pp 120-121). Most of the employment increase has taken place in the public sector. In spite of the increase in employment, unemployment rose from 2,622,000 in 1966 to 9,784,000 in 1976. Another recent estimate of total unemployment and under-employment is 40 million people (Tata Services Limited, 1978, p.126).

Unemployment of educated persons is increasing at a much faster rate. If the present trends are any guide, employment opportunities will further deteriorate because ever large numbers will be entering the work force. From 1980 onwards, the age structure will annually contribute to the labour force, 14.5 million persons between the ages of 20-24.99 years. This number will increase to 17.5 million persons in the early 1990's (Government of India, 1977, p. 6). If we assume that a majority of the women will not look for jobs, then 8 to 9 million new jobs are needed every year in the 1980's and 10 to 11 million in the 1990's. The organized sector has only increased from 12.09 million workers in 1961 to 20.21 million workers in 1976 (Tata Services Limited, 1978, p. 120). The organized sector has thus demonstrated a meagre capacity to absorb this flood of manpower. A new strategy needs to be devised. The unemployed labour force is not only a waste of resources, but can also be a great source of instability in the country. The agricultural sector, it is argued, is the only one which can help the country during this period of high population growth. After 2020, the labour force increase will slow down because of low population growth and the organized sector will be large enough to absorb the labour force. This can only happen if everything goes according to the textbook scenario. To absorb this rising work force, a 4-5 percent annual increase in employment is needed. This will be an enormous task.

Food

Food production constitutes one of the important elements needed to support this large and rising population. Table 3

provides a picture of the tremendous task that must be accomplished in the next two decades. If all Indian farmers were to produce food grains at the highest crop yield level obtained in one of the states in the crop year 1977-78, food grain production would be 2426 million tons and legume and pulse production would be 18.5 million tons. This production level will raise per capita food availability for the projected population of 975 million in the year 2000 by 25 percent. It is imperative that India rapidly increase its average crop yields two to three times the present level if it wants to improve the level of food consumption modestly.

Table 3

Principal Food Crops : Yields and Potentials

Crop	Highest yield obtained in a state (1977-78) Kilograms per hectare	Average national yield (1977-78)	Percent growth in national crop yields 1950-51 to 1977-78	Area under crop in million hectares (1977-78)	Production possibilities in million tons (highest crop yield times crop area)
Rice	3360 (Punjab)	1320	97.0	40.001	134.4
Wheat	2540 (Punjab)	1480	124.2	21.203	53.9
Jowar	870 (Karnatka)	730	108.2	16.273	14.2
Bajra	1130 (Punjab)	430	48.3	11.035	12.5
Maize	2960 (Karnatka)	1040	89.1	5.700	16.9
Small Millets	790 (Gujarat)	450	18.4	4.740	3.7
Ragi	1570 (Tamil Nadu)	1100	69.2	2.652	4.2
Barley	1400 (Rajasthan)	1160	52.6	1.992	2.8
					242.6
Grams	910 (Punjab)	660	37.5	8.253	7.5
Tur	1480 (Uttar Pradesh)	720	-8.9	2.623	3.9
Other pulses	560 (U. P and Punjab)	350	6.1	12.661	7.1
					18.5

Data Source : *Statistical Abstract*, India 1978. Central Statistical Organization, Department of Statistics, Ministry of Planning, Government of India, New Delhi. pp. 41-57.

Note : One ton = 1000 kg.

A comparison of the growth of average national crop yields with the growth of population is encouraging (Table 3). Population has increased by 76 percent from 1951 to 1977. During the same period the average yields of wheat, rice, jowar and maize have grown faster than the population. However, legumes, the major source of protein, have not been touched by any improvements brought by new techniques. Coarse grains (millet, ragi, barley) have increased at a slower rate than population. Their best yields are only half the size of the best yields obtained from wheat and rice. For comparison an analysis up to 1974 indicates that only wheat yields had increased faster (83. 2 percent from 1951 to 1974) than population (62 percent in the same period). Increases in rice yields of (63. 7 percent from 1951 to 1974) had barely kept pace with population. Increases in the yields of all other crops were lower than the population increase. Thus impressive gains have been achieved since 1974 in agricultural productivity.

Productivity increases in agriculture are essential to the development process. There are no short cuts to increasing per capita food supplies. Domestic production must be increased, because in the current international political situation food grains have become a premium commodity and must be bought at a competitive price.

Why have the yields of various crops not increased uniformly ? Theodore W. Schultz, a recipient of 1979 Nobel Prize in economics has ascribed the variations in crop yields to incentives provided to farmers (Schultz, 1978, pp. 3-23). He attributes the increase in wheat yields to price incentives. For example, the wholesale price of wheat in the state of Punjab was consistently higher than the imported price of wheat during the early phases of the green revolution (from 1967 to 1972). A consistent and favourable price policy leads to various farm investments in the form of water pumps, new seeds, use of fertilizers and other improved techniques. The price of rice during the same period was much lower than the price of imported rice. The under pricing of rice created disincentives for improved inputs in rice cultivation. Some of the disincentives (such as food zones) that kept the prices artificially low in certain regions were removed in the seventies and subsequently there has been remarkable growth in yields since 1975.

Schultz cites numerous examples from around the world to make a convincing case that agricultural improvements take place in an environment that allows prices to rise to the market level. A floor price must also be provided so that prices are not allowed to dip below an ascertained level. The World Bank in its "World Development Report 1980" strongly emphasizes the same point and adds that instead of lowering the prices paid to farmers, food should be subsidized to consumers from the public revenue (World Bank, 1980, pp. 59-64). To avoid budget deficits and to keep the food prices low to the urban population there is a strong temptation on the part of the government to pay lower prices to farmers. Such a policy is counterproductive in three ways. First it will stagnate food production. That situation will force government to import expensive food to meet the rising demand and, finally, such a policy would suppress the incomes of the rural population. Conversely, subsidization of food increases effective demand and thus encourages food production. But general subsidization can

become very expensive to the central government and divert funds from other development projects. Therefore, food subsidization should be targeted to provide low income families with adequate food. One way this can be achieved is by subsidizing only those foods, (such as coarse grains) which are the staple of the low income people.

Though determination of prices by the free market is vital to agricultural development, there are essential auxilliary and long-term investments that can only be made by the public sector (Pereira, 1978, pp. 24-34). These investments provide the infrastructure to facilitate and enhance agricultural development. Some examples of these public investments and policies are : banking and loan institutions; agricultural research and extension services; irrigation and water works; prevention of soil erosion and water logging; efficient markets for agricultural products and availability of inputs needed for agricultural productivity ; and education of rural people. Also the public sector can play a very constructive role in maintaining ecological viability.

The American agricultural experience tells us that, as agriculture modernizes that real prices of farm products decline as a consequence of reductions in the cost of production (shultz, 1978, p. 14) To increase farm incomes, American farmers have employed two strategies. Farm size has increased and at the same time the farm labour force has decreased. However, this pattern may not be duplicated in India because developments in the 70's have created new conditions. Petroleum and natural gas, a major input for the production fertilizers and pesticides have been increasing in real prices and are expected to continue to rise in the future. A second factor to be considered is that there is very slow employment growth in the non-farm sectors of the economy. Therefore, agriculture is the sector that must absorb the increasing labour force created by population growth. In a situation where the cost of population as well as the farm labour force increases, we can project that farm income will stagnate. This will be counter productive to the development progress.

The effective demand for food can only be increased by raising the per capita income of a large majority of people, particularly at the lower rung of the economic ladder. In 1970, for instance, five percent of the population controlled 25 percent of the national wealth, and the 20 percent of the population at the lowest rungs of society controlled only five percent of the national wealth (World Bank, 1976, p 515). Across the board increases in per capita income will not only stimulate food production, but will also result in a more diversified and possibly nutritionally balanced diet and thus greater energy for economic productivity. Availability of food calories in India is 2,210 whereas the minimum daily recommended requirement is 2,400, India ranked 87 th in calorie intake in a world community of 125 (World Bank, 1976, p. 544). A full employment policy is needed to increase the per capita income of majority of the population.

Environment

Environment degradation is another area of concern related to population growth and industrialization. Progressive

degradation of the environment erodes the "carrying capacity"...the ability of biological systems to provide resources for human needs...and reduces the chances of raising living standards. Air, water, land and noise pollutions are known for their harmful effects on human health (Government of United States, 1980, pp. 241-251). The United Nations, through various Mega-conferences has attempted to heighten the concern of the international community for the preservation of a clean and viable environment. Megaconferences included Human Environment, 1972 ; Population, 1974, Ford 1974 ; Human settlement, 1976 ; Water; 1977 ; Desertification, 1977 ; Science and Technology for Development, 1979 ; and New and Renewable Sources of Energy, 1981.

Some pollutants have global effects, while the effects of others are limited to a region. The principal contributors of the global pollutants are the industrialized countries. However, the consequences will be borne by the whole world community. Examples of global pollutants are carbon dioxide, ozone depletion and acid rain.

Carbon dioxide is a by-product from the burning of fossil fuels. An increase in carbon dioxide can lead to warming of the earth's atmosphere and a change in climates. These climatic changes may have an adverse impact on agriculture and food crops. Ozone depletion results from air-craft exhaust in the stratosphere, the use of chlorofluro-carbons in spray cans, emission of holocarbons and nitrogen fertilizer use. Ozone absorbs the ultraviolet radiation from the sun. In doing so protects life on earth from the harmful effects of ultraviolet radiation such as cancer of the skin (Government of United States, 1980, pp. 264-266). It is estimated that a 10 percent decrease in stratospheric ozone is likely to lead to a 20 to 30 per-cent increase in skin cancer. (Ultraviolet radiation reaching the ground increases by about 2 percent for every one per-cent decrease in stratospheric ozone.) Ultraviolet radiation also inhibits plant growth and interferes with the process of photosynthesis. Its effect is lethal on seed-lings, single cell plants like algae, and fish and crustacean larvae. Exposure to ultraviolet radiation, therefore, has a dis-ruptive effect on the food chain and eco-system as a whole. Acid rain is primarily the product of emission of sulfur dioxide from coal burning and to a lesser extent nitric oxide from the auto exhaust. These two air pollutants react with air moisture to form acids and return to earth as acid rain. Acid rain increases the acidity of rivers, lakes and other inland water bodies, and have a damaging effect on plants and aquatic ecosystems. Acid rain inhibits reproduction of fish. It damages leaves of crops. High acidity of water helps dissolve toxic metals like aluminium and mercury in water and therefore has a great potential for contamination of drink-ing water supplies resulting in a serious health hazard. Acid ran slowly disfigures and decays historical monuments con-structed of limestone and marble. It is realized to be one of the serious environ-mental problems of the coming years (Likens and others, 1979, pp. 43-51).

Since environmental degradation is a slow process, we recognize it only when it reaches severe proportions. For example in Indian cities, noise pollution has reached a critical state. Also pollution of rivers

from urban sewage and industrial effluence is spreading in India. As urbanization and industrialization will increase so will water pollution. For example, only eight of India's 142 major cities have effective sewage treatment plants. Another 62 have partial facilities. The remaining 72 have no facilities at all (Sunanda, 1980, p. 3) Water pollution contaminates the drinking water supply as well as rendering water useless for other uses such as agriculture. Pollution of surface water also leads to contamination of ground water through percolation. It should be stressed that water filtering stations can remove suspended particles and bacteria through chlorination. But even the most advanced filtering systems cannot remove dissolved toxic metals... a product of industrial effluents. They have the potential to become a major health hazard. Providing safe drinking water and the disposal of sewage and industrial wastes will remain a central concern of the urban environment.

The water supply has to increase rapidly to meet the demand of rising population and economic growth. Increases in crop yields required to meet the food needs of the society will necessitate the extension of irrigation. Irrigation is a consumptiveuse of water because the water consumed in this process is not available for further use. Many Indian cities experience shortages of water before the onset of the monsoon. Pollution of rivers will aggravate these water shortages even more. The seasonal nature of the rainfall in India requires good management of water resources. This will require a judicious interference in the hydrologic cycle through the construction of waterworks that catch and store the flood water and make it available in dry seasons.

Another most serious environmental issue is deforestation, the result of the lumber and fuel wood requirements of the growing population as well as the need to extend cultivated areas. It has already reached a critical stage in the foothill region of the Himalayas. (Government of United states, 1980, pp 272-283). Deforestation causes soil erosion. It renders the earth incapable of absorbing rain and regulating the runoff in streams. This contributes to flash floods that cause loss of life, property and crops. Also it results in little charging of the underground aquifer and a lowering of the water table. This in turn, reduces the discharge in rivers especially in the dry season when water is most needed.

Since industrial activity is one of the primary sources of pollution of the environment, its growth, undoubtedly, will exacerbate environmental problems. Conflicts will arise between the proponents of "save the environment" on one side and proponents of "unbridled economic growth" on the other. A recent controversy surrounding the location of the government's Rashtriya Chemical and Fertilizer plant in the Bombay metropolitan area is an example. (Kannan, 1980, pp 693-696).

Two views are advanced to explain these environmental conflicts (Thurow, 1980 pp 103-121). One view is the pollution control regulations increase the cost of production and therefore reduce profits. With reduced profits there is less capital available that can be ploughed back as new investment for further growth. Because of the high cost of regulations, industries

are put at a disadvantageous position vis-a-vis their competitors from countries with fewer environmental regulations. This results in the loss of jobs and slow growth. Workers' fear of losing their jobs and industrialists' fear of reduced profits create opposition to environmental regulations. This can be remedied if uniform environmental regulations are developed for all countries. This is not altogether impossible in the future, but it looks improbably at present. The second view does not perceive any inherent conflict between the industrial workers and environmentalists. According to this scenario workers feel their standard of living improving with the acquisition of material goods. But once the material demands are satiated, the next step which would improve their standard of living further is the accessibility to aesthetic goods like clean air, clean rivers, quiet neighborhoods, etc., which cannot be purchased in the marketplace like material goods.

The Question—"Who should pay the cost for this clean environment ?"—becomes the center of controversy. Workers do not like to pay for clean environment because of their priority to acquire material goods. The middle class make the point that pollution is not their doing and point out that industry should bear the expense of cleaning the environment because it is the industry that produced the pollution in the first place.. The very rich, generally the owners, and large st ockholders, can obtain access to a clean environment for their personal use. Also they resist because pollution control will reduce profits. Environmental quality, according to this scenario, will improve only after most workers achieve the material goods they seek. Then there will be a big enough majority of people demanding a cleanup of the environment to overcome the resistance of industry.

Human Capital, Basic Needs and Poverty Alleviation.

A confluence of forces—rapid population increase, late start of the development process and slow economic growth—has resulted in keeping a large proportion of the Indian population at or below the poverty level. The World Bank has estimated 780 million persons as absolute poor in the developing countries (excluding China and other centrally planned economies). Half of the world's absolute poor are residing in India and Bangladesh (World Bank, 1980, pp. 33-34).

In addition to very low incomes, absolute poverty also means malnutrition, poor health and lack of education. Any program formulated to successfully tackle the problem of poverty has to take into consideration all the above aspects. It is widely realized that economic growth, though essential, will not reduce absolute poverty with an acceptable speed. Therefore, to reduce poverty at an acceptable pace, both a basic needs approach and a human capital approach have been promoted.

The Basic Needs approach requires the use of both the public and private sectors to provide a minimum level of consumption of food, shelter and clothing and later potable water, environmental sanitation, public transportation and health and educational facilities. The Basic Needs approach requires improved income distribution especially to the lower income

group (International Labour Office, 1977).

Human Capital is the "skills dexterity and knowledge" of the population. Investment in human capital leads to rapid economic growth and reduces poverty. The activities that lead to improvements in human capital and human capabilities are : (1) health facilities and services that affect the life expectancy, stamina, strength and the vigor and vitality of people, (2) on the job training, (3) education, (4) adult education, (5) migration of individuals and families to adjust to changing job opportunities (Schultz, 1980, pp. 639-651).

The World Bank has combined the essence of both the Basic Needs approach and the Human Capital approach in its Concept of Human Development (World Bank, 1980, pp. 32-98).

Human Development requires raising income— through expanded employment opportunities approaching full employment, and raising the nutrition and education level of the population. It also requires improvements in health and reduction in the fertility rate. It must be emphasized that all these five elements are interrelated. Consequently, improvements in one aspect lead to improvements in other aspects.

Progress on Human Development lines has been taking place in India for some time but achievements are uneven. Education is far ahead of the achievements in other areas. India has gained a valuable experience through its various employment pilot projects in providing employment and therefore raising the incomes of the poor in rural areas (Raj 1980, pp, 166-178). These pilot projects are : (1) Employment Guarantee schemes of the state of Maharashtra, (2) food for work programs (3) employment increase through intensification in agriculure, (4) "ANTYODAYA!" self employment approach of the state of Rajasthan, (5) small farmers development agency, (6) and operation flood — the dairy scheme.

The reduction of poverty cannot be achieved by distribution alone. The economic pie must also increase in size through more production. In the first phase when there are under-utilized resources—like high unemployment—production can be increased simply by providing employment. The next phase requires the increase in per capita production. This gain in productivity comes through the use of improved techniques of technology. In this phase capital expenditures on new tools and machinery, research and development and human capital play a crucial role in increasing productivity.

In the coming years the rate of population growth will certainly decline. But for at least three decades the absolute increase of population will be larger than at present. Achieving human development in a period of increasing stress on the "carrying capacity" of the land will be a herculean task. A national *concerted* effort is required to achieve the goals of human development. In it lies India's challenge and hope for the future.

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SOME FACTORS INFLUENCING VARIATIONS IN THE RATE OF NATURAL INCREASE OF POPULATION IN WESTERN MAHARASHTRA

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The paper analyses the impact of various factors on variations in the rate of natural increase of population in Western Maharashtra. By using district level data, coefficients of correlation have been calculated between rate of natural increase, birth-rate and death rate on the one hand and different factors affecting them on the other. The analysis shows that in Western Maharashtra birthrate is high in response to high death rate and high infant mortality rate. It is also revealed that the rate of natural increase of population declines with increase in proportion of working females as also of educated males. All this signifies that the region under study is in the second stage of the "demographic transition".

The most important problem before the country today is the one created by population explosion. All attempts to improve economic condition of the people have been thrown out of gear by enormous increase in population of the country from 238 million in 1901 to 683.8 million in 1981. Western Maharashtra, consisting of the districts of Thana, Kulaba, Ratnagiri, Dhulia, Jalgaon, Nashik, Ahmednagar, Pune, Solapur, Satara, Sangli, Kolhapur and Greater Bombay, also experienced during the same period a big increase in population from 11.1 million in 1901 to 38.6 million in 1981. Percentage increase in population during the decade 1961-71 for the Western Maharashtra as a whole was 25.61. This increase has not been uniform within the region under study. Central part of the region consisting of the districts of Greater Bombay, Thana, Pune, Ahmednagar and Nashik recorded higher percentage increase than the average for the region during the same decade. Similarly south-eastern part of the region consisting of the districts of Kolhapur and Sangli also recorded higher than average increase. On the other hand, the south-western part (districts of Kulaba and Ratnagiri), the south central part (districts of Satara & Solapur) and the northern part of the region (districts of Dhulia & Jalgaon) showed percentage increase in population significantly lower than the average for the region.

Increase in population has two components, natural increase and net migration. In the present study, attempt has been

made to find out the relative contribution made by these two components. From the the Public Health Department of the Government of Maharashtra, data on births and deaths during the decade 1961-71 were collected for all the thirteen districts of the region. The rate of natural increase in each district was calculated from these data. Any increase or decrease over this was the contribution made by net migration. Two maps showing the respective contribution made by these components were prepared. The map showing percentage increase due to net migration brought out that the central and south eastern parts of the region as distinctive in this respect. These areas experienced considerable net in-migration as a result of which their population recorded a high growth rate.

The map showing the contribution made by natural increase revealed that there are two regions, namely northern and southern, where contribution made by natural increase is significantly high. The northern region consists of the districts of Jalgaon, Dhulia and Nashik while the southern region consists of the districts of Kolhapur, Sangli, Satara and Solapur. The central region consisting of the districts of Pune and Ahmednagar showed moderate increase related to natural increase. The western part consisting of the districts of Thana, Kulaba and Ratnagiri showed very low percentage increase due to natural increase. The contribution made by natural increase varied from less than 15 percent in the districts of Ratnagiri and Kulaba to more than 20 percent in the districts of Greater Bombay, Nashik, Dhulia, Satara, Solapur, Jalgaon and Kolhapur (Table 1).

Table 1

Contributions made by Natural Increase and Net Migration towards Percentage Increase in Population during 1961-71 in Different Districts of Western Maharashtra.

District	Percentage increase in population during the decade 1961-71	Percentage increase in population due to natural increase*	Percentage increase in population due to net migration
1. Greater Bombay	43.80	22 52	21.27
2. Thana	38.06	15.72	22.29
3. Kulaba	19.28	13.66	5.62
4. Ratnagiri	8 84	14.36	— 5.52
5. Nashik	27.70	20.26	7.44
6. Dhulia	23.01	22 03	0.98
7. Jalgaon	20.29	24 02	— 3.73
8. Ahmednagar	27.77	18.32	9.45
9. Pune	28 83	17.70	11.13
10. Satara	20.79	20.02	0.77
11. Sangli	25.12	18.08	7 04
12. Solapur	21.17	22 16	—0 99
13. Kolhapur	28 28	21.45	6.83
Western Maharashtra	25.61	19.25	6.39

*Based on data collected from Public Health Department, Government of Maharashtra, Poona.

It is necessary to analyse the factors influencing these variations and to establish their relationship with the rate of natural increase of population. This might help in deciding a strategy to regulate the growth of population. With this view in mind, district level data regarding various demographic, economic and social factors were collected for the year 1976-77 from the District Statistical Abstracts for various districts, published by The Bureau of Economics and Statistics, Government of Maharashtra, Bombay and were analysed.

Demographic Factors

In an economically backward country like India, demographic factors such as birth rate, death rate, infant mortality rate, proportion of females in reproductive age-group and proportion of sterilization operations done to females in the reproductive age-group were expected to influence the variations in the rate of natural increase. By using district level data, coefficients of correlation were calculated between these factors on the one hand and the variations in the rate of natural increase, birth rate and death rate on the other.

The rate of natural increase showed a correlation of 0.91 with birth rate. Such a high value of 'r' shows that variations in birth rate have a distinct bearing on variations in the rate of natural increase of population.

Coefficient of correlation between birth rate and death rate for Western Maharashtra as a whole by using district-level data was also found to be positive and significant (0.80). This clearly means that birth rate is high in response to high death rate.

Significant and positive correlation (0.57) between birth rate and infant mortality rate shows that the variations in birth rate are influenced also by variations in infant mortality rate. This means that birth rate is high in response to high infant mortality rate.

The coefficient of correlation between the rate of natural increase and death rate was found as 0.53. This means that no doubt the death rate is high but the birth rate is so high that it more than compensates for the high death rate so that the resultant rate of natural increase of population remains still high.

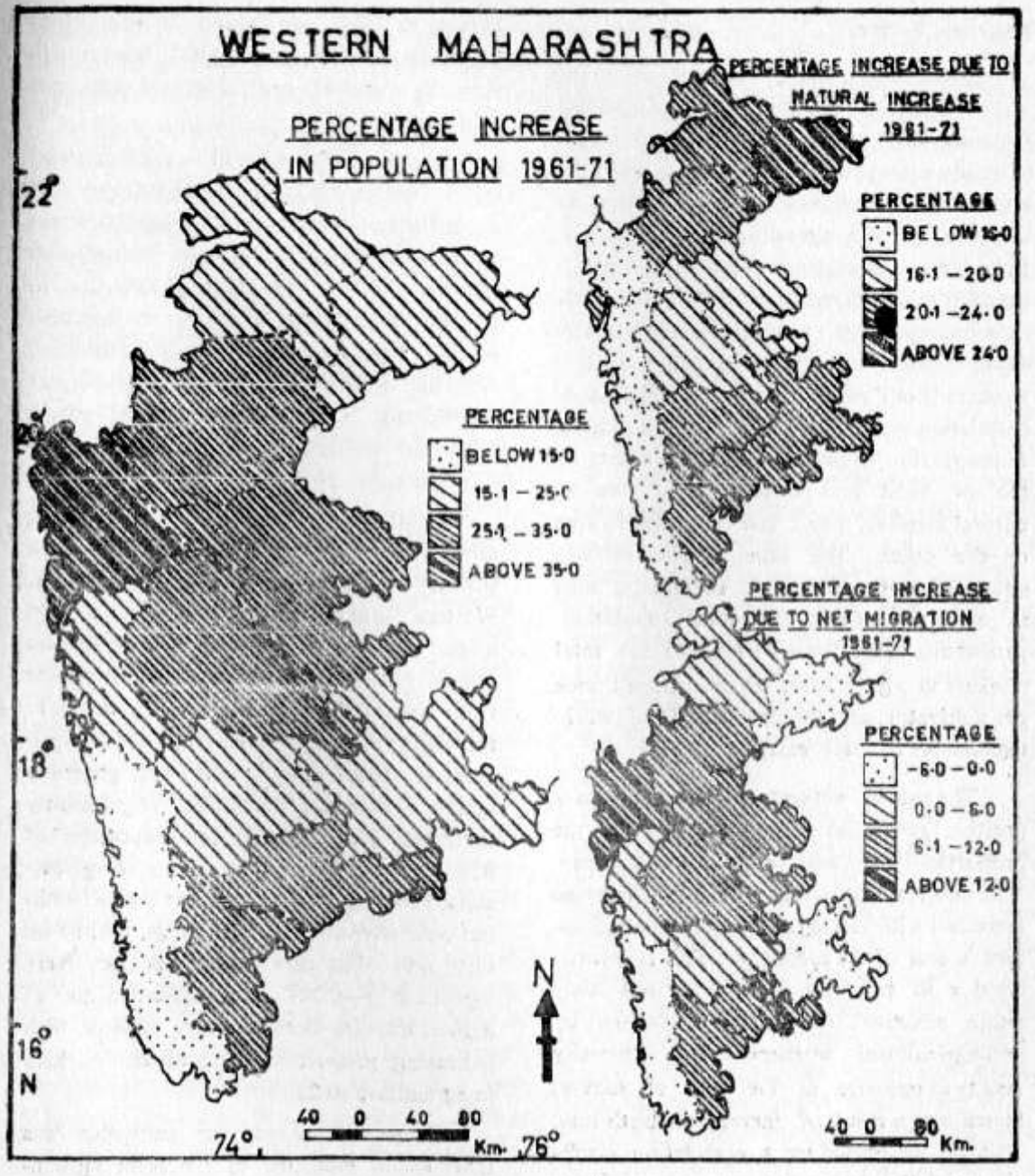
For obvious reasons, the rate of natural increase of population is influenced by proportion of females in the reproductive age-group. Positive and significant value of coefficient of correlation between the two (0.85) supports this.

To evaluate the impact of family planning programme on the rate of natural increase of population, the rate of natural increase was correlated with the proportion of sterilization operations done to females in the reproductive age-group. Positive and significant value of 'r' (0.62) showed that family planning programme has not yet made significant impact on natural increase of population in the Western Maharashtra.

Table 2

Correlates of Natural Increase of Population, Birth Rate & Death Rate in Western Maharashtra

Correlate	Coefficient of correlation with		
	Rate of natural increase	Birth rate	Death rate
1. Demographic factors			
(a) birth rate	+0.91	—	—
(b) death rate	+0.52	—	—
(c) proportion of females in the reproductive age-group	+0.85	—	—
(d) proportion of sterilization operations done to females in reproductive age-group	+0.62	—	—
(e) death rate	—	+0.80	—
(f) infant mortality rate	—	+0.57	—
2. Economic factors			
(a) proportion of workers engaged in non-agricultural occupations	+0.53	+0.29	+0.05
(b) proportion of earners to total population	+0 55	+0.08	—0.08
(c) proportion of landless workers to total workers in agriculture	+0.28	—0.24	—0.52
(d) gross cropped area per cultivator	+0.19	+0.02	—0.54
(e) proportion of working females to total females	—0.67	—0.09	—0.08
3. Social factors			
(a) proportion of urban population to total population	+0.59	+0 37	—0.23
(b) proportion of literates to total population	+0.61	+0.32	+0 05
(c) proportion of educated to total population	+0 58	+0.35	+0.03
(d) proportion of male literates to total male population	+0.61	—0.14	—0.08
(e) proportion of educated males to total male population	—0.09	—0.17	—0.08
(f) proportion of literate females to total females	+0.89	+0.48	—0.55
(g) proportion of educated females to total females	+0.51	+0.33	+0.03
(h) hospital beds per thousand population	+0.33	+0.59	—0.10


WESTERN MAHARASHTRA
PERCENTAGE INCREASE IN POPULATION 1961-71
PERCENTAGE
BELOW 15·0
15·1 – 25·0
25·1 – 35·0
ABOVE 35·0
PERCENTAGE INCREASE DUE TO NATURAL INCREASE 1961-71
PERCENTAGE
BELOW 16·0
16·1 – 20·0
20·1 – 24·0
ABOVE 24·0
PERCENTAGE INCREASE DUE TO NET MIGRATION 1961-71
PERCENTAGE
-6·0 – 0·0
0·0 – 6·0
6·1 – 12·0
ABOVE 12·0
22°
18°
16° N
74°
76°
N
40 0 40 80 Km.
40 0 80 Km.

Economic Factors

It has been observed that in economically backward regions, rates of natural increase, birth rates, death rates and infant mortality rates are generally high, while in economically developed regions, these rates are low. In an agricultural country like India, certain indicators related to agriculture can taken to represent different aspects of economy. The proportion of workers engaged in non-agricultural activities to total workers is one such indicator. Coefficients of correlation were calculated between variations in proportion of non-agricultural workers on the one hand and those in the rate of natural increase, birth rate and death rate on the other. The same procedure was adopted for other economic indicators, such as proportion of earners to total population, proportion of landless workers to the total workers in agriculture, gross cropped area per cultivator, and the proportion of working females to total females.

The rate of natural increase showed a positive relationship of 0.53 with the proportion of non-agricultural workers. This means that the rate of natural increase increased with the bigger size of non-agricultural sector of the economy. This is probably due to migration which is not only youth selective but also dominated by non-agricultural workers. This normally results in increase in the rate of natural increase as a result of increase in birth rate. This was supported by a correlation coefficient of 0.29 between the proportion of non-agricultural workers and the birth rate.

Three indicators were used to represent level of poverty, namely 1) proportion of earners to total population, 2) proportion of landless workers to total workers in agriculture and 3) gross cropped area per cultivator.

To start with, the coefficient of correlation between the rate of natural increase and proportion of earners to total population was calculated. It was found to be positive and significant (0.56). This is probably due to the fact that majority of the earners are also in the reproductive age-group. However, birth and death rate revealed an indifferent relationship of 0.08 and—0.08 respectively with the proportion of earners to total population.

Another indicator used to represent level of poverty was proportion of landless workers to total workers in agriculture. Western Maharashtra has considerable area under sugarcane. Landless workers from other parts of Maharashtra, particularly from nearby Marathwada region, come to this region in search of employment in agriculture. These in-migrants are generally young. Hence, death rate significantly decreases with increase in proportion of landless workers to total workers in agriculculture (-0.52). Some of them come without their wives. This results in decline in birth rate. But this decline is not very significant (—0.24). Consequently, rate of natural increase increases only slightly with increasing proportion of landless workers in agriculture (0.28).

Gross cropped area per cultivator was taken as an indicator to represent agricultural prosperity. With increasing agricultural prosperity death rate declines significantly (r=0.54). It has very little impact on birth-rate (r=0.02). Consequently, rate of

natural increase of population increases only slightly, with increase in agricultural prosperity (r=0.19).

As expected, rate of natural increase declines with increase in proportion of working females (r=0.67). But its impact on both birth rate and death-rate though negative is not very significant (r=-0.09, r=—0.08, respectively).

Social Factors.

An attempt was made also to find out if social factors, such as level of urbanisation, rates of literacy and availability of medical facilities have any bearing on variations in the rate of natural increase. Contrary to expectation, the rate of natural increase had a positive relationship (0.59) with urbanisation. This means that the rate of natural increase increased with urbanisation. This is possible if there is increase in birth rate or decrease in death rate. To find out clearly whether it is due to former or later, coefficients of correlation were calculated between variations in rate of natural increase of population on the one hand and birth rate and death rate on the other. Both were insignificant but one with birth rate was positive (0.37) and that with death rate was negative (—0.23). Because of rural to urban migration, which is age-selective, proportion of people in the reproductive age-group is higher in urban areas, which results in slightly higher birth rate in urban areas. Decrease in death rate in urban areas may also be partly due to the same reason. Partly it may be due to availability of slightly better medical facilities. High birth rate and low death rate have resulted in higher rate of natural increase of population in urban areas of Western Maharashtra.

Another social factor, which generally influences the rate of natural increase, is literacy. Surprisingly, coefficient of correlation between variations in the rate of natural increase and proportion of literates to total population was found to be positive and significant (0.61). Birth rate also showed a positive relationship of 0.32 with of the literacy rate. Proportion of literates did not influence the death rate to any significant extent. This is shown by an insignificant cofficient value of 0.05.

Coefficient of correlation between proportion of educated persons (matriculation and above) and the rate of natural increase was found to be positive and significant (0.58). A positive relationship discovered also between the proportion of educated people and birth rate. Influence of proportion of educated people to total population was found to be insignificant on death rate (r=0.03).

Likewise the relationship between the rate of natural increase and the proportion of male literates to total male population was found to be positive and significant (0.61). Coefficients of correlation between proportion of male literates to male population on the one hand and birth rate and death rate on the other were found to be negative but insignificant. This means male literacy has only slight negative impact on birth rate and death rate but on the whole the rate of natural increase is not much influenced.

Coefficient of correlation between the proportion of educated (matriculation and above) males and the rate of natural increase

of population was found to be negative though not very significant. But the fact that it is negative shows that education of males results in a decline of the rate of natural increase. This is also supported by the nature of relationship between the proportion of educated males and the birth and death rates. Both were found to be negative though not very significant. This means that with education of males both birth-rate and death rate decline. Between the two, birth rate declines more rapidly. This clearly shows that though the rate of natural increase is not much influenced by increase in total literacy or literacy among males, it showed a definite downward trend with an increase in proportion of educated males.

Many people believe that it is not literacy among males but it is literacy among females that influences the rate of natural increase of population. To verify this, coefficient of correlation between the proportion of famale literates to female population and rate of natural increase was calculated. This was found to be positive and significant (0.89). Further, coefficient of correlation was calculated between the proportion of literate females and birth rate. This also was found to be positive (0.48). This shows that in Western Maharashtra variations in rate of natural increase of population and birth rate are influenced more by age-composition and not by female literacy. One encouraging point to note was that the coefficient of correlation between the proportion of literate females and the death rate was found to be negative and significant. This clearly shows that with spread of literacy among females, death rate is declining rapidly. Similarly a positive relationship (0.51) was discovered between the proportion of educated (matriculate and above) females and the rate of natural increase. It means that not only with literacy among females but even with education among females, the rate of natural increase of population increases. This was further supported by a positive relationship (0 33) between the proportion of educated females and the birth rate.

It follows that with increasing proportion of literates or educated among females the birth rate instead of declining tends to increase but with both increasing proportion of literates and educated among males, the birth rate shows a tendency to decline Not only that. With increasing proportion of educated among males, even the rate of natural increase declines. This clearly shows that in a socially backward country like India, it is the husband who decides the size of the family.

Availability of medical facilities as represented by the ratio between the hospital beds and population showed positive (0.33) relationship with the rate of natural increase. This shows that availability of medical facilities has not influenced the rate of natural increase of population to any significant extent. This is further supported by a positive relationship (+.59) between these facilities and the birth rate. As expected, these facilities had a negative relationship with the death rate (— 0.10). with Increasing inadequacy of medical facilities, death rate increases. This is clearly shown by the coefficient of correlation between population per bed in hospitals and death rate (0.10).

Conclusions

In the area under study, the rate of

natural increase of population is high as a result of high birth rate. Several factors contribute towards the high birth rate. Important among them are the death rate and the infant mortality rate. In Western Maharashtra, birth rate is high in response to high death rate and high infant mortality rate. Unfortunately, family planning programme has not yet made a significant impact on natural increase of population in Western Maharashtra.

Growth of non-agricultural sector of the economy which encourages migration and which is age-selective leads to high birth rate and lowering of death rate. The same is effected by an increase in the proportion of earners and by in migration of landless workers on a large scale. Increased agricultural prosperity and spread of education among females result in lowering of the death rate.

Some social factors have contributed towards decline in rate of natural increase of population. Important among them are increase in the proportion of working females and of educated males.

It is evident that the region under study is in the second stage of the "demographic transition" in which due to improvements in socio-economic conditions, death rate has started declining rapidly while there is very little impact on birth rate. Consequently, rate of natural increase of population is increasing. The peculiar age-composition of the population established by high birth-rate over a long period is also partly responsible for this increase.

A PERSPECTIVE ON POPULATION GROWTH IN INDIA

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Population growth is widely heralded as a major problem of India. It will determine, to a large extent, the living conditions of people for decades to come. Therefore, it is of paramount interest to raise the following questions :

(1) When will the Indian population stabilize ?
(2) How large will it be when it is stabilized ?
(3) What will be the magnitude of efforts necessary to provide basic essentials to the growing population ?
(4) How will population growth impact upon the environment ?

This paper analyzes these inter-related questions. A deeper understanding and an open discussion of these issues will lead to better decision-making at the individual and societal level.

Estimation of the future demand for the basic necessities of life and planning for economic development requires an accurate projection of population size and its growth trends. But population projections should be taken as an estimate not as a prediction. An accurate projection of population requires information on the replacement level of fertility, the age structure and the age at marriage. All these variables are influenced by a number of socio-economic forces. Error is difficult to avoid in the estimation of the growth trends. The more long-term the projection, the greater the margin of error. Because of the socio-economic complexities involved in the population growth process, demographers have been more successful in making relatively accurate population projections for the short-term than for the long-term.

Table 1 projects India's population in the year 2000 A.D. on the basis of achieving replacement level fertility in three different years : 1985, 1995, and 2005. (Population Reference Bureau, 1970). Replacement level fertility, also technically termed Net Reproductive Rate of one (NRR=1) indicates the condition that occurs when child-bearing women, on the average, bear only enough daughters to replace themselves. Table 1 also shows India's population in the year 2000 under four different conditions. If replacement level fertility is reached in 1985, the population will be 882 million. If it is achieved in 1995, the population will be 982 million. If it is attained in 2005, the population will be 1097 million. If fertility remains, constant at the 1965 level, that is, a birth rate of 41.1 per thousand persons, and if the corresponding death rate of 18.9

(d) Tables of migration across significant boundaries

(e) Data regarding births and deaths.

The first four types of data throw light on the process of migration but do not lend themselves to identification of out-migrant areas. The fifth type of data, on the other hand, can be used to arrive at the net migration from an area by the residual method. The difference between the total number of births and deaths in a period in any area is a measure of the natural increase of population, while the difference between the population counts at the beginning and end of the period indicates the actual increase of population. The difference between the two, i.e. natural and actual increase is a measure of the net migration from the area. This technique has been used in the present study to identify the areas of out-migration in Maharashtra. The talukas of net out-migration in 1961-71 are those where

$$(P_2-P_1)<(B-D)$$

where

P_1 is the population of the taluka in 1961

P_2 is the population of the taluka in 1971

B is total births recorded in the taluka from 1961-71

D is total deaths recorded in the taluka from 1961-71

This technique is hence based on census data and vital statistics of births and deaths.[1] In advanced countries of the world, the registration of births and deaths is more reliable and complete than in the developing countries. In the case of India, there has been an improvement in the recording of such data after Independence and the post-Independence statistics pertaining to the registration of birth and deaths in India are thus fairly reliable (Chandna and Sidhu, 1980, p.14)

Results

Sixty eight of the two hundred and thirty two talukas in Maharashtra emerged as net out-migration talukas (Fig 1). These lie in three main areas ; one extends eastwards from Yeola (Nasik) to Melghat and Murtazapur (Akola) in the northern part of the state ; a second extends discontinuously from Junnar Pune to Akalkot (Sholapur) with an outlier extending from Koregaon (Satara) to Atpadi (Sangli) and a third lies in the southern part of Kolaba district and in Ratnagiri district to the south of Bombay.

In most talukas the extent of out-migration in absolute figures ranged from 5,000 to 10,000. A few talukas had a net out-migration in the range of 10,000 to 20,000 and only in two talukas of Sholapur North and Malkapur (Buldana) it was above 20,000 (Fig 2).

The amount of out-migration expressed as a percentage of the natural increase[2]

1 The data on births and deaths for each taluka were computed from the *Socio-Economic Review and District Statistical Abstracts* for each district for each year. The problem encountered in applying the technique was that in some cases taluka figures are not available for certain areas. In such cases, the taluka figures were computed on the basis of the district total for the year and the proportionate share of each taluka in the remaining years.

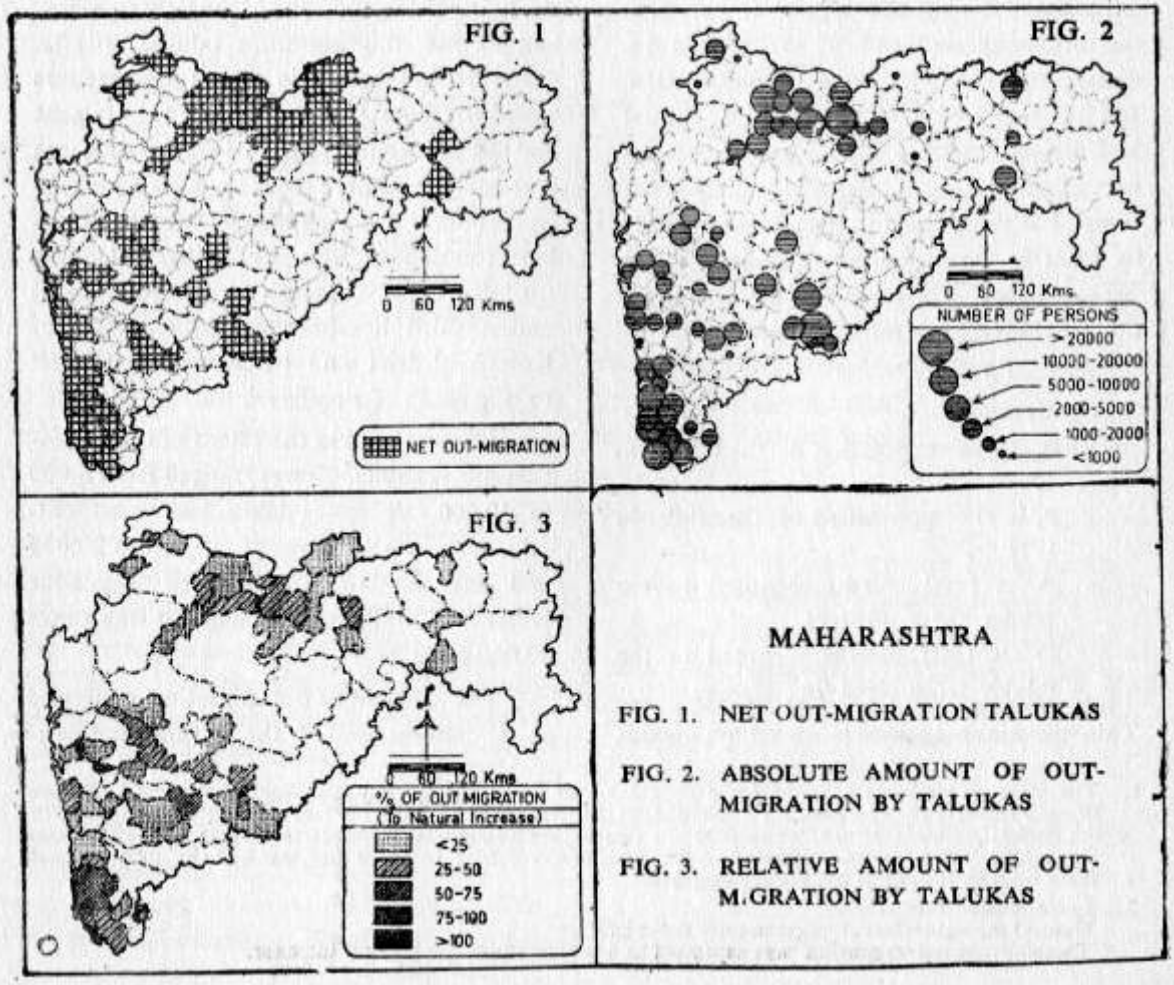
2 In net out-migrant talukas
Natural increase=actual increase+net out-migration
Therefore net out-migration was expressed as a percentage of the natural increase.

indicates its relative importance in different areas. In two talukas of Ratnagiri district i.e., Vengurla and Malwan the percentage of out-migration was over 100 percent. Inspite of excess of births over deaths, the talukas experienced a decline of population due to net out-migration. Out-migration was relatively important in Velhe (Pune) and in some of the Ratnagiri talukas where it ranged from 50-100 percent of the natural increase. In most of the other talukas the amount of out-migration ranged between 0-50 percent (Fig 3). In Sholapur North, though out-migration was large in absolute numbers, in relative terms it is only 32 percent.

Causes of out-migration :

An analysis of the characteristic features of the out-migration areas suggests that the following are some of the probable causes of out-migration.

(a) Constraints on development due to relief : Many of the out-migrant areas lie along the mountain belt of the Mahadeo range in the south-eastern part of Maha-



rashtra and the Gwaligad hills in the northern parts. For, example the talukas of Khanapur and Atpadi (Sangli), Khatau, Man and Koregaon (Satara), and Melghat (Akola).

(b) Susceptibility to drought : A comparison was made of the out-migrant areas with the drought-prone areas (Ministry of Irrigation and Power, 1972). Of the 68 talukas identified as out-migration areas, 28 talukas are drought-prone i.e., 40 percent. In these talukas there are differences in the frequency of drought. The average net out-migration from talukas having the same probability of drought was calculated (Table 1).

Table 1

Frequency of Drought and Average Percentage of Out-migration

Frequency of drought	Average percentage of net out-migration
1 in 4 years or greater	24.7
1 in 6 to 1 in 4 yrs	23.5
1 in 9 to 1 in 6 yrs	21.2
Less than 1 in 9 yrs	16.9

As the incidence of drought becomes more frequent, the extent of out-migration generally increases. Hence, susceptibility to drought appears to be one of the causes of out-migration.

(c) The changes in the occupational structure of the out-migrant talukas were studied to see if it would provide clues to other causes of out-migration. In the majority of the talukas, the total number of workers decreased during the period 1961 to 1971. Whether this was due to definitional changes or is an index of decrease in employment opportunities is difficult to establish. The decrease is particularly striking in the case of household industries as 40 of the 68 out-migrant talukas experienced a decline in this category. Closure of household industries due to competition from factory industry is a probable cause of unemployment and out-migration.

(d) Another cause for out-migration is the 'pull' effect of major metropolitan centres such as Bombay. This is more difficult to identify but it is an established fact that there has been extensive migration from South Konkan to Bombay. It is due to this that many of the talukas of Kolaba and Ratnagiri districts stand out as areas of major out-migration.

Conclusions

The application of the 'residual' method of measuring migration enabled the identification of 68 talukas as net out-migration areas. These talukas lie in 3 major belts, one extending eastwards from Yeola (Nasik), another south-east from Junnar (Pune) and a third lies to the south of Bombay. In absolute terms out-migration was greatest from Sholapur North and Malkapur and relatively it was most significant in Vengurla and Malwan. The study indicates that out-migration from these areas is due to a complex interaction of many factors, such as constraints of relief, susceptibility to drought, decrease in employment opportunities and the pull effect of major metropolitan centres, such as Bombay.

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HISTORICAL DISTRIBUTION AND GROWTH OF POPULATION IN THE GANGA-YAMUNA DOAB PRIOR TO TWENTIETH CENTURY

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In this paper an attempt is made to trace out the history of the habitation and to determine the size of the population prior to twentieth century in the Ganga-Yamuna Doab region of Uttar Pradesh taking into consideration various archaeological excavations, physical aspects, mythological narrations and related place names and historical records of the region.

Various archaeological and historical records suggest that the Doab is a very old settled part of India. It seems that the region forming the present day Meerut district is the earliest settled part of the Doab and was inhabited by non-Aryan peoples even before the Aryans settled here

The Aryans also first inhabited the northern part of the Doab, mainly in areas close to the river Ganga and the river Yamuna. Later on, as their population grew, both because of natural increase and Aryanising the native peoples, the Aryans started inhabiting southern and southeastern parts of the Doab along the river courses. However, the process of thickening of the population in the region was not smooth and continuous. Perhaps, the population of the Doab ranged between 6 to 8 million during most of the historical time after the Aryan settled over here.

Historical distribution and growth of population in any area is very important as in most of the cases the pattern of present spatial distribution of population results from the past trends in its growth and distribution. The age of peopling of area provides significant clues to unfold the present as well as the future population trends of the area concerned. The Ganga-Yamuna Doab, lying on the western section of the Great Plains of India and at the western extremity of Uttar-Pradesh, is one of the oldest settled part of India. Culturally as well as politically also the region has been the most important part of the northern India and anciently held a unique position in the march of Indian history even before the Kuru-Panchalas days. The present paper aims to determine the habitable area and the size of the population in the Doab in pre-historical and historical times, i.e. before the current century.

The historical distribution of population prior to earliest available statistics may be outlined by a variety of indirect devices. If we could know the early physical environment and the stage of technological development of an area then we may be able to reconstruct the historical as well as the pre-histori-

cal spatial pattern of the population, at least in outline. Various archaeological and written records may also yield some approximation of the patterns and trends. The main sources for the present study are the physical aspects of the region, the ancient sites, the archaeological evidences, place names, travellers' accounts, statistical material of the 18th and 19th centuries, the survey maps and the remarks by settlement officers given at the end of the settlement report of each village, district gazetteers and information collected during personal field visits.

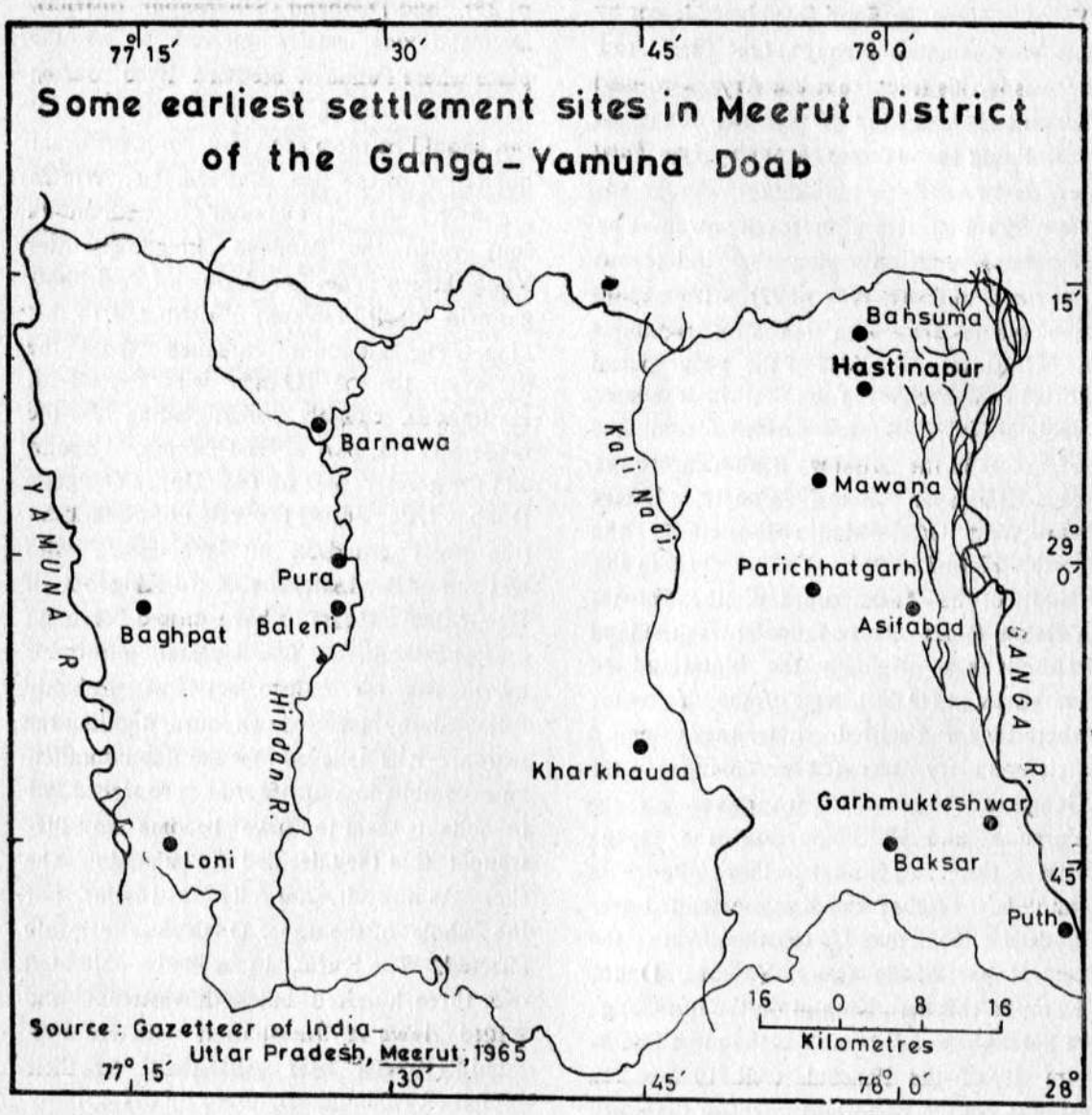
The present map of the distribution of population in the Doab reveals that except the Siwalik mountainous area in the northern most part and some ravine and *usar* tracts, practially whole of the Doab was under active human habitation in 1971. Easiness of terrain, good climatic conditions and rich and fertile alluvial soils resulted in a very early habitation of the Doab. But certainly, the population distribution would have remained sparse during most of the historical time and increasing concentration could be started only after the establishment of British rule in this region.

Various archaeological excavations and historical records suggest that some parts of this region were habited even before Aryans settled here. Archaeological excavations (1950-52) of the Mound Ulta Khera or Vidura Ka Tila at Hastinapur suggests that the land adjoining the western bank of the river Ganga was inhabited by native peoples even before Aryans reached here some 4000 years ago (Lal, 1954-55). This archaeological evidence could further be supported by the fact that a number of places in Meerut district like Meerut, Jharkhand near the village of Asifabad in pargana Kithore of Tehsil Mawana, Loni and Parichhatgarh are associated by tradition with non-Aryan and probably pre-Aryan peoples like Rakshasas, Asuras and Nagas. Even in the hills and submontane tracts of the Ganges valley the existence of a pre-Aryan or non-Aryan population is suggested (Chatterji, 1964, pp. 331-347). From the early physical history of the region it is clear that the land in between the Ganga and the Yamuna rivers was covered with thick forests before the Aryans settled here and this pre-Aryan population, mainly hunter and gatherer by nature, might have lived in the northern part of the Doab, mainly confining to forested areas of Saharanpur, Muzaffarnagar and Meerut districts. The land now forming Meerut district seems to be the earliest settled part of the Doab and most of the area of the Doab, south of Meerut district, might have remained uninhabited before the Aryans settled there.

Many evidences suggest that Aryans also while entering Madhyadesh (the heart of the Indian sub-continent) first established themselves in different parts of district Meerut which became the home or the first stronghold of Vedic culture. The evidences of early Aryan settlers are found in a number of ancient sites of this district (Map 1). Important among these include Alamgir Buzurg, Baghpat, Baleni, Pura, Bisarakh, Barnawa and Muzaffarpur Saini (Lal, 1954-55), all located in its western part and Bharatas, one of the most important of the Rigvedic tribes, were the earliest Aryan people to be associated with this region (Tripathi, 1960, p. 29). As these Aryans brought with them the art of cultivation they established their first colonies east of the

Yamuna along the flood free river levees by purifying country through *Agni* (fire) and it was in this tract that the Aryans evolved fire cult as a weapon of clearing the forest or draining the marshes through *Agni Bana* (fire arrow). The population of the Aryans grew, both by natural increase as well as by aryanising and absorbing the indigenous peoples (Panikkar, 1959 p. 99). The expansive colonies grew into Janpadas, republics or Kingdoms. An idea of the geographical horizon of the Aryan habitat in the later Vedic period can be formed from the references in the Aitareya Brahmana to the trans-Himalayan States, namely, Uttar-Kuru and Uttara-Madra located in the north, Kuru-Panchals, Yashas etc., in the middle of the Aryandom, i. e., the Ganga-Yamuna Doab. Kuru Janpada was the land of the Kurus, originally the hinterland of Indraprastha (Delhi), west of the Yamuna, where they first settled. Later they extended their boundary across the Yamuna to the Ganga in the east. Indraprastha on the Yamuna and Hastinapur on the Ganga were the two capital cities. Panchala Janpada, rival of the Kuru, extended over modern Rohilkhand, together with the central part of the Ganga-Yamuna Doab. Kampila (Modern Kampil on the old Ganga in Farrukhabad district) was the most important city of the Panchala (Ali, 1966 p. 34). Almost all the important towns of the north India were in this region. Sursena dynasty had its suzerainty in Mathura. It was the land of Lord Krishna who was honoured equally by the Kuru and the Panchals. Mahaban was also populated. The other places mentioned were Varanavala (Barnawa in tahsil Sardhana), in which Kauravs built a house of lac to burn Pandavas (Dey, 1927, p. 25), and Deoband (Saharanpur district). Deoband was usually referred to as the place where Pandava brethern lived during their exile (Nevill, 1921, p. 177). Obviously this should be the place away from the usual habitation of the people. Parikshit (Arjun's grandson and Abhimanyu's posthumous son) ruled the Pandava kingdom after Yudhishthira. The foundation of Parichhatgarh (in tahsil Mawana) is attributed to this king. The kingdom extended from the Sarasvati to the Ganga with capital at Hastinapur, [roughly corresponding to the modern Delhi, part of East Punjab, Haryana and the greater part of the Upper Gangetic Doab. Later during the reign of Nichakshu (the great grandson of Janamejaya, who was son of Parikshit) the Kuru Kingdom of Hastinapur appears to have passed through several calamities. The devastation of crops by locusts (or hailstorms) was probably followed by heavy downpours, flooding the region. It is believed that the flood entailed an enormous loss of life and property and inhabitants seem to have become so distraught that they decided to abandon the site. As a result, not only Hastinapur but the whole of the upper Doab was seriously affected. The Kurus in a body migrated over three hundred miles downstream and settled down in Vatsabhumi with Kaushambhi (Kosam near Allahabad) as their capital (Raychaudhuri, 1950, pp. 43-45).

Thus we see that habitable area of the Doab during epic period was confined mainly to the Upper Doab and on the banks of the two great rivers. All the above mentioned places were either on the mainstreams of the Ganga or Yamuna or on the banks of their tributaries. The region away from the rivers was mostly uninhabited and


77° 15′
30′
45′
78° 0′
Some earliest settlement sites in Meerut District of the Ganga-Yamuna Doab
Bahsuma
Hastinapur
Barnawa
Kali Nadi
Mawana
15′
29° 0′
YAMUNA R.
Pura
Parichhatgarh
Baghpat
Baleni
Asifabad
GANGA R.
Hindon R.
Kharkhauda
Garhmukteshwar
Loni
Baksar
45′
Puth
16 0 8 16
Kilometres
Source: Gazetteer of India- Uttar Pradesh, Meerut, 1965
77° 15′
30′
45′
78° 0′
28°

forested. The cities were very large and populous. The city of Hastinapur was evidently at the height of its glory and has been described as a storehouse of wonders. It extended for miles (twenty one miles or forty eight *yojanas*) along the western bank of the Ganga and had its different *muhallas* (localities) in what are now Bahsuma, Mawana, Baksar, Parichhatgarh and Garhmukteswar. The village of Saini (Muzaffarnagar Saini) marked the site of its Senadwara (military gate); in Puth was located the pleasure garden of its princess, the cattle were housed in Gauhra, the elephant stable in Gajapura and the horse stable in Kharkhauda; Makhanpur was the royal dairy; and Barnawas was an outlying fortress and Meerut a suburb (Jain, 1955, pp. 1-2).

During sixth century B.C., the region was greatly influenced by Buddhism and Jainism and at this time like rest of the country, the Doab was divided into a number of petty states, the size of which could have hardly exceeded that of a modern district. The important states of the Doab of that time were Vaisa or Vamsa, Kuru, Sursena and the Panchal, with their capitals at Kausambhi, Hastinapur, Mathura and Kampilya respectively. Hastinapur again regained its glory and figured as one of the ten capital cities of ancient India. About the middle of the fourth century B.C., the region was under Nandas and afterwards under Chandra Gupta Maurya (circa 324 B.C.). It was towards the end of his reign or the beginning of that of his successor Bindusara that practically the whole of the city of Hastinapur was burnt down in a widespread conflagration (Lal, 1954-55).Thus at the time of emperor Asoka (circa 273-236 B.C.). Hastinapur was no more in existence, its place having been taken probably by Meerut. Asoka Pillars and edicts have been found at Allahabad, Meerut and later removed to Delhi, Kausambhi and Sankisa. Probably to the same period may be assigned the buried town discovered in 1834 at Behat (Saharanpur) by Captain Cautley (Atkinson, 1876, p.91). All this suggests that by this time the habitable area of the Doab increased upto the submontane tract of the Saharanpur district. About the beginning of the second century B.C. Hastinapur peopled once again and it remained inhabited till about the close of the third century A.D. (Lal, 1954-55).

From this time onward the whole of the Gangetic Doab formed part of the Gupta Empire till the beginning of the sixth century A.D. and was called the Antarvedi Vishaya (province) which in 466 A.D. was being ruled by the Vishayapati (provincial governor) Sharvanage (a Naga chief), probably directly under emperor Skand Gupta (Raychaudhuri, 1950). Kannauj is mentioned, for the first time, in the Ramayana and the Mahabhashya of Pantanjali under its Sanskrit name of Kanyakubja. Upto this time Kampil became to dwindle into insignificance and Kannauj gradually took its place as the chief city of Panchala. For some time, however, Sankisa on the western border of the Farrukhabad district, seemed to have at least rivalled Kannauj in importance. Kannauj, along with many other parts of the present day Farrukhabad district, perhaps came under Gupta Empire at the time of Skanda Gupta (circa 326-336). When Chinese pilgrim Fa-Hian visited Kannauj between 399 and 414 A.D. during the reign of Chandra Gupta II, it was evidently of small size and importance, containing only two Buddhist monasteries and no building

worth mentioning. On the contrary Fi-Hian has devoted many pages of description to Sankisa and remarked about its neighourhood as a very productive country with very prosperous and exceedingly rich people beyond comparison.

During the sixth century A.D., the region seems to have been under the domination of Maukharies of Kannauj. Kannauj city was at the pinnacle of grandeur and glory and became the imperial capital of Uttarprathas (northern India) during the reign of Maukhary king Harshavardhan. (Cunningham, 1872, p. 3J6). The Chinese pilgrim Hwen-Thsang visited India during Harsha period. The period of Hwen Thsang's travels extended from A.D. 629 to 645. At that period the Ganga-Yamuna Doab formed a part of the central India. The region extending from Sutlej to the head of the Gangetic Delta and from the Himalayan mountains to Narmada and Mahanadi rivers was called central India. Of the thirty seven separate states of central India, seven were completely in the Doab and some others like Thaneshwara (which extended from Hari Ki Patan on the Sutlej to Muzaffarnagar near the Ganga in the north to near Pak Patan on Sutlej to Anupshahr on the Ganga in the south) lso comprised of some parts of the Doab (Cunningham, 1872). These states possessed some of the most populous and most flourished cities of that time, such as Srughna (Sugh 3½ miles in circuit, Mayapura or Hardwar, about which Hwen Thsang has described that the town was about 20 li or 3½ miles in circuit, Kannauj 20 li or 3½ miles in length and 4 or 5 li or 3/4 of a mile in breadth, Ayuto (Kakupura), Prayaga (Allahabad) and Kausambhi etc. Other important places, mostly in the present day districts of Meerut, Bulandshahr, Aligarh, Agra and Mathura were settled and developed by Tomars, Dors, Jats, Ahirs and Chauhan chieftains between seventh to tenth centuries A.D. Later period saw political chaos and confusion in this region, accentuated by the Muslim invasions, though the rural polity and social organizations were being co-ordinated by local Rajput, Jat and other clan chiefs and the country was in prosperous condition. In A.D. 1016, Mahmud of Ghazni saw Kannauj, "a city which raised its head to the skies, and which in strength and structure might justly boast to have no equals" (Cunningham 1963, p. 317). During his campaign Mahmud (1018 A.D.) followed the route along the foot of the hills and during his campaign the sub-montane area of the Doab fell out of cultivation and reverted almost to forest which resulted into a very little development of this region in the later period also. As the Doab region was in the route of Muslim marchland, it tasted the bitterness of all the successive Muslim invasions. Shamusuddin Altamash subjugated all the territory upto the Siwaliks in 1217. In 1331-32, Sultan Muhammad bin Tughluq levied heavy taxes in the Doab and treated the whole area as a hostile country. The Rajputs (people) were unable to meet the demand and abandoned their holdings Their life and property were no more safe and they fled to jungles where they were hunted like wild beasts. The severe famine which followed, lasting for seven years greatly worsened the condition of this region (Joshi, 1965, p. 35). Again during 1397-98, Timur robbed destroyed and ravaged this region. Loni, Meerut and Hardwar had a taste of Timur's ruthless savagery. The condition of the people was worsened by famine and pestilenec

which followed (Joshi, 1965, p. 3). During fifteenth century the Doab was shared between several Hindu and Muslim chieftains. However, during the reign of Akbar the economic and political life of the region became much more stable and better. Moorland (1920), while discussing the economic conditions of the region at the death of Akbar, wrote that in Bengal, Gujarat and the Upper Gangetic plain, the bulk of country was under regular cultivation, and the jungles, though more extensive than now, were not the principal feature of the landscape. He further mentioned that the cultivated area in settled country between the Yamuna and a line joining Bareilly and Agra was about three-fourths of the present standard, the proportion being more than eight-tenths in the tract between the Ganga and the Yamuna known as the Doab. The Doab may be described as fully occupied but the Doab from Agra eastwards experienced a rapid decline in cultivation (Moorland, 1920). If we take the area under crops as rough index to the number of rural population, we reach to the conclusion that the Doab was almost as full of people in Akbar's time as it is today, and consequently was very densely populated. For Delhi Sultanate and the Moghuls, the Doab was the "heartland" ; the granary and the economic hinge of the empire. Akbar shifted his capital from Delhi to Agra not only to control the Malwa passage-way but also the Doab and the southern zone more tightly. The rulers tried to improve the agriculture and the economy in this part and the towns were not only centres of grain trade but also of handicrafts and other products. The local aspirants of power, however were never calm and with falling days of the Moguls, the Jats in the upper and middle Doab and Marathas in the lower Doab tried to control this area (Singh, 1971, p.129). Meanwhile, the British power was progressively marching from the east and in 1803 practically whole Doab came under British rule. In the early days of its rule, the East India Company did not take much interest in this region except keeping peace and order. But later the British Government realised the strategic value of this region and accordingly tried to develop the region economically. The increased transportation and irrigation facilities led to rapid agricultural development. This resulted in the rise and revival of cities, and the rapid progress of Kanpur from a small trade depot to a large industrial giant is an example of this. The country between Hardwar and Najibabad, which was under woods and marshes, was reclaimed for cultivation.

Thus we see that a large part of the region between the Ganga and the Yamuna remained inhabited during most of the historical times but due to natural calamities like flood or famine and a continuous struggle for power among clans, the possibility of being reverted into jungle of a great part of the region is also not uncommon and thus it can be said that periods of sparse and thick population concentration occured intermittently.

Growth of Population in the Past

No direct statement can be made about the size of population of the Ganga-Yamuna Doab prior to the census counting in 1847 but the history of the occupance of the region as presented above may be utilized to determine the population size of this region in the past. The first census for most of the districts of Uttar Pradesh, formerly

known as the United Provinces of Agra and Oudh, was conducted in 1847 and at that time 7,834,625 persons were recorded in the Doab. Between 1847 and 1881 (later was the first in the decennial series similar on the lines of present day census recording of population) three censuses were taken in 1853, 1865 and 1872 in United provinces of Agra and Oudh. But the machinery was extremely defective and no reliance can be put on the figures. Inspite of the defective enumeration system, one thing is clear that the population between 1847 and 1881 increased gradually and in 1881 the population of the Doab was 11,180,986 persons. The total increase during 34 years was of 3,346,358 souls or 42.3 percent. But keeping in view the political disturbances of 1857 and famine of 1877, the population of 1847 seems to be under-enumerated. At the time of next census, i.e. in 1891 the population of the Doab increased by 131,744 persons or 1.1 per cent over that of the previous census raising total population of the Doab to 11,312,730 persons. The next decade was the period of astonishing growth in this region inspite of the fact that the state of Uttar Pradesh suffered from a succession of calamities between 1891-1900. The malaria endemic due to abnormal heavy rain of 1894 and severe famine in 1896-97 due to deficient rainfall resulted into a very high death rate (42.1 per cent) and low birth rate (34.7 per cent) in Uttar Pradesh but the suffering was the greatest in the hills and plateau divisions, central plain and Jaunpur. Only south-western portions of trans-Yamuna tahsils of Agra and Mathura districts in the west plain were effected, and rest of the Doab remained virtually free from these calamities (Census, of India, 1911) and the population of this region rose to 12,492,990 in 1901 or by 10.4 percent during 1891-1901. The growth of population in this region was much faster than in the Uttar Pradesh as a whole.

The population of this region increased at a rate of 7.2 per mille per annum between 1872-1900. During the same period the growth rate for U. P. as a whole was only 3.1 per mille per annum. However, it is interesting to note that the share of the population of this region in country's total population did not change over different periods of time. The Doab consisted of nearly 4.9 percent of the country's total population in 1901 and in 1971 proportion was nearly the same (4.5 percent).

Perhaps the proportion remained the same or even more. This assumption is based on the fact that many parts of India which were populated heavily in 1971, were either very sparsely populated or not populated at all during most of the pre-historical and historical period. Evidences suggest that in the early Vedic period the natural increase of population might have taken place due to the eastward migration of the Aryans which resulted in the gradual clearance of the forests and grasslands for agriculture (Saxena, 1962, p. 152). Gradually as the art of agriculture developed, an increase in Aryan population also followed. The population of this region increased at a high rate as the Aryans shifted towards east.

The existence of almost all important towns of North India in this region in post Rigvedic period also suggest the existence of a large population in this region. The Buddhistic literature indicates that the economy of north India between the seventh and fourth centuries B. C. was comparable to that of later middle ages in Europe. Approximately

20 cities existed in northern India at that time and a city generally possessed from 30 to 1,000 families. This impression of dense population was confirmed by Alexander's army which invaded India in 327-26 B. C. One small kingdom was said to have 37 towns of over 5,000 inhabitants (Cunningham, 1922, p. 369). Later India's first real empire under the sway of Chandra Gupta (Circa 321-297 B.C.) left records indicating army of approximately 700,000 men, the maintenance of which must have required a substantial population. The population of ancient India around 300 B. C. has been estimated between 100 and 140 million (Nath, 1929). Evidently when seen in the light of the fact that the Doab was the heartland of the Aryan civilization and possessed many important cities, the population of the Doab around that period might have been more than 7 million.

The travel accounts of several Chinese pilgrims in the fifth, sixth and seventh centuries of the Christian era may prove very helpful in estimating the population of the Doab during that period. As already stated, the travel accounts of Hwen Thsang has suggested the presence of the most flourishing cities of India in the Doab indicating its being very thickly populated in sixth, seventh and eighth centuries A. D.

It seems that the population of the Doab might always have remained in a progressive stage with some local exceptions until the Mohammadan invaders came to this land, though the rate of increase when judged from modern standard, might be very slow. Nath (1929), who has examined later as well as earlier documents, believed that the population of the country as a whole did not greatly vary between the early Hindu period and the first advent of the Mohammadans, and it may be supposed to have been roughly between 100 to 140 million. The Ganga-Yamuna Doab served as a forefront, checking Mohammdan invaders from the west and petty kingdoms from southwest and south who continuously tried to possess this heartland of the Aryan civilization. Thus, the region remained a field of bloody wars and disturbances during Mohammadan period and seems that there were short run periods of population growth and decline with virtual fixity of numbers in the long run. How slowly the population grew is clear from the careful estimate of the numbers in 1600 made by Moorland (1920, p. 7), who gave India 100 million. The estimate of Davis is slightly higher (125 million) than that of Moorland. According to him (1951, p. 24) Middle Ganga and the Punjab plains had close to 40 million. In any case, independently of the precise accuracy of the estimate, it seems clear that the number of the people was virtually stationary and the population of the Doab remained between 6 to 8 million during most of the historical period.

Summary and Conclusions

The above analysis of the distribution and growth of population in the Ganga-Yamuna Doab prior to twentieth century suggests that the Ganga-Yamuna Doab is very anciently settled part of India and even before the Aryans it was populated by native peoples. The various archaeological excavations in different parts of this region have proved the existence of the copper age civilization very similar to the copper age civilization of the Indus valley.

Different parts of the present day Meerut districts may be considered the earliest occupied places by human population. The excellent physical conditions of the region provided the foundation on which later established and flourished the Aryan civilization and afterwards each successive stream of migrants was attracted to this region making it sufficiently thickly populated and when the first census was conducted in this region the population turned out to be 7,834,628 persons in 1847 and hence forth it grew much faster upto the close of the nineteenth cenutry than that in the United Provinces of Agra and Oudh of which it was a part. The population of the Doab might have remained between 6 to 8 million during most of period after the Aryans migrated to the region.

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