

STRUCTURE OF URBAN SETTLEMENTS IN NORTHERN UPPER GANGA PLAIN

*Dissertation submitted to the Jawaharlal Nehru University
in partial fulfillment of the requirements
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DEEPA AHLUWALIA



CENTRE FOR THE STUDY OF REGIONAL DEVELOPMENT
SCHOOL OF SOCIAL SCIENCES
JAWAHARLAL NEHRU UNIVERSITY
NEW DELHI-110067

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जवाहरलाल नेहरू विश्वविद्यालय
JAWAHARLAL NEHRU UNIVERSITY

NEW DELHI - 110 067

CENTRE FOR THE STUDY OF REGIONAL DEVELOPMENT
SCHOOL OF SOCIAL SCIENCES.

CERTIFICATE

This is to certify that the dissertation entitled **STRUCTURE OF URBAN SETTLEMENTS IN NORTHERN UPPER GANGA PLAIN**, submitted by Ms. Deepa Ahluwalia in partial fulfillment of the requirements for the award of Degree of **Master of Philosophy**, of this university is her original work and has not been previously submitted for any degree of this and any other University.

We recommend that this dissertation be placed before the examiners for evaluation.

Prof. Harjit Singh
CHAIRPERSON

Chairperson
Centre for the Study of Reg. Dev.
School of Social Sciences,
Jawaharlal Nehru University,
New Delhi-110 067

Prof. Sudesh Nangia
SUPERVISOR

DEDICATED TO

MUMMY & PAPA

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(Deepti Ahluwalia)

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CHAPTER I

INTRODUCTION

Urbanisation refers to the proportion of population resident in the urban places particularly the proportion of population engaged in the secondary and tertiary sectors of economy in urban places. Demographically, it has been described as an increase in the proportion of urban population to the total population over a period of time. India has a long history of urbanisation, but rapid urbanisation is only a recent phenomena. Similar, is the case of Uttar Pradesh, its urban growth dates back to Indus Valley Civilization (2500 - 1750 B.C), one of the oldest urban civilization, which had its extension upto the area presently falling in this state. But in spite of such a prolonged history of urbanisation U.P could not perform well to increase its share of urban population to the total. In 1971, it had hardly 14.02 per cent of urban population which however increased to 19.84 per cent in 1991.

In the present study, we have taken northern Upper Ganga plain for studying and analysing the process of urbanisation since 1971. We have tried to make a thorough analysis of the pattern and process of urban growth, its spatial dimensions; the rank size relationship and the functional character of the urban centres have also been examined and finally we have worked out the hierarchical structure of the urban centers on the basis of availability of infrastructural facilities in these towns. Thus, in the following study we have tried to fully understand the structure of urban settlements in the Northern Upper Ganga plain.

In order to gauge the growth of urban centers, it is desirable to know some of the salient geographical features of the region. Hence, we have attempted to outline the physiography, soil, drainage, climate, natural vegetation, and transport network of the study area.

Uttar Pradesh extends from 23° 52' N and 31° 28' N latitude to 77° 4' E and 84° 39' E longitude, respectively. The state is bound by Tibet (China) and Nepal in north, Madhya Pradesh in the south, Bihar in the east and Rajasthan, Haryana, Himachal

Pradesh and Delhi in the west. The total area of the state is 294,411 sq. kms with population of about 139.11 million. Out of this total area, 5603 sq. km is urban with 19.84 per cent of the total population (Fig. 1.1)

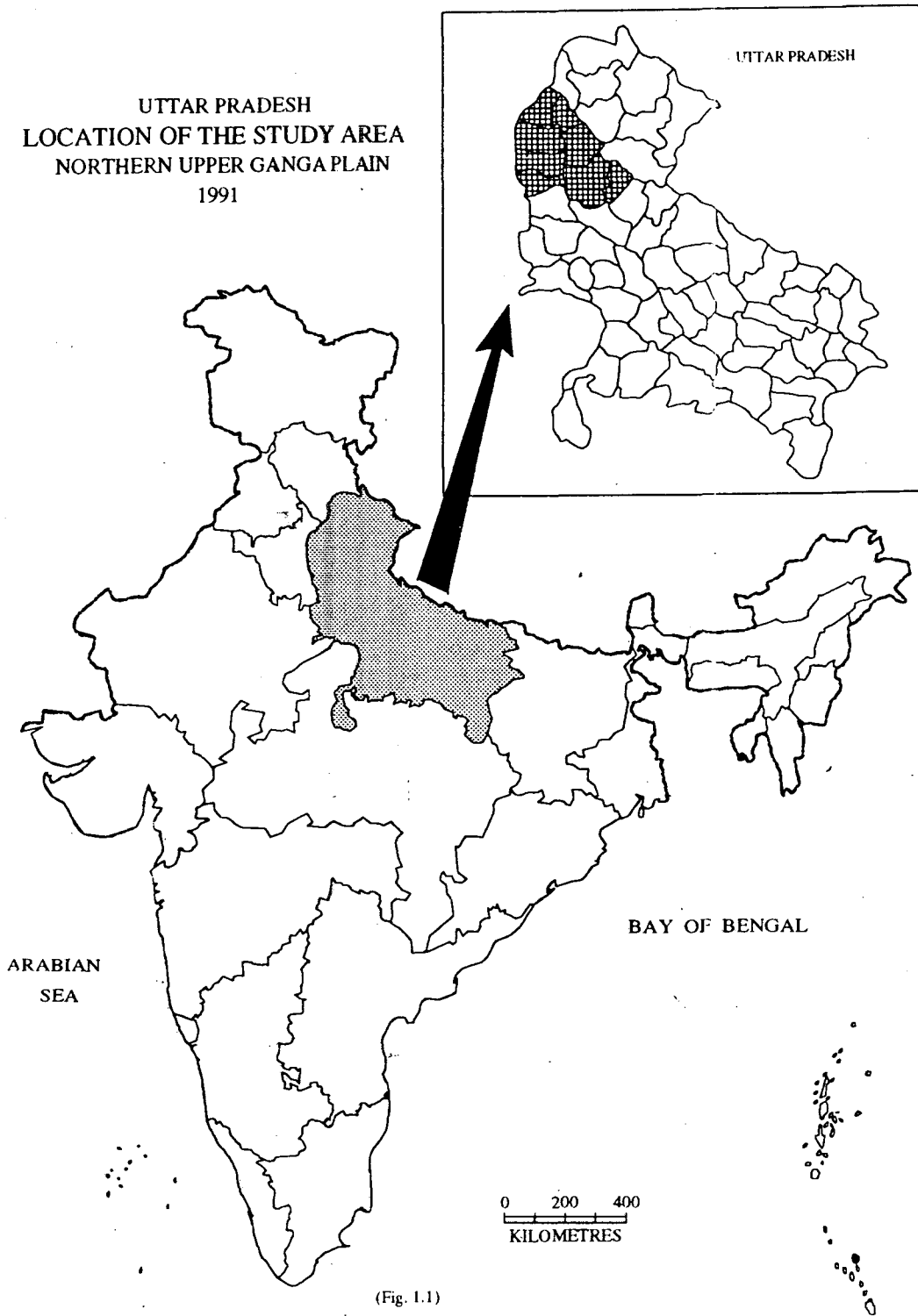
In terms of population, UP ranks first (16.44%) while, it is at fourth (8.18%) place in terms of area among all the states and urban territories of the country. It is the most populous state with manifold geographical, social, economic characteristics. The main physiographic characteristics of the state are high mountains, valleys, flat and fertile Plain and dissected plateaus which can be further divided into four meso regions:

- (1) Uttar Pradesh Himalayas
- (2) Upper Ganga Plain
- (3) Middle Ganga plain
- (4) Uttar Pradesh uplands.

Of the four macro regions, the Ganga Plain (the area of present study) is situated like a trough between Himalayas in the north and uplands in the south. Three-fourth of the total area of the state comes under this region. The region slopes from northwest to southeast, with an average gradient of one metre for five kilometres. There is a narrow strip, immediately after the foothills known as *Bhabar*. It is mostly covered with forests. In this tract the torrents rush down from the steep slopes and disappear under the boulders and gravels except in the rainy season. Below the Bhabar tract and parallel to it, '*Tarai*' is situated. It is marshy and damp tract covered with tall grasses and forests. But these forests are becoming sparser. The 150 metres contour divides this plain approximately into two equal halves. The northern part is known as the Upper Ganga Plain and the southern part as the Middle Ganga Plain. In general the soil is alluvial but variations are noticed in the highland and low land areas. This belt is fertile and densely populated. The Upper Ganga Plain is further subdivided into Northern Upper Ganga Plain and Southern Upper Ganga Plain.

The Northern Upper Ganga Plain is chosen as the area for the following study. It covers eight districts of western U.P, namely, Bijnor, Moradabad, Rampur,

UTTAR PRADESH
LOCATION OF THE STUDY AREA
NORTHERN UPPER GANGA PLAIN
1991



(Fig. 1.1)

Saharanpur, Hardwar, Muzaffarnagar, Meerut and Ghaziabad. The Northern Upper Ganga Plain extends from 28° 30' N to 30° 30' N latitude and 77° 4' E to 79° 10' E longitude covering an area of approximately 29,453 sq. kms. Himachal Pradesh, Dehradun and Garhwal districts form its northern boundary while, the districts of Bulandshar, Budaun and Barielly form its southern boundary. State of Haryana and Delhi form its western border while Garhwal and Nanital lies to its east (FIG.1.2)

1.1 (i) PHYSIOGRAPHY

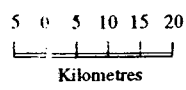
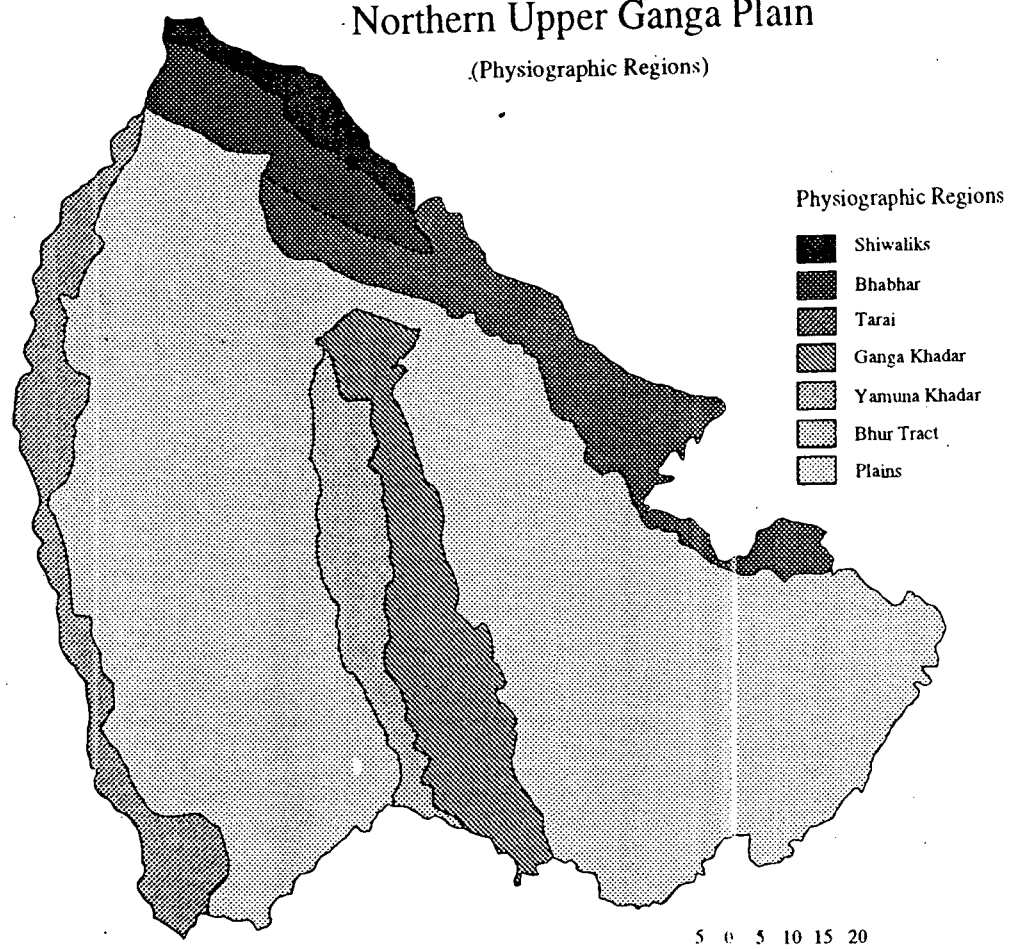
The area is characterised partly with characteristics of Shiwaliks, Bhabar, Tarai, Khadar and the Plain in the specific zones of the district. In general, vast area of the region is almost a level alluvial plain with a slope from north to south or south east, with reference to the alignment of the major rivers and tributaries joining them. The physiography of northern Upper Ganga Plain can be subdivided as Shiwalik, Tarai, Bhabar, Yamuna Khadar, Ganga Khadar, Plain and the Bhur tract which needs further description :

i. Shiwaliks: "The range mostly wooded and uninhabited consists of relatively loose rocks (sandstone, sandrock, clay and conglomerate) which supply ample debries to the Bhabar zone."¹ The hilly tract of Shiwalik ranges along the northern border of Saharanpur, stretching from west to east direction having a breadth of 10-16 kilometres.

It has an area of about 134 sq. kms (approx.). The whole range is forested. The 500 mts. contour delimits its southern boundary. There are some peaks having altitude of about 872 mts. in this region. Shiwaliks is a latitudinal hill sloping both towards north and south directions. The southern slope is steep while the north is gentle. The region is composed of upper Shiwalik and lower Shiwalik of Plio-pleistocene and Miocene periods. The soil sub-order associations found in the region are Udalfs, Ochrept, Ochrept Udalfs. The region is drained by a number of rivulets. These rivulets cut deep valleys and remain dry in most part of the year. The area is covered

¹ Ahmad, A(1979) "Social and Geographical aspects of human settlements, classical Publication, New Delhi.

Uttar Pradesh
Northern Upper Ganga Plain
(Physiographic Regions)



Source : Regional Divisions of India - A Cartographic Analysis
Series 1, Vol. 22 (UP)

(FIG.1.2)

with thick reserved forests. Except few forest villages it is completely devoid of settlements.

ii. Tarai: Tarai area lies below the Bhabar in eastern part and extends towards south east. It occupies an area of approximately 2981sq.kms. It include parts of Roorkee tehsil, Nazibabad, Nagina, Dhampur tehsils partly and small portions of Thakurdwara and Moradabad tehsils. It also extends in east-west direction in tehsils of Suar and Bilaspur.

The area is infested by wide streams which are also known as *chos*. These streams have characteristics of changing their course. The region is flat with undulating surface. Near the Ganga river the streams or chos disappear. The slope runs from northwest to southeast direction. All streams are torrential having wide beds. Solani, Ralmau Rao and their tributaries flow generally parallel to each other in Saharanpur and join beyond the region. In Bijnor, the main tributaries draining this belt are Pili Rawasan , Kotwali Rao, Ratnal,SukhRao,Nakta, Ramganga, etc. Various streams also originate from Nanital hill to drain the Tarai region in Moradabad district.

Rainfall in this region decreases from north to south . The width of the belt ranges from 10-20 kms (maximum being in eastern part of Bijnor district) Being closest to the Himalayas , the effect of the mountain region is considerably marked on it .

The region is composed of recent alluvium and has Tarai soils. There is a patch of Pathri reserve forest near Ganga river. The Southern part of Ganga is served by a good transport network than its northern counterpart. Upper Ganga canal passes through this belt. Due to topographical limitations the area is difficult to traverse from east to west direction, but parallel to streams a number of roads serve the region. The settlements near the Ganga river are sparse whereas their intra-distance decreases away from the river due to physiography. There were two urban settlements in Tarai namely, Afzalgarh and Thakurdwara. While in 1991, the number increased to six. The four new urban centres added are Laksar, Barahpur, Maswasi and Sherkot.

ii. Bhabar: It lies immediately below the Shiwaliks in the Saharanpur district, intersected by the numerous torrents that drain rainy water into the Ganga - Yamuna rivers and their tributaries. This sub-montane belt, once forested, stands almost denuded with the great extension of tillage. The eastern Bhabar consists of a series of high broken spurs. In the west however, the surface is tolerably even. The 300 mts. contour marks the southern limits of the region. The rivulets coming from Shiwaliks disappear in this region. These streams deposit unsorted sediments and boulders, shingles from the Shiwaliks and form fans and talus. These torrents accelerate soil erosion and render the land unfit for agricultural purposes by depositing coarser materials. Streams are notable for changing their courses and thus do not have well defined banks.

There are system of small elevations known as Chandi hills which are smaller to Shiwalik rocks. The region is composed of recent alluvium. The soils of the region are mostly coarse loamy to sandy . The roads run parallel to the streams. The settlements are scattered and shun from streams. The holy city, Hardwar lies in this region. It is a nodal centre as it links hills with the Plain.

iv. Khadar: Khadar can be further subdivided into Yamuna Khadar and Ganga Khadar.

(a) Yamuna Khadar is a strip running in almost north-south direction in the western part all along river Yamuna . It has an area of about 1541 sq. kms., extending from Saharanpur covering parts of Nakur and Saharanpur tehsils, part of Kairana and Budhana tehsil, Baghpat tehsil, portion of Ghaziabad and Dadri tehsils. It is mostly flat surface with monotonous topography. This region is demarcated on the basis of the extent of Yamuna flood waters and thus has varying width. There is a great impact of river Yamuna on topographical features of the region. The general slope of the region is towards south. It is composed of recent alluvium and has alluvium, soils with sandy loamy texture, which are fertile.

In the southern part Hindan is the main stream which makes its eastern boundary. Katha nala is the main stream in the region originating from a local depression in Saharanpur district, which joins the Yamuna river in the north of Kairana. This is a non-perennial stream. The southern part of the plain is flood affected because of the meeting of Hindan with Yamuna. Bhurs are wide spread in the north. The main topographical features are ox-bow lakes, small depressions, dead arms of the river, meander and Bhur. Population density is more than the Khadar region but lower than other regions. Rural density is low as compared to other regions and there are only six urban centers due to Khadar, agriculture is the main occupation. Transport network is sparse and roads are few, which run in north-south direction due to Yamuna river.

(b) Ganga Khadar: This region extends in north-south direction for about 70 kms., parallel to river Ganga in an elongated shape. It is wider in extreme north, shrinks in the middle and becomes wide again in the southern part. It has an area of about 1970 sq. kms covering the parts of eastern fringe of Muzaffarnagar, Jansath, Mawana and Hapur tehsil and western fringe of Bijnor district and Hasanpur tehsil of district Moradabad.

Old channels and shallow depressions are the main physiographic features of the region. Other features are old abandoned course of main stream, dead arms, oxbow-lakes, sandbars, bluffs, sporadic sand-dunes etc.

There are a number of small rivulets along the Ganga which are the shifting course of Ganga. The region is subjected to inundation frequently. Flood water contains higher proportion of sand than mud, which makes the region less fertile.

Transport links are restricted due to physiographic limitations and settlements are also scattered. Thus, the area lags far behind due to physiographic limitations. There are two urban settlements in the area namely, Garhmukteshwar and Gajraula. The local area is approx. 2002 sq. kms. which is mostly rural in character.

v. **Bhur Tract:** The Bhur tract is situated parallel to Ganga river in an elongated shape from north to south. It is wider in northern part and becomes narrower in south and ranges 5-7 kms. in north and 2-4 kms. in south. It is called Mawana Bhur tract in Meerut district as it extends in Mawana tehsil and Garhmukteshwar Bhur tract in Ghaziabad district . It has an area of approx. 1553 sq. kms.

The area is characterized by low sandy ridges and sand dunes. The relative height of sand-dunes varies from 1-3 mts. The slope is gentle and lean towards southern direction. Geologically, the region belongs to alluvium and Dun gravels. It is composed of recent alluvium and has alluvium soils. The region is rich in agriculture because of development of irrigational facilities. Transport network is relatively developed. Due to the pressure of growing population and technological development, the Bhur patches have been reclaimed and made fit for agriculture. Boker-khedi, Jansath, Miranpur, Mawana, Bahsuma, Hastinapur, Parikshitgarh and Shahajahanpur are major urban centres of this region.

vi. **Plain:** The major portion of the study areas is under Plain. It has an area of about 2025 sq. kms. They are monotonous and leveled, and unevenness occurs only in a series of depressions caused by various rivers draining the area. These depressions are separated from each other by broad strips of high lands or Bhurs. The general slope of the Plain is towards south. The region has alluvium soil of recent origin. Being a leveled plain, agriculture is the main activity over here; region is fertile, canal irrigation is dominant.

The Plain can be sub-divided as:-

- (i.) Saharanpur plain:- (a) It is situated in the central part of the district covering half of Deoband, about two third of Nakur and parts of Saharanpur tehsil(b) Shamali plain of the western district (c) Deoband Plain covering parts of Deoband , Roorkee and Saharanpur tehsil.
- (ii.) Muzaffarnagar Plain:- This region covers a large part of Muzaffarnagar and Jansath tehsils and a patch of Budhana tehsil.

- (iii.) Hindan Plain :- It lies in Ghaziabad tehsil delimited by watershed line of the Hindan in the east and Yamuna in the west.
- (iv.) Meerut Plain :- It covers a major part of Meerut and Sardhana tehsils
- (v.) Hapur Plain:- It covers entire tehsil of Hapur district.
- (vi.) Bijnor Plain:- It covers the tehsil of Bijnor, Najibabad and partly Dhampur tehsil.
- (vii.) Upper Ramaganga plain:- The region covers a major part of Dhampur tehsil, fringes of Bijnor, Nagina and Nazibabad tehsils and also Thakurdwara, Moradabad tehsils of Moradabad district and partly Bilari and Amroha tehsil of Moradabad district. Sahabad and part of Milak and Rampur tehsil of Rampur district.
- (viii.) Sambhal plain:- It extends in Bilari and Sambhal tehsil.
- (ix.) Amroha Plain:- It forms the major portion of Amroha and partly of Sambhal, Haspur tehsil and Morababad tehsil.
- (x.) Rampur plain:- It covers parts of Rampur, Milak, Suar and Bilaspur tehsils. In these Plain the transport network is well developed and roads and railways connect the places with each other. The settlement pattern is well developed and distributed. Most of the urban centres are situated in these Plain.

(ii) Soil

Geological formation has a direct bearing on soil. The soil units respond to the physical set up of region and correlate to the climate, vegetation and relief to a greater extent. The soil of the study area are mainly alluvial and on geological basis falls into two broad sub-divisions: the new alluvium and the old alluvium. In khadar, the soil are markedly sandy, adjacent to the river banks, but away from these banks in the valleys of the rivers, it is sandy silt, silty and becomes silty clay in depressions. The bhangar soil varies from grey brown in colour to dark brown and sandy loam to silty clay, depending upon the topography and drainage. In the sub-montane tract the

substratum of stones and boulders are mostly covered by a thin layer of dark loamy soil. In khadar area the relatively elevated sandy parts are devoted to maize, millets, sugarcane, while silty clay is devoted to coarse varieties of rice, wheat, barley, lentils and peas mixed with oats and gram. In the bhangar soils, sugarcane, maize, bulrush, millet, pulses, fodder are the principal crops cultivated in kharif season, while wheat, gram, peas and barley are mainly cultivated in the rabi season. In the sub-montane tracts maize, millets, groundnuts, cotton and sugarcane in the kharif ² and wheat mixed with gram, peas and barley in the rabi ³ season are generally sown.

iii. Drainage

Drainage system of the area follows the direction of the slope and is closely linked with physiography. Ganga and Yamuna are the major rivers draining the area. Hindan is a major tributary of Yamuna, other tributaries of the river are Karsauni, Katha Nala and Kali Nadi. River Ganga has also many tributaries both perennial and non-perennial.

Ram-Ganga, Sot, Ban-Ganga, Khoh and Kosi are some of them. Ban-Gangan and Karudhla, the tributaries of Ram Ganga, follow parallel to their master stream and then join at different places. The Ram Ganga canal originates from upper Ram Ganga plain and serves the southern part only. The two tributaries Malin and Chhoiya drain the water of Bijnor plain and join Ganga near Bijnor and Saidabad respectively. River Sot flows through Sambhal plain; khanda, Pilakher, Sainjni are the sub tributaries of river Sot. Most of the streams are non-perennial which originate in Shiwaliks, Nanital hills and some in Bhabar tract and occupy wide beds. These streams are torrential which may be only a thin thread like rivulet, but occupy a shape of wide river during rainy season. They often change courses and hence, the settlements shun these streams. These streams deposits large amount of material, as there is abrupt change in the gradient.

² Kharif season denotes the period during which summer crops occupy the soil generally mid June to mid October.

³ Rabi season denotes the period during which winter crops occupy the soil generally mid Oct to mid April.

iv. Climate

The climate of the study area is characterized by seasonal rhythm which is produced by the south west and south east monsoon twice in course of the year. In one part of the year, the winds are of continental origin and blow from west to east, while of the other part they are oceanic and blow from east to west. The cold weather extends from last week of October to the middle of the march. January is the coldest month and records the lowest temperature of the year. In the winter season, light showers are received which result from the western disturbances. The rainfall in the winter season, though small in quantity is highly beneficial to the rabi crops, as it generally comes when the plants are flowering; the effectiveness of the rainfall is further increased by prevailing low temperature.

The summer season starts from mid-march to the end of the June. In the months of May and June the heat of the sun becomes unbearable and the hot winds called '*Loo*' blow from morning till evening and sometimes are dangerous enough to kill people. A fall in temperature takes place with the advent of the rains and the climate during July and August is not altogether unpleasant. The season of general rains normally commences in the 3rd week of June and lasts till the first week of October. The rains are quite uncertain both in its incidence and the total amount received. Spatially over the study area the temperature remains low in the north, comparatively and increases towards the south. Himalayas cast their influence in terms of temperature and precipitation in Shiwaliks and Tarai.

v. Natural Vegetation

There is a variety of vegetation found in the study area, which is mostly of tropical variety, except in the montane tracts. The forest tracts in the region are mainly confined to Shiwaliks in Saharanpur district and some part of Bijnor, Nazibabad and Afzalgarh. The forests of Nazibabad are included in gangetic division while that of Afzalgarh forms part of the Garhwal forest division. Hill range of Shiwaliks, Chandi and Pathri are also forested. Pathri forests comprise of semi tarai tracts. The trees

mainly found in these forests are Sal, Chir, Khair, Shisham and bamboo. The region had dense forest in north eastern part but now it is depleting both in quantity and quality. Whole of the Plain have been brought under plough due to the pressure of population and thus the forests are mainly confined to sub montane tracts, Shiwaliks and Tarai (pipli forest reserve) region. The region lies in sub tropical division of deciduous type of vegetation and does not have vast expanse of natural forests. Whatever forests occur are in patches, in the lowlands or along the rivers and canals which are the result of cultivation and plantation by the forest department. The important trees found are those of shisham, mango, jamun, imili, babul. Eucalyptus is also an important variety, others are mahua, banyan, kaitha etc. The river doab is endowed with trees, grasses and bushes. Dhak jungles were mostly found on the banks of Hindan and Yamuna. Bhabar grass is an important forest produce which is used as raw material for manufacturing of paper. Suar and Bilaspur tehsil of Rampur district have large patches of overgrown long grasses which cannot be cultivated. The khadar of Ganga and Ramganga in Moradabad are mostly covered with Jhau and Dhak jungle, which are used as fuel and also for making baskets.

vi. Transport

The transport system of any area is highly influenced by the geology, relief and drainage of the area. In the study area, the transport system is well developed mainly in the Plain and the bhur tract. The transport network is mainly governed by the streams. The roads mainly follow the streams and run parallel to them. So the major trend is north south direction as due to topographical limitations, the area is difficult to traverse from east-west direction (especially in Tarai). The road network is sparse in Ganga and Yamuna khadar where the rivers force to keep the network in north-south direction. The Tarai and Shiwaliks region is least served by the roads. Northern upper Ganga Plain are served by the northern railways. The National highway 24 passes through Ganga khadar and National highway 1 passes through Moradabad and Rampur. While the state highway 12 and 49 passes through Bijnor Tarai. No national highway passes through Bijnor, Saharanpur and Hardwar. To avoid the

difficulties of bridging and the low khadar liable to floods, railways avoid crossing the main arteries of drainage except at favourable or unavoidable points. Along the khadar especially if its wide, we find a belt of communication.

vii. Impact of Relief on Urban Settlements

After we have had discussed about the physiography, climate, soil, drainage and natural vegetation of the study area, we can have a fairly good idea of the distribution of the settlements. For it is the relief and drainage of any area which has a direct bearing on settlements, transport network and even economy of any area. Man like to settle down on places of least resistance hardships. Same is the case in the study area. The Shiwaliks, Ganga and Yamuna khadar are the main regions which discourage settlements. The Shiwaliks are not a favourable area for inhabitation and no urban settlement are found in this tract. Similarly, khadar is generally liable to be submerged during the rains owing to the greater discharge of the rivers and so, on both of its sides the growth of urban settlements are discouraged. Tarai of Saharanpur and Bhur of Garhmukteshwar are also devoid of any urban settlements. The urban settlements are numerous in number and also dense and larger in the Plain especially, of Muzaffarnagar, Deoband, Shamli, Hindan, Meerut, Hapur, Bijnor and Amroha. Bijnor Tarai, Bhur tract of Muzaffarnagar and Yamuna khadar of Meerut have high urban density, owing to high population pressure, although they are physiographically not very suitable for large urban settlements. Yamuna khadar of Ghaziabad, Plain of Shambal, upper Ramganga Plain of Bijnor and Rampur and Mawana Bhur tract are regions of medium urban density.

1.2. OBJECTIVES OF THE STUDY

The present study is an attempt to understand the structure of urban centres in the study area for the period of 1971 and 1991. The study has the following objectives:

1. To understand the spatio-temporal trends of the urban population in terms of growth, density and distribution.

2. To identify changes in the functional classification of settlements between 1971 and 1991.
3. To examine the hierarchy of urban settlements on the basis of availability of the social facilities.

1.3. DATA BASE

The study is entirely based on the secondary data derived from census of India publications for the year 1971, 1981, 1991. The District Census Handbooks (DCH), town directory and various occasional papers have been consulted. Regional divisions of India - A cartographic analysis, occasional paper is used for first chapter. However, the data on seven non-agricultural i.e., industrial and the infrastructural facilities have been taken from computer division, Pushp Bhawan, New Delhi.

1.4. METHODOLOGY

The spatial distribution of towns has been analysed from the study of topographical sheets and by applying the nearest neighbour technique. Simple cartographic and statistical techniques have been used for calculating growth rate and density of urban settlements. The rank size relationship has also been examined in the study. 'Ternary diagram' has been used for the functional classification of towns. The Hierarchy of urban centres is derived from the composite index of several urban, social and infrastructural facilities. The respective techniques along with their merits have been analysed in the appropriate chapters.

1.5 LITERATURE REVIEW

Settlements have since long formed the focus of study and research in human geography. It is one of the most significant theme in human geography, as the form of settlements in any particular region reflects man's relation with the environment. The term settlement geography is derived from German '*siedlung geographic*'⁴ which involves the study of visual imprints made by man upon the

⁴ Singh, R.L and Singh, K.N(1975) "Readings in rural settlement geography"

cultural landscape in the process of occupying i. e; the settlement is regarded by the geographer as a man made habitat on the earth's surface. These imprints vary from one cultural landscape to another, according to physio cultural setting and man's ability to change the natural features. So it is necessary to understand the structure of settlements of an area and also to evaluate the spatial linkages of the settlements with the regional economy. These settlements not only express the sectoral and spatial changes but also act as catalyst in bringing the change. The settlements have gradually grown up and evolved over a period of time and by studying the site, pattern, arrangement, location and spatial distribution, the man-land interaction can be analysed in time and space. However, the criteria for delineating urban places differs from place to place and on the purpose of study. The urban settlements with their population components work as an agent of transformation in themselves and also affect the surrounding countryside. The urban settlement and its population play a vital role on space because they, while catering for their own needs also serve rural population of surrounding countryside.

The significance of urban studies dates back to the writings of Greek scholars. There are several review of the early development of urban geography which have been dealt with by Berry and Harton (1970)⁵ and Carter (1974)⁶. Berry and Harton in their book 'Geographical perspectives on urban system' have made an attempt to introduce readers to its present days status. They have observed that 'the formative year of the social science in the late 19th century were also the years in which urban studies first developed. Thus providing the content for the geographers emerging interest in cities.

In the historical perspective the works of urban geography show that the pre 20th century studies primarily concerned themselves with the themes of location, size and shape of the cities. The initial findings were strongly subjective, descriptive and

⁵ Berry and Harton (1970), F.E. Geographic Perspective on Urban system with Integrated Readings. Prentice Hall Inc. New Jersey, 1970

⁶ Carter (1974) 'The study of urban geography' Edward Arnold, London.

dependent more on observation such as the works of Hassert(1907)⁷ and Blanchard(1911)⁸. In the succeeding years, the conceptual framework of site and situation was criticized by Aurousscau⁹ (1924) and Crowe¹⁰ (1930), their presumption being that cities were not inanimate objects in landscape, but also were organic elements which involved people and their movements. The morphologists later in 1960, brought the indigenous line of evolution in the sphere of the urban geography and studies on the build up fabric of cities.(Conzone,1960)¹¹.

Smailes(1955)¹², developed the prime base of urban geography which remained till early 1960's, later the studies on the morphological aspect of urban system was influenced by eternal force and methodological framework was diversified. The concept was derived from the economic theories of Cooley(1894)¹³, Weber (1899)¹⁴ and Hurd (1903).¹⁵ The Chicago school of urban ecology hastened the evolution of urban geography. In his monumental work Park (1915)¹⁶, developed the idea of order and analysis of towns. Further a powerful thrust and much of the rationale was provided to the studies of urban geography by Christaller's Central Place Theory (1933).¹⁷ Later the impact of statistical method was powerful and it brought rapid and enormous changes in the field of urban geography. Brian. J.L Berry¹⁸, a pioneer in the field analysed the spatial order, size and location of towns and cities. The

⁷ Hassert, K.(1907) 'Die Stadte Geographisch Betrachtet' Leipzig.

⁸ Blanchard, R (1911)'Grenoble: Etude De geographic urbanine' Paris

⁹ Aurousscau, M. (1924) 'Recent contributions to urban geography- A Review' pp 4, Geographical Review.

¹⁰ Crowe, P.R. (1938) 'On progress in geography' Scottish Geographical magazine, Volume 54, pp 1-19.

¹¹ Conzone(1960) 'The plan analysis of an English city centre'

¹² Smailes, A.E(1955) 'The urban mess of England and Walls' Transactions and papers institute of British geographer. pp.101

¹³ Cooley, C.H(1894) The theory of transportation publications of the American Economic association. 1894, vol.9, pp. 5-7

¹⁴ Weber, A.F(1899) The growth of cities in 19th century: A study in statistics, New York, 1899.

¹⁵ Hurd, R(1903) Principal of city land values: New York Record and Guide, 1903 pp.19-21.

¹⁶ Park, R.E(1925)

¹⁷ Christaller, W(1933) Central places in Southern Germany, Guster Ficher Jenö, 1933.

¹⁸ Brain J. Berry, The Human Consequence of urbanisation, New York, 1973

statistical methods were put to a variety of uses. Smith (1965)¹⁹, evaluated the classification of settlement. Berry and Garission (1957)²⁰, examined the utility of Rank Size Rule for urban population. Various scholars classified the urban centres on the basis of their functions. The method could be divided as qualitative and quantitative methods. In qualitative schemes, Aurousscau is doubtless the best known. He postulated six urban functions through a combination of observation and logical deductions. These urban functions were namely- administration, defence, culture, production, commerce and recreation. He noted that while a combination of these function, was performed by any given city, one function usually tend to overshadow the rest. Thus, he enunciated the concept of functional differentiation and specialisation (as quoted by C.S Yadav)* . A similar kind of approach was followed by several other scholars like H.Rees,²¹ V.A.Janaki,²² A.A Mints²³ , B.S. Khorev etc. Studies based on quantitative data are far numerous. Harris²⁴ (1943), did the authentic study of town classification on the statistical criteria. He treated the functional structure of certain typical centres of US and fixed certain percentage and ratio for each function separately on an empirical basis. His method was followed by several other scholars with certain modifications as Kneedler (1945) and Victor Jones²⁵ (1954) . Hart²⁶ (1953), reclassified the American cities using this method with modification. Pownell ²⁷ (1953), made an authentic classification of New Zealand town on the basis of functional structure. He emphasized that the significance of the

¹⁹ Smith, R.M.T, 'Method and Purpose in functional Town Classification' Review Article AAAG, Vol. 55, 1965

²⁰ Berry and Garrison." Alternate Explanation of the Urban Rank-Size Relationships in Mayer. H. M. and , C.F (eds) Readings in Urban Geography, Allahabad, 1967

* Yadav,C.S. 'New directions in Urban Geography'. Concept Publishing House New Delhi, 1986.

²¹ Rees, H. 'A functional classification of towns' Journal of Manchester Geographical society. vol.52,pp.

²² Janaki, V.A(1954) "Functional classification of urban settlements in Kerala" Journal of the Maharaja Sanajirao University of Baroda. vol.3,pp.81-114.

²³ Mints, A.A(1959) Opyt ekonomiko geograficheskoi tipologi sovetskikh gerodov(an attempt at economic geographic typology of Soviet cities.voporsy Geografic. vol.54,pp.72-88.

²⁴ Harris, C.D(1943) 'Fuctional classification of cities in US'Geographical Review, vol.33

²⁵ Jones Victor(1954) 'Economic classification of towns' Muncipal year book, Chicago.

²⁶ Hart, Jone(1955) 'Functons and occupational structure of cities of the American geogrphers',vol.45

²⁷ Pownell, L.L(1953) 'The function of New Zealand towns.' Annals of Association of American geographers. vol.43,No.4.

functions can be ascertained only by a positive simple percent deviation after calculating the national average or mean for towns of different sizes.

Nelson (1955)²⁸ developed a method on the basis of Pownell's ideas by using average of percentage of employees engaged in various functions in all towns. He calculated the mean percent and standard deviation for each function and town. Mattila and Thompson²⁹ (1955), developed a new method to assess the significance of a function of a town. This method develops an index of surplus workers over the national average for the function.

Back home, although India has one of the oldest tradition of urbanisation in the world dating back to Neolithic period and claiming such famous excavations sites, as that of Mohenjodaro (now in Pakistan) and Lothal, the study of its urbanisation has been very limited.

Natesen and Subramanyam (1941),³⁰ Deshpande (1941)³¹, can be credited for their studies in the field of urbanisation during pre-independence period at the regional level. During the last few decades a number of publications have appeared on various aspects of Indian urbanisation. A rapid rate of urban growth seemed to be the main reason for their increased awareness as urbanisation gives rise to a number of problems which demand immediate as well as long term solutions.

Publication of the proceedings of the seminar on urbanisation in India (Turner,1962)³² at Berkley and of the IGU symposium on urban geography in developing countries (1973) at Varanasi may be regarded as the valuable contribution to this branch of geography.

²⁸ Nelson, J.H (1955) "A service classification of American cities" Economic Geography.

²⁹ Mattila and Thompson (1955) "The measurement of the Economic Base of the Metropolitan areas, Land economies vol.31.

³⁰ Natesen, S: "The Early European Trade Centres of Malabar' Jour. of the Madras geographical Association, Vol.6, 1931.

Subramanayam, N "Regional Distribution of relative growth of cities in TamilNadu' Indian geographical Jour. Vol.6, 1941

³¹ Deshpande, C.D "Cities and Towns of Bombay province : Aspect of Urban geography" Indian geographical Jour. Vol.6, 1941.

³² Turner, Roy (ed.) "India's Urban future" University of California Press, 1962.

The characteristics of the urban settlements like their size, spacing, layout, built, function all vary regionally with the physical environment, with the density of population and with the character of human economies and the cultures, which they serve and represent and so their scientific examination and elucidation of their regional variations both over wide areas and within the urban complex and also their comparative study are essential problems of urban geography and have been studied by various geographers. Geographers have also examined the relationship between cities and towns of different size and their spacing in the landscape. Implicit in such assumptions that there is some sort of order and logic underlying the size relationship and spatial distribution of towns. It is assumed that settlements do not grow up in haphazard or random manner and that a measurable degree of order is to be found in their size and spacing.

Various studies of settlements pattern have attempted to classify settlements as regular, random or clustered and the Nearest Neighbour analysis was used to compare the observed pattern to the hypothetical frequency distribution. Dacey (1960)³³, was the first to use this technique in geography and has made a number of contributions applicable to geographical problems.

King (1972)³⁴, analysed the urban settlement pattern of twenty selected sample areas of U.S. He chose the physical and economic areas which represented a cross section of the country using Nearest Neighbour technique, he was able to determine whether the urban settlement in those sample areas formed uniform, random or clustered pattern.

Berry (1967)³⁵, introduces the time dimension into modern Central Place theory and emphasized that the location of central places depends on the site advantages and proximity to transport routes.

³³ Dacey, M.F " A note on derivation of nearest neighbour distance" Jour. of Regional Science, pp.81-87 No.2, 1960.

³⁴ King, J.Leslie "A multivariate Analysis of the spacing of Urban settlement in the US" AAAG, Vol.51, 1961.

³⁵ Berry, B.J.L and Garrison, W.L " Alternate Explanation of the Urban Rank Size relationship in

A study of Delhi's urbanisation by V.K.R.V Rao and P.B Desai³⁶, gives a glimpse of pre industrial and post industrial Delhi and its subsequent growth, both demographic as well as economic.

R.L Singh³⁷, in his urban survey of Bangalore through past decades to present, discusses the physical setting, the demographic, socio-cultural aspects of the city, its public utility services, urban morphology and landuse, its umland and the umland's physical and cultural characteristics. In the end he give suggestions on the planning and improvement of the city.

N.K Bose³⁸, studied a few aspects of social life of Calcutta in 1964. In this book, he divides the people into Bengali and non Bengali communities and then studies their occupations and their involvement in various voluntary organisations in the state.

P. Pandeya (1970)³⁹, studies the impact of industrialization on the urban growth of Chottanagpur region which abounds in rich minerals. He investigated how these minerals helped many individuals to grow and prosper and how these industries then set in motion the wheels of development in Chottanagpur.

Ujagir Singh (1965)⁴⁰, studies the distributional pattern and character of the cities of the Ganga Plain and reveals that most of the cities are riverine towns located either on the bank of Ganga or Yamuna or their tributaries and finds out that the cities on the main river are larger than on their tributaries. The striking feature of the distribution of cities in the Plain is the urban concentration in the western and eastern

Mayer, H.M and Kohn, C.F(ed.) Readings in urban geography, Allahabad, 1967

³⁶ Singh,R.L "Bangalore- An Urban survey" Tara Publications, Varanasi, On behalf of the National Geographical Society of India, 1964.

³⁷ Rao,VKRV and Desai,P.B "Greater Delhi-A Study in Urbanisation(1940-57)"Asia Publishing House,New York,1965.

³⁸ Bose,N.K "Calcutta 1964-A Social Survey" Lawani Publishing House,Calcutta,1968.

³⁹ sBose,N.K "Calcutta 1964-A Social Survey" Lawani Publishing House,Calcutta,1968.

⁴⁰ Singh, Ujagir "Distribution and character of cities of the Ganga Plain "National Geographic Journal of India, Vol. 11, Part-1, march, 1965.

margins of which Delhi and Calcutta form the nuclei. He further classifies the cities using Nelson's standard deviation method and concludes that functionally the Ganga plain consists of four categories of cities, more than two-third of the cities are commerce and trade centres about two-third are transport centres, 50 per cent are manufacturing centres and less than 50 per cent fall in the category of service centres. Thus majority of cities are multi-functional.

O.P Singh (1972)⁴¹, studies the spatial distribution of 130 selected central places including KAVAL towns of UP by nearest neighbour method. He observes that there is a decrease of distributional density of centres from northwest towards east, and he also confirms spacing of centres of varying size classes, with distance size principle i. e ; higher order centres are less in number as compared to lower ones and so they are spaced at more distance.

Om Prakash (1970)⁴² asserted the influence of physical setting on population distribution as quite obvious in UP. He analysed that the distribution of population pattern is like a sensitive photographic plate which records changing condition. The urbanisation decreases from west to east and the western Plain has the highest urban percentage.

He explain that generally population remains dispersed in villages and tends to become concentrated in cities. But this does not hold good always in case of UP where the pace of industrialization has been so slow that the cities of UP could not create the force of attraction strong enough to draw labour from its hinterland.

⁴¹ Singh, O.P "Spatial Distribution of sizable Central Places of Uttar Pradesh on Nearest Neighbour Method" National Geographer, pp79-84, Vol.7, 1972.

⁴² Prakash, O " pattern of population in Uttar Pradesh" National Geographic Jour.of India, Vol.16, No.2, 1970.

Singh, H.H and A.K Mishra (1988)⁴³, examined the trend of growth and the spatial characteristics of urban settlement in Dun valley. The nature of dispersion of these urban centers has been analysed by nearest neighbour analysis and the clustered nature of distribution was found where the urban centres were concentrated in a few isolated pockets which was a result of harsh terrain, administrative structure and good transportation facility in a limited area only. The authors further classify the urban centres using Nelson's standard deviation method. Finally, they concluded that the physical configuration affects the transportational pattern which plays an important role in the nodality of the urban centres and that the physical, economic and cultural factors play a definite role in stimulating the spread of urban centres.

M.F.Karenavar (1976)⁴⁴, uses the nearest neighbour analysis to study the pattern of the urban settlements in Karnataka for the decade 1971.

Ahmad, E (1978)⁴⁵ in his book "Social and Geographical Aspects of Human Settlements" has attempted to study the rural as well as urban settlements of the United province. He has clearly brought out the physical and cultural features. He examined the towns and traces their origin and evolution and analysed the dominance of the historical factors on the growth of the towns and in the study area. He has also shown the distribution of towns and how the existing distribution is related to the historical antecedents as well as physical and economic factors. The size and function of the towns, their morphology has also been discussed by him.

Singh, A.N (1967)⁴⁶, in his paper has discussed the evolution and growth of Itarsi town which is situated on level surfaced land of the fertile middle Narmada basin. The functional classification of town was done and the functional zones of the town were identified by personal observation. It was concluded that it is a commercial town, but except two distinct functional zones viz. business and residential. Other

⁴⁴ Karenavar, M.F "A quantitative Analysis of the pattern of urban settlements in Karnataka state, Geographical Review of India, Vol.38, No.1

⁴⁵ Ahmad, E (1979) op. cit

⁴⁶ Singh, A.N "Functional zones of Itarsi town" National Geographic Jour. of India, Vol.13, No.2, 1967.

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activities like educational, industrial., religious, recreational, administrative are scattered all over the town.

Sinha (1970)⁴⁷, studied the application of research models and discussed the origin and growth of Sirsi town. After discussing the topographical structure he studied the functional and occupational aspects of urbanisation. He has also studied the infrastructural facilities like transportation and communication network of the city. Lastly, he has applied certain quantitative techniques like the functional classification of Sirsi town.

K.M Kulkarni (1981)⁴⁸, has attempted the urban structure of Nasik city. He has traced its growth and development, its morphology and functional interaction along with infrastructural development.

Jauhari⁴⁹, in his four papers has traced the origin, evolution, growth and development of urban settlement in Sutlej-Yamuna divide right from prehistoric and early historic period to the present times, including medieval to post partition period and then the post partition growth of small towns from pre existing rural settlements and also the expansion of pre existing towns in the post partition time .He analysed that partition has played an important role in growth of small towns.

Many studies have been taken to examine the hierarchic arrangement of urban centres on the basis of the services which urban centres perform.

⁴⁷ Sinha, B.N "Sirsi - An Urban study in the application of research models" Karnataka University, Dharwas, 1970

⁴⁸ Kulkarni, K.M " Urban structure and Interaction- A study of Nasik City" Concept publishing company, New Delhi 1981,

⁴⁹ Jauhari, A. S "Growth of early urban structures in Sutlej - Yamuna Divide (pre- historic and early historic periods) National geographical Journal of India, Vol.8, part-2, 1962. "Urban settlements of Sutlej-Yamuna Divide" (647 A.D - 1947 A.D) National geographical Jour. of India, Vol.8, part-2, 1962. "Sutlej-Yamuna Divide: A study in Post partition growth of small towns from pre existing rural settlements" National geographical Jour. of India, Vol.9, part-2, 1963. "Post partition expansion of pre existing towns in the Sutlej -Yamina Divide: A study in the development of urban Fringe and suburbs" National geographical Jour. of India, Vol.10, part-2, 1964.

Bimalendu Bhattacharya (1972)⁵⁰, has determined the central functions (the external services offered by an urban centre to its supplementary region) of the urban centre by giving score values to these selected central functions. He analysed that the administrative status appears to act as the most distinctive force in elevating the economy and ultimately the cultural status of an urban centre and this modus operandi is disturbed only in exceptional cases like heavy industrialisation or some other towns having far better site and situation. He concludes that the size of an urban centre is the direct result of its functional character. A town attains its size through its functions and the variation in size is due to the variation in the type of functions that individual towns perform (As a general rule the manufacturing centres need a large band of workers than a purely wholesale or retail centre, while a transport centre would need still a small number of working population, while the administrative centre would need largest number of workers not only for government officers but also for other wide range of activities that are established). He summed up two facts in his study that :

(a) administrative status exerts a significant influence on determining the size of the towns and has much to do in deciding the hierarchical order of them. (b) The compatibility between the size and hierarchical order of towns is another important guideline in understanding the extent and variable nature of central functions performed by industrial centres, and that the existing hierarchical pattern may change with the economic and cultural emancipation of the region.

A. Kumar and Sharma (1976)⁵¹, attempts to study the number, location, spacing and size of urban centres in Chottanagpur. He correlated the spatial distribution of towns with their rank size, the number of towns and their functional specialisation and has brought out the regional imbalances in the field of urban industrial development. He also gauged the population potential by correlating the population

⁵⁰ Bhattacharya ,B. "Factor determining the central functions and urban hierarchy in north Bengal" Geographical Review of India, Vol.34, No.4, 1972.

⁵¹ Kumar, A. and Sharma "Spatial arrangement and degree of specialisation of urban centres" Geographical Review of India, Vol.36, No.2, 1976.

rank with the territorial rank of an urban centre. He found regional imbalances in the distribution of urban centres. He concludes that the western half region is more urbanised than others . It has all the class I towns of the region and has more closed and regularly spaced urban centres which are basically industrial, mining or service towns. He has suggested certain solutions for regional imbalances like decentralization by developing new service centre especially the small and medium towns and also suggests to adopt growth pole strategy to bring out a balanced urban economic development in the region.

M. M. Jana and K. Bagchi (1980)⁵², in their paper have tried to examine the hierarchy of settlements of lower Sitabali basin (which lies in the north east part of Ghatal subdivision of the district Midnapur in West Bengal) on the basis of some selected functions which are weighted according to their degree of importance and interactions with the other functions. He observes that only 15 per cent of the settlements serve their complementary region. He has grouped the selected centres into four levels of hierarchy according to their centrality scores. Finally, they also discussed how more urban centres can be upgraded to come under selected centres and how the centrality score of these selected centres should be increased.

S.K Biswas (1980)⁵³, in his study has made an attempt to assess the potentiality of the urban centres of Burdwan district of West Bengal by taking several socio economic variables which covered not only territorial but also extra territorial jurisdiction of towns. He has then scored them and taken out the cumulative score to delineate five order of centres. The merit of the study was that it provided clues to identify the potential centres of different orders which otherwise would not have been possible with the population rank alone. He analysed that ranks as per total population and potentiality score were not absolutely identical. He analysed that the industrial centres have proved themselves worthy and have high development

⁵² Jana, M.M and Bagchi, K " Hierarchy of settlements in Lower Silabati basin" Geographical Review of India, Vol.40, No.4, 1980.

⁵³ Biswas, S.K " Hierarchic arrangement of the Urban centres of Burdhwana district according to levels of potentiality" Geographical Review of India, Vol.40, No.4, 1980.

potential. Further in his study , he has delineated the umlands of the urban centres using potentiality score, rather than centrality score, the former being more appropriate due to the cohesion of several variables.

Trideb Kumar Basu (1977)⁵⁴, in his paper has functionally classified 20 urban centres of Singhbhum district of Bihar using continuous sub-division a method used by Cole and King (1970) , in which the percent of each category of occupations primary, secondary and tertiary, were plotted on the three sides of a triangle and thus the triangular graph was obtained allowing a mental picture of all towns of a region giving visual expression.

M.M Jana (1977)⁵⁵ attempted to study the decadal growth of population characteristics of the urban centres during 1901-1971. The author has used Bose's (1961) method of classifying towns by their functions i.e; the maximum number employed in a particular function while the index of specialisation of a function was determined by the ratio of functions of the town to the district value(Gibbs,1961), further a special classification of towns was done by analysing the three attributes like density of population, population of the town and economic structure of the town.

Later, the author concludes that the majority of towns depend on rural economy and have low economic growth. Some of the reasons put forward by Jana were that they were far from Calcutta so its influence is checked and the total workers of each town have been reduced by abolition of household and cottage industries and high rate of decrease was noticed in towns where household industry predominated.

Prahalad Kumar⁵⁶, utilized a mixture of Thompson and Pownell's method (1953) in a modified form to study the functional characteristics of Dehradun urban complex.

⁵⁴ Basu, T.K "Fucctional Classification of urban settlements in Singhbhum district, Bihar- A cartographic appraisal" Geographical Review of India, Vol.37, No.4, 1977

⁵⁵ Jana,M.M "Deccinnial growth and functional characteristics of urban areas in Midnapur district" appraisal" Geographical Review of India, Vol.37, No.4, 1977

⁵⁶ Kumar, P "Functional analysis of Dehradun urban complex".Geographical Review of India, Vol.45, No.2, 1985.

The desired deviation of functions of different centres from primate city was obtained by a modified equation from Thompson's original formulae, while Pownell's approach was used for further planning and distribution of population in different centres of the complex.

V.A Janaki (1954)⁵⁷, examined the influence of physical and economic factors on the functions of the towns and also the inter-relationship between the function and size of the town. The author identifies four manifestations affecting the town i. e ;

- i. The physical conditions of site of towns.
- ii. Agriculture, industrial or economic condition of the towns .
- iii. Historical factors and
- iv The cultural development of the people.

K.N Singh (1959)⁵⁸, analyses the functional character of urban centre in UP in order to group them according to pattern and potentialities of growth. The study reveals that the non agricultural functions become predominant with increase in size of urban centres and that the urban functions has been experiencing slow but steady growth since 1921. Though the towns have been influenced by new employment in the industries and commerce. They have not been able to disassociate themselves from factors underlying their origin and early growth and that most of the towns of the state have grown up and acted essentially as service centres for the surrounding agricultural communities of the state.

U.P Shahi (1989)⁵⁹, in his book studies the evaluation and growth of urban centres of Gujarat state from Harappan period to present century. He has analysed the growth of urban population by size class of towns as well as the district wise growth and tried to draw a relationship between the growth of an urban centre and its size. He

⁵⁷ Janaki, V.A "Some aspects of population pattern in the different functional groups in Gujarat"pg.80, Jour. of M.S University of Baroda, 1967

⁵⁸ Singh, K.N " Functions and functional classification of UP" National geographical jour. of India pg. 121, vol.5, No.3, 1959.

⁵⁹ Shahi, U.P "Urbanisation in Gujarat : A Geographical Analysis" Institute of Rural Eco- Development, Gorakhpur, 1989.

concludes that the trend of urbanisation in Gujarat has been rapid and the large urban centres have continuously grown at the expense of smaller ones during the eight decades of the present century. After studying the spatial pattern of urban growth rate, he has seen the functions and examined the functional classification of urban centres, calculating functional specialization index and functional centrality index which involved the scientific study of both functional specialization and functional hierarchy to clearly bring out the population comparative specialisation with regard to the size of a particular town and in relation to whole set of towns. The author concludes that there is no positive relationship in the level of specialization and functional association i.e; the more a town is specialized , the fewer number of significant functions it will possess and vice versa.

He has also studied the rank size relationship and reveals that 8.24 per cent of urban residents of the study area would be required to move from one centre to another to bring a perfect correspondence between urban hierarchy and rank size rule. Studying the hierarchical grading of urban centres the author analyses that there occurs a positive correlation between the population and centrality of the centre. He analyses that the process of Industrialization and urbanisation in class I and II town have gone together and one has stimulated the growth of another. While the relative importance of industrial activity gradually decreases in towns III, IV, V order centres while 40 per cent of class VI towns have industries as their predominant function.

1.6 ORGANISATION OF THE STUDY

The study has been divided into five chapters. The first chapter is introductory in nature and gives a clear idea of the study area, its physiography, soil, drainage, climate, natural vegetation, transport and the effects of the above on the distribution of urban settlements. The objectives, data base and methodology have been given next. A brief literature survey is given at the end of this chapter.

The second chapter discusses the growth, density and distribution of population of the urban centres in the study area.

The third chapter examines the functional structure of towns and changes there in, if any, between 1971 and 1991. Further, the relationship between the location, the size and the functional character of urban centres is examined.

In the fourth chapter the hierarchy of towns based on the composite index of several social and infrastructural facilities of the towns has been identified.

The fifth chapter provides summary and conclusions from the research conducted.

CHAPTER II

GROWTH, DENSITY AND SPATIAL DISTRIBUTION OF TOWNS

2.1 INTRODUCTION

Uttar Pradesh has a long history of urbanisation. There are sufficient evidences which prove that Indus Valley Civilization, (2500-1750 BC) one of the oldest urban civilization had its extension upto the area presently falling in this state.

Explorations made in different parts of the state clearly indicate that there were some sort of desertion of cities in the Post Kushana Period when, a large number of prominent urban places, many of the capitals of the kingdom, declined due to political, geographical and socio-economic reasons and today they are not even formal villages. In contrast, UP still holds a large number of flourishing urban centres of different sizes belonging to different phases of history. In spite of such a prolonged history of urbanisation UP could not perform well to increase its share of urban population to the total. A large majority of population has remained confined in the vast rural tracts and only a small share is settled in few urban centres. The 20th Century, which has been called the age of urbanisation could hardly change the prevailing situation. The level of urbanisation in the state is still very low. In 1971, there were 325 urban centres in the state with a population of 12388596 (1.24 Crore) i.e. hardly 14.02 percent of the total population while the average for India was 19.91 percent. U.P ranks 14th in terms of urbanisation while in area it ranks fourth. There was rapid increase in urban population since then and in 1991 the urban centres grew upto 753 with the total urban population of 27605915 i.e. 19.84 percent while for India as a whole it increased to 25.71 percent (Census of India).

In the present study, we have confined ourselves to the northern upper Ganga plain consisting of eight districts in 1991 census. This chapter brings about some of the important aspects of the spatial and temporal pattern of urbanisation.

The statistical study of urbanisation is impossible unless adequate note is taken of the definition of the urban area, city or town which varies from census to census.

2.1 (a) Census Definition of 'Towns'

The present study aims at analysing the structure of urban centres for the decade 1971-91 and has 'town' as its unit of analysis. The concept of town should be very clear before going further. The census of India 1991 defines town or urban centre as -

1991⁶⁰

The places which fulfilled the following criterion were termed as towns -

- (a) All statutory towns i.e. all places with a local authority like a corporation, municipality, cantonment or a notified area.
- (b) All localities though not in themselves local bodies yet are part of city or town agglomeration and /
- (c) All other places which satisfy the following criteria :
 - (i) A minimum population of 5000,
 - (ii) 75 percent of the male working population being engaged in economic pursuits other than agricultural and
 - (iii) A density of population of at least 400 persons per square kilometre.

2.1 (i) Urban Agglomerations (1971-91)

The concept of urban agglomeration was adopted in 1971 census. It is defined as the continuous urban spread at a place which may cover more than one town, with their urban outgrowths. This concept is an improvement on the town group concept of 1961 where the urban spread was not necessarily continuous. Some urban settlements like residential colonies, campus etc. come up outside the notified limits of a town, but adjoining it and such settlements may not be local bodies in themselves but they form a continuous spread with

⁶⁰ Census of India, 1991, General Population Table, Series I, part II A.

the adjoining town and so it should be treated as urban. Such towns together with their outgrowths have been treated as one urban unit called urban Agglomeration.

There were five (5) urban Agglomerations in the study area in the 1971 census.

Table 2.1

URBAN AGGLOMERATIONS IN 1971

DISTRICT	U.A.	TOWNS
Meerut	Ghaziabad U.A	Ghaziabad(M.B) Ghaziabad Rly. Colony(C.T)
Saharanpur	Hardwar(U.A)	Hardwar Gurukul Kangri(O.G) Jawalapur Mahavidyalaya BHEL Ranipur
Meerut	Meerut(U.A)	Meerut Malayana Meerut cantt.
Moradabad	Moradabad(U.A)	Moradabad (M.F.) Moradabad Rly Settlement(N.A)
Saharanpur	Roorkee(U.A)	Roorkee Roorkee cantt.

Source : Census of India, 1971

* Out growth of urban area which do not qualify to be treated as separate towns (Gurukul kangri, Jawalapur Mahavidyala)

There were seven (7) urban Agglomerations in the study area during 1981. Modinagar UA is included during 1981 census period.

Table No. 2.2

URBAN AGGLOMERATIONS IN 1981

DISTRICT	U.A.	TOWNS
Ghaziabad	Ghaziabad U.A	Ghaziabad(M.B) Ghaziabad Rly.Colony(C.T)
Meerut	Meerut(U.A)	Meerut Meerut cantt. Kankar kheda Basar kheda
Moradabad	Moradabad (U.A)	Moradabad

Table 2.2 Cont.....

Table 2.2 concl.....

Moradabad	Bilari (U.A)	Moradabad Rly Settlement(N.A) Bilari Rustamnagar Sahaspur
Saharanpur	Hardwar (U.A)	Hardwar Gurukul Kangri(O.G) Jawalapur Mahavidyalaya BHEL Ranipur
Saharanpur	Roorkee (U.A)	Roorkee Roorkee cantt.

Source : Census of India, 1981

Apart from the towns/cities, the 1971 and 1981 concept of urban Agglomeration is also adopted for the 1991 census. Some urban settlements like railway colonies, university

Table : 2.3

URBAN AGGLOMERATIONS IN 1991

DISTRICT	U.A.	TOWNS
Bijnor	Bijnor U.A	Bijnor(M.B) Mukarumpur khema(C.T)
Ghaziabad	Ghaziabad U.A	Ghaziabad(M.B) Rajapur(C.T) Ghaziabad Raly. Colony(C.T)
Ghaziabad	Modinagar U.A	Modinagar Begumabad Budhana(C.T) Bisohkar(C.T)
Hardwar	Roorkee U.A	Roorkee(M.B) Roorkee(cant)
Hardwar	Hardwar(U.A)	Hardwar(M.B) Gurukul Kangri(O.G) Jawalapur Mahavidyalaya(O.G) B.H.E.L Ranipur(N.A)
Meerut	Meerut(U.A)	Meerut(M.C) Meerut(Cant)
Moradabad	Moradabad(U.A)	Moradabad Moradabad Rly Settlement(N.A)
Muzaffarnagar	Mujaffarnagar(U.A)	Muzaffarnagar(M.B) Adarsh Nagar & Devpuram(O.G) Subhash Nagar & LB(O.G)

Source : Census of India

campus, port areas and military camps come up outside the notified municipal limits of a town but adjoining it, such outgrowth (s) may actually fall in the area of the adjoining revenue estate, but it is not realistic to treat them as rural area on account of their highly developed urban characteristics, while at the same time each such out-growth by itself may not satisfy the requirement to qualify itself for treatment as a town. So, they are included in U.A. There were nine (9) Urban Agglomerations in the study area for the 1991 census.

Bijnor (UA) and Muzaffarnagar (UA) are the two new additions during 1991 census. The concept of SUA (standard urban area) is different from U.A.

2.1 (ii) Standard Urban Area (SUA)

The concept of standard Urban Area (SUA) was to replace the town groups of 1961 census. Standard Urban Area was introduced in 1971 census. The essential requirements for the formation of SUA as laid down in 1971 census are -

- (i) It should have a core town of a minimum population of 50,000,
- (ii) The contiguous area made up of other urban as well as rural administrative units should have mutual socio-economic links with core town and
- (iii) In all probability, this entire area should get fully urbanised in a period of two or three decades.

The concept of SUA is different from the urban agglomeration. The standard urban area is based on the potentialities of development of any urban growth in the next two or three decades, while the urban agglomeration depicts the present state of any outgrowth of urban spreading adjoining a core town.(see table 2.4)

2.2 TRENDS OF POPULATION GROWTH

The urban population of the study area was 25.73 lakh in 1971 which increased to 63.09 lakh in 1991 census thus showing an increase of approximately 2.5 times. The decadal

TABLE:2.4
STANDARD URBAN AREA (1991)

TOWN		TOTAL POPULATION	DENSITY OF POPULATION	GROWTH RATE (in %) (1981-91)	WORKERS PARTICIPATION RATE
AMROHA	SUA	159754	2847	23.45	26.40
	URBAN	137061	21687	21.64	26.36
	RURAL	22693	456	35.67	26.48
CHANDAUSI	SUA	111372	2264	23.63	27.16
	URBAN	82748	9403	23.56	26.23
	RURAL	28624	709	23.84	29.86
MORADABAD	SUA	597551	3079	35.33	26.87
	URBAN	443701	12325	28.48	27.12
	RURAL	153850	973	59.93	26.16
SAMBHAL	SUA	202464	2211	31.78	27.37
	URBAN	150869	9640	39.39	26.58
	RURAL	51595	680	13.63	29.69
RAMPUR	SUA	279548	3532	21.68	28.3
	URBAN	243742	12066	19.13	28.22
	RURAL	35806	5593	42.53	28.99
SAHARANPUR	SUA	464572	3386	31.27	27.28
	URBAN	374945	14785	26.95	27.07
	RURAL	89627	15221	53.07	28.12
HARDWAR	SUA	231167	1941	29.37	27.46
	URBAN	187392	4461	28.40	27.14
	RURAL	43775	568	33.68	28.84
ROORKEE	SUA	147272	2463	24.82	26.67
	URBAN	91139	5349	15.25	27.23
	RURAL	56133	1313	44.25	25.75
MUZAFFARNAGAR	SUA	350159	2747	42.54	27.08
	URBAN	247624	20567	44.12	25.98
	RURAL	102535	888	38.88	29.74
MEERUT	SUA	903954	3567	54.95	27.07
	URBAN	849799	4785	56.50	27.00
	RURAL	54154	714	34.09	28.15
GAZIABAD	SUA	1088144	1907	103.39	27.83
	URBAN	819044	4428	143.31	28.49
	RURAL	269100	698	35.50	25.83
HAPUR	SUA	196868	2986	40.89	25.48
	URBAN	149843	3177	42.40	25.14
	RURAL	47025	760	36.27	26.57
MODINAGAR	SUA	162530	2913	46.61	13.89
	URBAN	131754	5527	50.29	11.02
	RURAL	30778	963	32.70	26.18

SOURCE : CENSUS OF INDIA, 1991, SERIES I, PART II-A.

growth rate of the urban population for 1971-81 was 69.31 percent while for 1981-91 it decreased to 44.85 per cent. On the other hand, for the state as a whole the decadal variation for 1971-81 was 60.6 percent but was only 38.73 per cent for 1981-91.

The study area comprises of six districts in 1971 while in 1981 they were increased to seven when Ghaziabad was formed a separate district, carved out of, whole of Ghaziabad tehsil and major portions of Hapur tehsil of erstwhile Meerut district and portions of Sikandrabad tehsil of Bulandshahr district.

In 1991 the number of districts rose to eight when Hardwar was made a separate district, including Roorkee tehsil of Saharanpur district, 53 villages of Muzaffarnagar tehsil and 25 villages and 2 forest villages of Nazibabad tehsil of Bijnor district.

2.3 LEVEL OF URBANISATION

Level of urbanisation is the most important characteristics of urbanisation. It is the proportion of urban population to the total population of the region and is also known as the degree of urbanisation.

(a) 1971 Meerut district had its 24.26 percent of urban population to total population. It was followed by Moradabad and Saharanpur. Rampur and Bijnor had 19.53 per cent and 18.10 percent of their population as urban. Muzaffarnagar was the least urbanised district with only 13.86 percent of its population living in towns, which was even lower to the state average of 14.02 percent. Thus we see that the overall level of urbanisation was very low during 1971 and it was only in 1981 that rapid positive change was seen in the level of urbanisation.

(b) 1981 The state average was 17.95 percent and all the seven districts were above the state average. Highest urbanisation was found in Ghaziabad (34.13 percent) followed by Meerut (31.22 percent) and Saharanpur (27.08 percent) while Moradabad had 26.95 percent of its population as urban and Rampur had 26.74 percent. Least urbanisation was again found in Muzaffarnagar.

TABLE 2.5

GROWTH OF TOWNS 1971-1991

DISTRICT	TOWNS IN 1971	TOWNS ADDED IN 1981	TOWNS ADDED IN 1991		
Saharanpur	Saharanpur	Landhaura	laksar		
	Deoband	Behat			
	Gangoah	Chilkana Sultanpur			
	Rampur Maniharan	Nanauta			
	Nakur	Ambetha			
	Hardwar	Sarsawan			
	Rorkee	Titron			
	Mangalaur	Jhabrera			
	Mzaffarnagar	Mzaffarnagar		Thana Bhawan	Banat Ailum
		Shamali		Budhana	
Kairana		Charthawal			
Khatauli		Jalalabad			
Kandhala		Purqazi			
Miranpur		Bhokearhedi			
Jansath		Un			
		Sisauli			
		Jhinjhina			
		Shahpur			
Rampur	Rampur	Garhi Pukhta			
	Tanda	Bilaspur			
		Shahabad			
		Suar			
		Milak			
		Kemri			
		Maswasi			
		Bachharoon			
		Naugaon Sadat			
		Sirsi			
Moradabad	Moradabad	Kundarki	Gajraula		
	Sambhal	Bhojpur Dhampur			
	Amroha	Narauli			
	Chandausi	Ujari			
	Hasanpur	Umri Kalam			
	Kanth	Joya			
	Bilari				
	Bahjoi				
	Thakurdwara				
	Dhanaura				
Rustamnagar Sahaspur					
Bijnor	Bijnor	Sherkot			
	Nazibabad	Haldaur			
	Nagina	Sahaspur			
	Chandpur	Warahpur			
	Kiratpur	Noorpur			
	Seohara	Jhula			
	Dhampur	Sahanpur			
	Nehtaur	Jalalabad			
	Afzalgarh				
	Mandawar				
Meerut	Tajpur				
	Meerut	Khekda			
	Baraut	Chaprauli			

Mawana	Kithaur	
Sardhana	Parikshitgarh	
Kankerkhera	Tikri	
Bagput	Phalauda	
Kaila	Sewalkhas	
Rasulpur Dhulri	Deghat	
Aminagar Sarai	Karanwal	
Shahajanpur	Agarwal Mandi	
Hastinapur	Dhurala	
	Kharkheda	
	Bahsuma	
	Abdulpur	
Gaziabad	Gaziabad	Dasna
	Hapur	Pasaunda
	Modinagar	Rori
	Pilkua	Kalchhina
	Muradnagar	Dujana
	Dadri	Behta Hazipur
	Garhmukteshwar	Noida
	Loni	
	Begumabad Budhana	
	Faridnagar	
	Patala	
	Niwadi	
	Babugarh	
	Ord. Fac. Muradnagar*	

SOURCE : CENSUS OF INDIA

* Ordnance factory Muradnagar.

(c) 1991 During 1991 Ghaziabad district had highest percent of urban population (46.16 percent) which was followed by Meerut (37.02 percent) and Hardwar (30.96 percent). Moradabad, Rampur, Saharanpur and Bijnor had 27.65 percent, 26.14 percent, 25.53 percent and 25.07 percent urban population, respectively.

2.4 GROWTH OF TOWNS (1971-1991)

The number of towns in the region increased from 58 (fifty eight) in 1971 to 116 in 1981 and further to 126 in 1991⁶¹(fig. 2.1).

Eight new towns were included in 1971 census for the first time. These towns with their population are shown in the table 2.6.

Table : 2.6
NEW TOWNS ADDED IN 1971 CENSUS

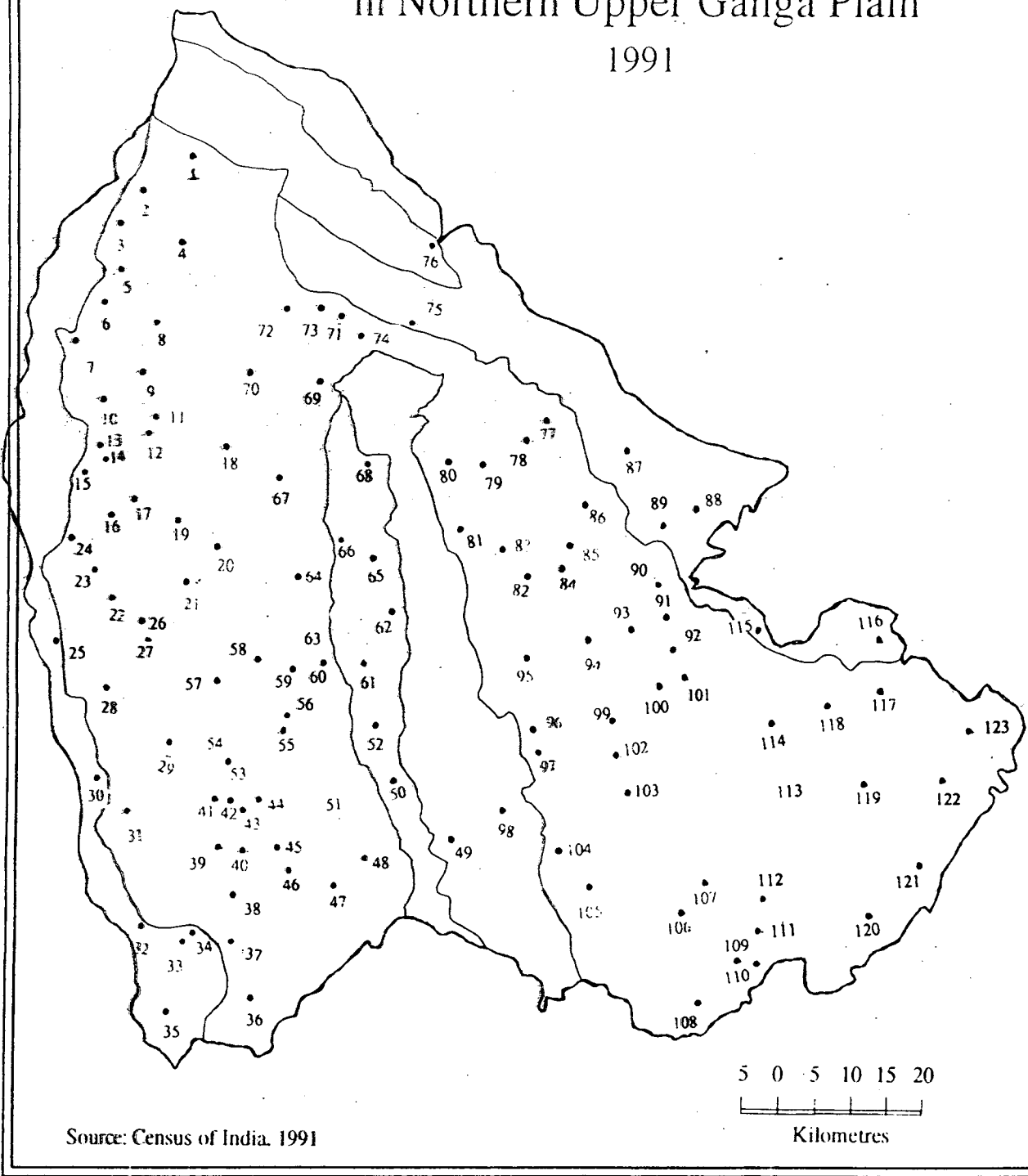
DISTRICT	TOWNS	POPULATION
Bijnor	Seohara	22821
Meerut	Ordnance Factory Muradnagar	9026
Meerut	Aminagar Sarai	5637
Meerut	Kaila	9333
	Rasulpur Dhulri	4944
Meerut	Rustamnagar Sahaspur	5391
Meerut	Hastinapur	8889
Moradabad	Rustamnagar Sahaspur	5391
Saharanpur	BEHL Ranipur	12094

Source : Census of India, 1971, series 22, part x-a , town directory

In 1981, the number of towns of the study area increased to 116. One town Rasulpur Dhulri was declassified in 1981 and 59 new towns were added.(see table 2.7a) Similarly during 1991 there were 126 towns in the study area. Eleven (11) new towns were included while one town (Abdulpur) was declassified in this census.(see table 2.7b). Rasulpur Dhulri was

⁶¹ In the present study we have considered the urban agglomeration as one individual urban centre i.e. the urban centres which were incorporated in urban Agglomerations have not been separately accounted in the study.

Spatial Distribution of Towns in Northern Upper Ganga Plain 1991



(Fig.2.1)

declassified as it had less than 75 percent of its working population in non-agricultural activities. During 1981 the settlement had 76.84 percent of its workers engaged in agricultural and allied activities.

TABLE :2.7(a)
NEW TOWNS ADDED AND DECLASSIFIED IN 1981

TOWNS ADDED		TOWNS DECLASSIFIED
Landhaura	Haldaur	Kaila
Behat	Sahaspur	Rasulpur Dhulri
Chilkana Sultanpur	Warahpur	Malayana (included in Meerut U.A)
Nanauta	Noorpur	Begumabad Budhana(included in Meerut U.A)
Ambetha	Jhalu	Baser Kheda (included in Meerut U.A)
Sarsawan	Sahanpur	
Titron	Jalalabad	
Jhabrera	Khekda	
Thana Bhawan	Chhaprauli	
Budhana	Kithaur	
Charthawal	Parikshitgarh	
Jalalabad	Tikri	
Purqazi	Phalauda	
Bhokerkhedi	Sewalkhas	
Un(Oon)	Doghat	
Sisauli	Karanwal	
Jhinhina	Agarwal Mandi	
Shahpur	Dawrala	
Garhi Pukhta	Kharkhoda	
Bilaspur	Bahsuma	
Shahabad	Abdulpur	
Suar	Ghaziabad	
Milak	Hapur	
Kemri	Modinagar	
Maswasi	Pilkhua	
Bachharoan	Muradnagar	
Naugawn Sadat	Dadri	
Sirsi	Garhmukteshwar	
Kundarki	Loni	

Table 2.7 (a) Cont....

Table 2.7 (a) concl....

Bhojpur Dharampur	Begumabad Budhana	
Narauli	Faridnagar	
Ujhari	Patala	
Umri Kalan	Niwadi	
Joya	Babugarh	
Sherkot	Ord. Fac.Muradnagar*	

SOURCE: CENSUS OF INDIA,1981

TABLE :2.7(b)

NEW TOWNS ADDED AND DECLASSIFIED IN 1991

TOWNS ADDED		TOWNS DECLASSIFIED
Laksar	Rori	Abdulpur
Banat	Kalchhina	
Ailum	Dujana	
Gajraula	Behta Hazipur	
Dasna	Noida	
Pasaunda		

SOURCE:CENSUS OF INDIA,1991

2.4 (a) Regionwise Growth of Towns (1971-1991)

While examining the growth of towns regionwise, we find that there was no urban centre in the Shiwaliks. (Fig.2.2)

The *Bhabar* region had only one urban centre, Hardwar during 1971 and no new town was added to this region in 1991.

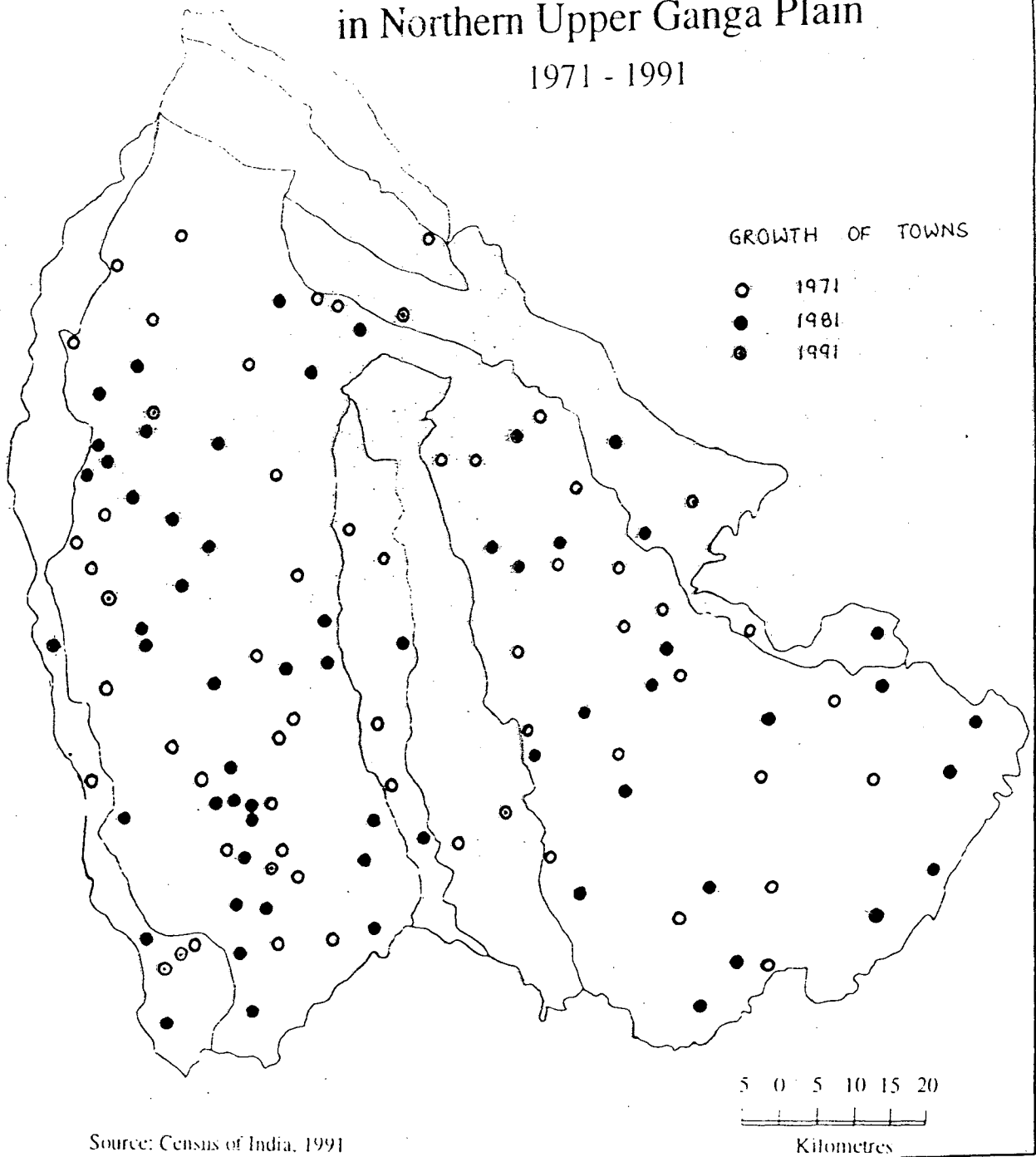
In *Tarai* Region there were two urban centres namely, Afzalgarh and Thakurdwara in 1971, the number of towns increased to six during 1991.

The *Ganga Khadar* had only one urban centre, Garhmukteshwar, during 1971 while during 1991 it increased to two, one new urban centre Gajraula was added to it.

The *Yamuna Khadar* sub-region had 2 (two) urban settlements namely Baghpat and Ghaziabad, in 1971, the number however increased to six in 1991. The towns added were Chaprauli, Loni, Pasaunda and Noida.

Growth of Towns in Northern Upper Ganga Plain

1971 - 1991



(Fig.2.2)

In 1971, there were (5) five urban centres in *Bhur tract*. These towns were Jansath, Miranpur, Shahjanpur, Mawana, and Hastinapur. In 1991, three more urban centres, namely Bhokerkhedi, Parikshitgarh and Bahsuma were added and thus the number rose to eight in 1991.

The *plain* have maximum number of urban centres to their credit. There were (45) forty five urban centres in plain in 1971, while the number increased to (98) ninety eight in 1991.(see table 2.8)

2.4 (b) Growth of Population by Size Class of Towns

It is seen that the proportion of urban population to the total population is considered to be only a crude indicator of urbanisation and hence it is worthwhile to analyse the distribution of population by size class of towns and then identify the trends of urbanisation, growth and density of population.

Table 2.9, provides an overview of the uneven distribution of percentage of urban population, number of towns, percentage of towns, percentage of area and also the average density of towns in various size classes during the three decades.

There is predominance of class I towns since 1971, although the number of towns was only 6 which formed 10.34 percent of the total towns, there was as much as 49.37 percent of the total population residing in these cities. In 1981 the percentage share of towns decreased to 8.62 but the percent population living in these towns increased to 53 and later 56.45 percent in 1991. Thus, it is seen that with hardly 9 percent of towns in these urban centres have 57 percent of the total population, and the remaining 43 percent of population is again unevenly distributed over the five classes.

The class II have experienced decrease not only in the number and percentage share of towns but also in the percent population residing in these urban centres. In 1971, the percent share of towns was 10.34 with 16.93 percent of population, however, in 1981 both the percent share of towns and population decreased to 6.9 percent and 11.46 percent respectively. During 1991, there was increase in percent share of towns and population with 9.52 percent of towns and 12.54 percent of population.

TABLE : 2.9
NUMERICAL AND POPULATION SHARE OF TOWNS (1971-1991)

CLASS SIZE	NUMBER OF TOWNS IN EACH CLASS SIZE			PER CENT TOWNS IN EACH CLASS SIZE			POPULATION OF TOWNS IN EACH CLASS SIZE		
	1971	1981	1991	1971	1981	1991	1971	1981	1991
I	6	10	12	10.34	8.62	9.52	1269702	2310613	3562947
II	6	8	12	10.34	6.90	9.52	435417	499058	791693
III	20	21	33	34.48	18.10	26.19	586056	650059	1031874
IV	13	51	58	22.41	43.97	46.03	180684	689975	838616
V	12	24	10	20.69	20.69	7.94	89671	200099	82529
VI	1	2	1	1.72	1.72	0.79	10335	5925	3581
TOTAL	58	116	126	100	100	100	2571865	4355729	6311240
SIZE CLASS	PER CENT POPULATION OF TOWNS IN EACH CLASS SIZE			AREA OF TOWNS IN EACH CLASS SIZE			PER CENT AREA OF TOWNS IN EACH CLASS SIZE		
	1971	1981	1991	1971	1981	1991	1971	1981	1991
I	49.37	53.05	56.45	185.15	306.7	522.41	39.53	41.18	49.58
II	16.93	11.46	12.54	59.29	68.14	81.34	12.66	9.15	7.72
III	22.79	14.92	16.35	126.14	114.73	225.98	26.93	15.40	21.44
IV	7.03	15.84	13.29	58.69	203.66	190.77	12.53	27.34	18.10
V	3.49	4.59	1.31	27.48	41.18	31.27	5.87	5.53	2.97
VI	0.40	0.14	0.06	11.61	10.4	2	2.48	1.40	0.19
TOTAL	100.00	100.00	100.00	468.36	744.81	1053.77	100.00	100.00	100.00

SOURCE : CENSUS OF INDIA

TABLE 2.8

REGION WISE GROWTH OF TOWNS (1971-1991)

SUB-REGION	TOWNS IN 1971	TOWNS IN 1991
Shivaliks	--	--
Bhabhar	Hardwar	Hardwar
Tarai	Afzalgarh	Afzalgarh
	Thakurdwara	Thakurdwara
		Laksar
		Maswasi
		Sherkot
		Wararahapur
Yamuna Khadar	Bagpat	Chaprauli
	Ghaziabad	Baghpat
		Loni
		Pasaunda
		Noida
		Ghaziabad
Ganga Khadar	Garhamukteshwar	Garhamukteshwar
		Gajraula
Bhur Tract	Jainsath	Bokerkhedi
	Miranpur	Shahajampur
	Salayanpur	Mawana
	Mawana	Parikshitgarah
	Hastinapur	Hastinapur
		Bahasuma
Plains-Deoband plains	Deoband	Deoband
	Rorkee	Rorkee
	Manglaur	Landhaura
		Manglaur
Saharanpur Plains	Saharanpur	Chilkana Sultanpur
	Nakur	Nakur
	Rampur Maniharan	Sarsawan
	Gangoah	Ambehta
		Gangoah
		Titron
		Nanauta
		Saharanpur
		Behat
		Rampur Maniharan
Muzaffarnagar Plains	Khatauli	Khatauli
	Muzaffarnagar	Purqazi
		Muzaffarnagar

Table: 2.8 cont.....

Shamli Plains	Shamli	Jalalabad
	Kairana	Thana Bhawan
	Khandhal	Garhi Pukhta
		Kairana
		Shamali
		Khandala
		Sisauli
		Bhudana
		Chatarwal
		Shahapur
Bijnor Plains	Mandawar	Sahanpur
	Kiratpur	Jalalabad
	Bijnor	Kiratpur
	Naziabad	Mandawar
	Chandpur	Bijnor
		Jhalu
Upper Ramganga plains	Nagina	Maldar
	Seohara	Chandpur
	Dhampur	Nazibabad
	Nehitaur	Nagina
	Tajpur	Nehtaur
		Dhampur
		Tajpur
Hindan Plains	Aminagar Sarai	Noorpur
	Baraut	Seohara
		Sahaspar
		Tikri
		Deoghat
Meerut Plains	Sardhana	Aminagar Sarai
	Meerut	Laranwal
		Baraut
		Khehra
		Sardhana
		Lawar
		Phalausda
		Daurala
	Meerut	
	Sewel khas	

Table: 2.8 cont.....

Hindan Plains	Kanker Khera	Kanker Khera
	Rasulpur Dhulri	Rasulpur Dhulri
		Kaithaur
		Kharkhoda
		Patala
Hapur Plains	Faridnagar	Faridnagar
	Muradnagar	Muradnagar
	Pilkhuwa	Pilkhuwa
	Modinagar	Modinagar
	Hapur	Hapur
		Dadri
		Niwadi
		Babugarh
		Kalchhina
		Rori
		Dasna
	Dujna	
	Bishokar	
Upper Ramganga Plains	Kanth	Kanth
	Moradabad	Moradabad
		Umri Kalan
		Bhojpur Dharampur
Sambhal Plains	Bilari	Bilari
	Chandausi	Chandausi
	Bahjoi	Bahjoi
	Rustamnagar Sahaspur	Rustamnagar Sahaspur
		Kundarki
		Narauli
Amroha Plains		Sirsi
	Dhanaura	Dhanaura
	Hasanpur	Hasanpur
	Sambhal	Sambhal
	Amroha	Amroha
		Bachharaon
		Joia
		Naugawan Sadat
		Ujhari
		Shahabad
Upper Ramganga Plains	---	
Rampur Plains	Rampur	Rampur
	Tanda	Tanda
		Kemri
		Bilaspur
		Suar
		Milak

SOURCE : CENSUS OF INDIA

As regarding class III towns, it had a share of 34.5 percent of towns and 22.8 percent of the population. But this share decreased to 18.1 percent of towns and 15 percent of the population in 1981. In the year 1991, again the number of towns increased to 26.2 percent while there was only a slight increase in population share.

In the class IV towns, the number and hence the percentage of towns have increased considerably since 1971. In 1971, the share of towns was 22.41 percent which increased to 44 percent in 1981 and 46 percent in 1991. But the population share has not increased in the same proportion, it was 7 percent in 1971, increased to 15.8 percent in 1981 but, it declined to 13.3 in 1991.

The class V towns have experienced decline both in terms of number (and percent) of towns as well as in the population since 1971. The percent share of towns decreased from 20.69 in 1971 and also 1981 to only 7.9 percent in 1991. The population share of towns in this class size was less in proportion to towns. The population was 3.49 percent in 1971 which increased slightly i.e., 4.6 percent in 1981 but declined to a meagre 1.31 percent in 1991.

The case of class VI towns is all the more interesting, inspite the increase in number of towns from 58 to 116 in 1981 and 126 in 1991, the towns in this class have decreased. There were 1.72 percent of towns in this class, this share remained the same in 1981 but declined to 0.8 percent in 1991. In terms of population share it decreased from 0.4 percent to 0.14 in 1981 and hardly 0.06 percent in 1991.

It has been observed that the concentration of population has been continuously increasing in class I towns while it has decreased in class II and class III towns. Similarly, the population share in class V and VI towns is very less and even this has declined since 1971.

2.4 (c) Change in the size of urban centres

To better understand the urbanisation trends, it is not the number of towns in which our interest lies, but in the population changes of the individual size class of towns at successive decadal intervals. (Robson 1973)⁶²

We can study this simply by observing the movement of individual centres between the six size classes in the census years 1971-1991. The range of movement of towns between size

⁶² Robson B.T - 'Urban growth an approach' Methven & Co London

classes is small, usually a town's population increases but, it remains in the same size class although its position changes from lowermost extreme of the class to the upper most limit. This happens especially at higher levels. Therefore, there was not a single case where the towns shifted from one size class to another skipping a size class in between. There is only one town, Modinagar, which moved from III size class in 1971 to class II in 1981 and class I in 1991.

There was not a single town that has changed class negatively i.e., moved from higher to lower class. In class size III, nine out of total 58 towns remained in the same class in all the three decades, however, this number was 3 in case of class IV towns and only one town each in class II and class V, remained in the same class for all the three decades.

Out of the total 37 towns that have shifted positions from one size class to another, 23 towns i.e. 62 percent have done it in 1971-81 (1981) while 14 have shifted to higher class in 1991. This also shows that there has been substantial urban growth in 1981-91 as compared to 1971-81. (This has also been observed by studying the growth rate of towns for the decades 1971-81 and 1981-91), (See appendices: 2.9)

2.4 (d) Proportion of urban population to the total population of the study Area

(i) District Level Analysis

(i) In 1971, out of the total six districts, Meerut has largest share of urban population and the area i.e 31.76 percent and 34.50 percent respectively. Meerut is followed by Moradabad which ranks second in terms of share of population (22.44 percent) but third in area (19.43 percent). Saharanpur has 18.77 percent share of population and 20.86 percent of the area of the total of the study area.

These districts are followed by Bijnor, Muzaffarnagar and Rampur which rank fourth, fifth and sixth respectively, in terms of both population and area.

In 1981, of the total seven districts, Meerut again ranked first, both in terms of population (19.84 percent) and area (20.85). It was followed by Moradabad having 19.48 percent share of population and 16.34 percent of area. Saharanpur had 16.62 percent of the population and 15.13 percent of the area. Ghaziabad, Muzaffarnagar, Bijnor and Rampur ranked fourth, fifth, sixth and seventh respectively in terms of population while in terms of area Saharnpur, Bijnor, Rampur and Muzaffarnagar ranked fourth, fifth, sixth and seventh respectively (see table2.10)

TABLE : 2.10

PROPORTION OF URBAN POPULATION IN THE STUDY AREA

DISTRICTS	1991		1981		1971	
	ABSOLUTE	PERCENT	ABSOLUTE	PERCENT	ABSOLUTE	PERCENT
BIJNOR	615352	9.75	480810	11.04	269702	10.48
MORADABAD	1139469	18.06	848666	19.48	577257	22.44
RAMPUR	392716	6.22	315107	7.23	176045	6.84
SAHARANPUR	589652	9.35	724119	16.62	482807	18.77
HARDWAR	348142	5.52	0	0.00	0	0.00
MUZAFFARNGR	699230	11.08	493985	11.34	249815	9.71
MEERUT	1276557	20.23	863966	19.84	816986	31.76
GHAZIABAD	1248260	19.78	629076	14.44	0	0.00
TOTAL	6309378	100.00	4355729	100.00	2572612	100.00
UTTAR PR.	27605915		19899115		12388596	
% OF THE STATE		22.86		21.89		20.77

SOURCE : CENSUS OF INDIA

TABLE : 2.11

DISTRICT WISE AREA : 1971-1991
(In sq. kms)

DISTRICTS	1991				1981				1971			
	TOTAL	PERCENT	URBAN	PERCENT	TOTAL	PERCENT	URBAN	PERCENT	TOTAL	PERCENT	URBAN	PERCENT
UTTAR PR.	294411.00		5603.10		294411.00		4560.40		294413.00		2845.00	
BIJNOR	4561.00	15.49	68.02	6.88	4848.00	16.46	69.50	9.75	4852.00		65.10	13.26
MORADABAD	5967.00	20.26	147.76	14.95	5967.00	20.26	116.50	16.34	5946.00	20.59	95.40	19.43
RAMPUR	2367.00	8.04	63.03	6.38	2367.00	8.04	63.00	8.83	2372.00	8.21	29.30	5.97
SAHARANPUR	3689.00	12.53	57.66	5.84	5595.00	19.00	107.90	15.13	5526.00	19.13	102.40	20.86
HARDWAR	2360.00	8.01	64.58	6.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MUZAFFARNGR	4008.00	13.61	67.87	6.87	4176.00	14.18	59.30	8.32	4245.00	14.70	29.40	5.99
MEERUT	3911.00	13.28	245.27	24.82	3911.00	13.28	148.70	20.85	5944.00	20.58	169.40	34.50
GAZIABAD	2590.00		283.93	28.73	2590.00	8.79	148.20	20.78	0.00	0.00	0.00	0.00
TO STUDY AREA	29453.00	100.00	998.12	100.00	29454.00	100.00	713.10	100.00	28885.00		491.00	100.00

In 1991 census, observing similar kind of population-area relationship, we analyse that Meerut ranked first in terms of share of population(20.23 percent) but, its share of area (24.82) decreased and it occupied second rank. Ghaziabad had 28.73 percent of the area and 19.78 percent of population to it credit. Moradabad, ranked third both in terms of population (18.06 percent) and area (14.95 percent) and Rampur ranked seventh. Bijnor had 9.75 percent share of population and 6.88 percent of area.(see table 2.11)

(ii) Regionwise Analysis

If we examine the proportion of urban population in each sub- regions to the total urban population of the study area, we find that in 1971, the highest percent of population was in plain (36 percent),followed by Yamuna Khadar which had around 28 percent of the population. The Bhabar region had approximately 16 percent of the population followed by the Bhur tract (12.7 percent). The lowest percent of population was found in the Ganga Khadar region (2.23 percent) and the Tarai (4.47 percent). Although both Ganga and Yamuna Khadar region have similar physiographic features but, it was observed that Y.Khadar had more population share than G.Khadar this may be explained by the fact that Y.Khadar is near to the national Capital Delhi and also had a good network of roadways.(see table 2.12)

TABLE : 2.12
PROPORATION OF URBAN POPULATION IN EACH SUB-REGION
TO THE TOTAL POPULATION OF THE STUDY AREAS

REGION	1971		1981		1991	
	ABSOLUTE	PERCENT	ABSOLUTE	PERCENT	ABSOLUTE	PERCENT
SHIWALIKS	--	--	--	--	--	--
BHABAR	79277	16.19	145946	3.31	187392	3.02
TARAI	21902	4.47	87292	1.98	131592	2.13
YAMUNNA KHADAR	139366	28.45	328391	7.44	748168	12.09
GANGA KHADAR	10931	2.23	17914	0.40	46337	0.75
BHUR TRACT	62251	12.71	116985	2.65	152631	2.47
PLAIN	176045	35.94	3717404	84.22	4923002	79.54
TOTAL	489772	100.00	4413932	100.00	6189122	100.00

Source : Census of India

2.5 GROWTH RATE OF URBAN POPULATION

2.5 (a) District Wise Growth Rate

Observing the growth rate of urban population district wise, we analyse that during 1971-81, Muzaffarnagar district experienced highest growth of 97.70 percent followed by Ghaziabad (90.5 percent). Lowest growth rate of the decade was observed in Moradabad (47 percent) followed by Saharanpur (48.7 percent). The growth rate of the districts Bijnor, Rampur, Hardwar and Meerut were 78.3 percent, 99 percent, 52.2 percent and 74.5 percent respectively. (See table2.13)

TABLE :2.13

DISTRICTWISE PERCENT DECADAL GROWTH RATE

DISTRICTS	ABSOLUTE	%G.R	ABSOLUTE	%G.R	ABSOLUTE
	1991	1981-91	1981	1971-81	1971
BIJNOR	615352	27.98	480810	78.27	269702
MORADABAD	1139469	34.27	848666	47.02	577257
RAMPUR	392716	24.63	315107	78.99	176045
SAHARANPUR	589652	-18.57	724119	49.98	482807
HARDWAR	348142	0.00	0	0.00	0
MUZAFFARNGR	699230	41.55	493985	97.74	249815
MEERUT	1276557	47.76	863966	5.75	816986
GHAZIABAD	1248260	98.43	629076	0.00	0
TOTAL	6309378	44.85	4355729	69.31	2572612
UTTAR PR.	27605915	38.73	19899115	60.62	12388596

SOURCE : CENSUS OF INDIA

For the decade 1981-91, the decadal variation of the urban population for all the districts decreased comparatively, except for Ghaziabad which experienced the growth of 98.43 percent. The growth rate was negative for Saharanpur (-18 percent) and it was followed by Rampur (24.63 percent) and Bijnor (28 percent).

Moradabad had growth rate of 34 percent while for Hardwar, Muzaffarnagar and Meerut it was 31.7, 41.55 and 47.76 percent respectively. In 1981-91, again the growth rate of Ghaziabad remained the highest as more and more urban centres were included.

For the decade 1971-81, five districts namely Bijnor, Rampur, Muzaffarnagar, Meerut and Ghaziabad had their growth rate above the state average of 60.6 percent while, in 1981-91 only three districts, Muzaffarnagar, Meerut and Ghaziabad had their decadal growth rate above the state average of 38.7 percent.

Thus, it was seen that the decennial growth rate of urban population has decreased during the decade 1981-91, as compared to 1971-81, not only for the state as a whole but, also for all the districts of the study area, except Ghaziabad.

2.5(b) Growth Rate of Population in various Towns

The growth rate of population in various towns is shown in the table 2.14. The table reveals that in all, there were only 17 towns which had experienced an increase from 1971-81 to 1981-91 while, 35 towns had experienced a decline in growth rate during the same period.

Out of the total 54 towns considered during 1971-81, three towns had their growth below 25 percent, forty three towns had it between 50-75 percent while only two (2) towns had their growth rate between 75-100 percent. There were three towns, namely Bilari, Ghaziabad and Modinagar which experienced more than 100 percent growth. During 1981-91 there were eight (8) urban centres having growth rate below 25 percent while thirty nine (39) towns had experienced growth rate between 25-50 percent. Four towns namely, Thakurdwara, Meerut, Shahjahanpur and Muradnagar had their growth from 50-75 percent. Ghaziabad is the only urban centre having growth rate between 75-100 percent. However, there was not a single town having the growth rate above 100 percent during the decade 1981-91.

2.5 (c) Region wise Growth Rate of Population (1971-1991)

It has been observed that the growth rate in the sub-regions was much higher in 1971-81 than during 1981-91. But there was no set pattern in the decades i.e. the growth rate was haphazard among various sub regions. In 1971-81, the highest growth was observed in Tarai. It was 298.56 percent. Bhur tract was second in terms of growth, it had a growth rate of 145.18 percent, it was followed by the Yamuna Khadar, which had a growth rate of 135.63 percent. Lowest growth was observed in Ganga Khadar (63.8 percent). During 1981-91, it was the Ganga Khadar region which had experienced highest growth rate. It was

TABLE: 2.14

GROWTH RATE OF TOWNS 1971-81 TO 1981-91

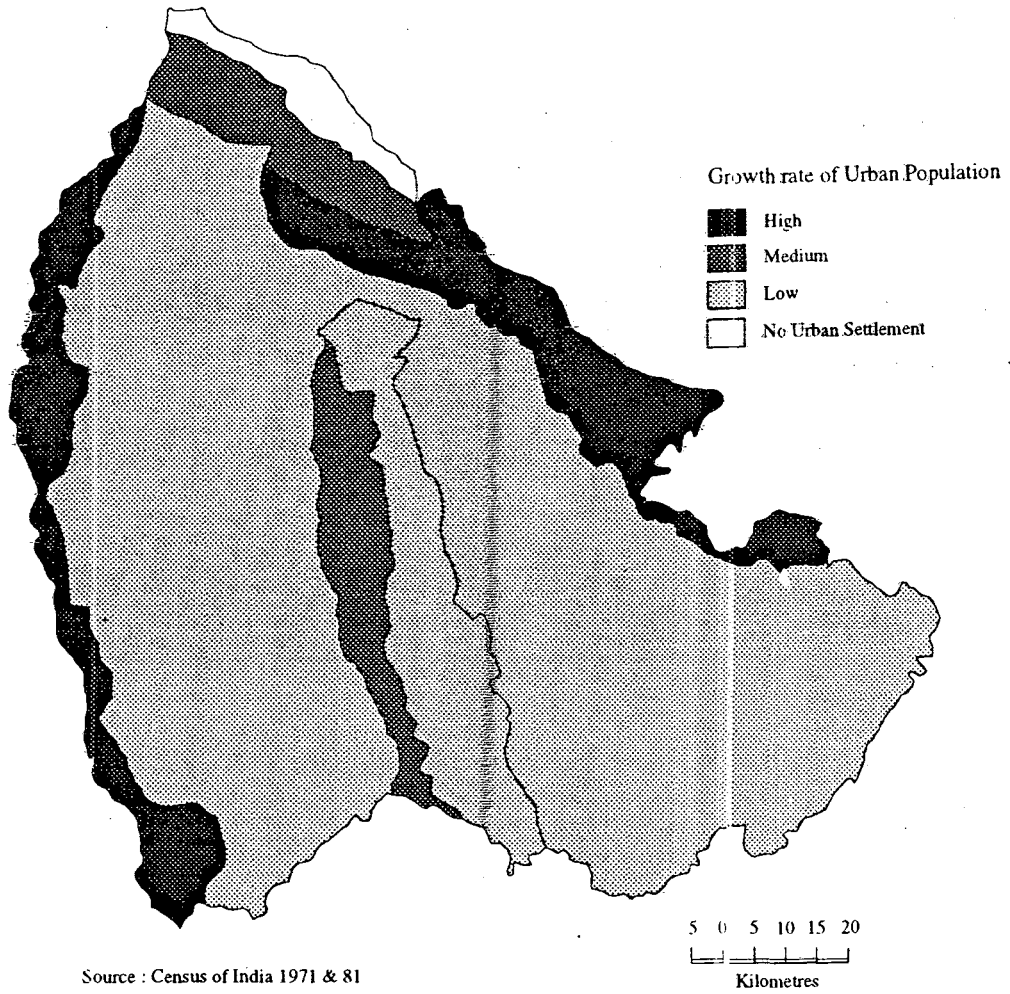
CLASS (In Percent)		1971-81		1981-91
BELOW 25		Mandawar Sahajanpur Aminagar Sarai		Nazibabad Nagina Seohara Chandausi Amroha Rampur Rorkee Aminagar Sarai
25 to 50	Nazibabad Nagina Chandpur Kiratpur Seohara Dhampur Nehtaur Afzalgarh Tajpur Bijnor Chandausi Hasanpur Bahajoi Kanth Dhanaura Moradabad	Sambhal Amroha Tanda Rampur Deoband Gangoah Rampur Maniharan Nakur Saharanpur Manglaur Rorkee Shamli Kairana Khatauli Khandala Miranpur Jansath Muzafernagar Baraut Sardhana Bagpath Hastinapur Meerut Kankerkhera Ordinance factory Muradnagar Hapur	Hasanpur Mandawar Dhampur Kanth Moradabad Sambhal Tanda Rampur Maniharan Manglaur Khatauli Khandala Miranpur Jansath Sardhana	Chandpur Kiratpur Nehtaur Afzalgarh Tajpur Bijnor Bahjoi Dhanura Bilari Deoband Gangoh Nakur Saharanpur Hardwar Shamli Kairana Mawana Bagpat Hastinapur Garhmukteshwar Pilkua Hapur Modinagar
50 to 75	Mawana Garhmukteshwar Pilkua		Thakurdwar Meerut Shahjanpur	Muradnagar
75 to 100	Hardwar Muradnagar			Gaziabad
ABOVE 100	Bilari Gaziabad Modinagar			

SOURCE : CENSUS OF INDIA

Regionwise Growth Rate of Urban Population

in Northern Upper Ganga Plain

1971-81



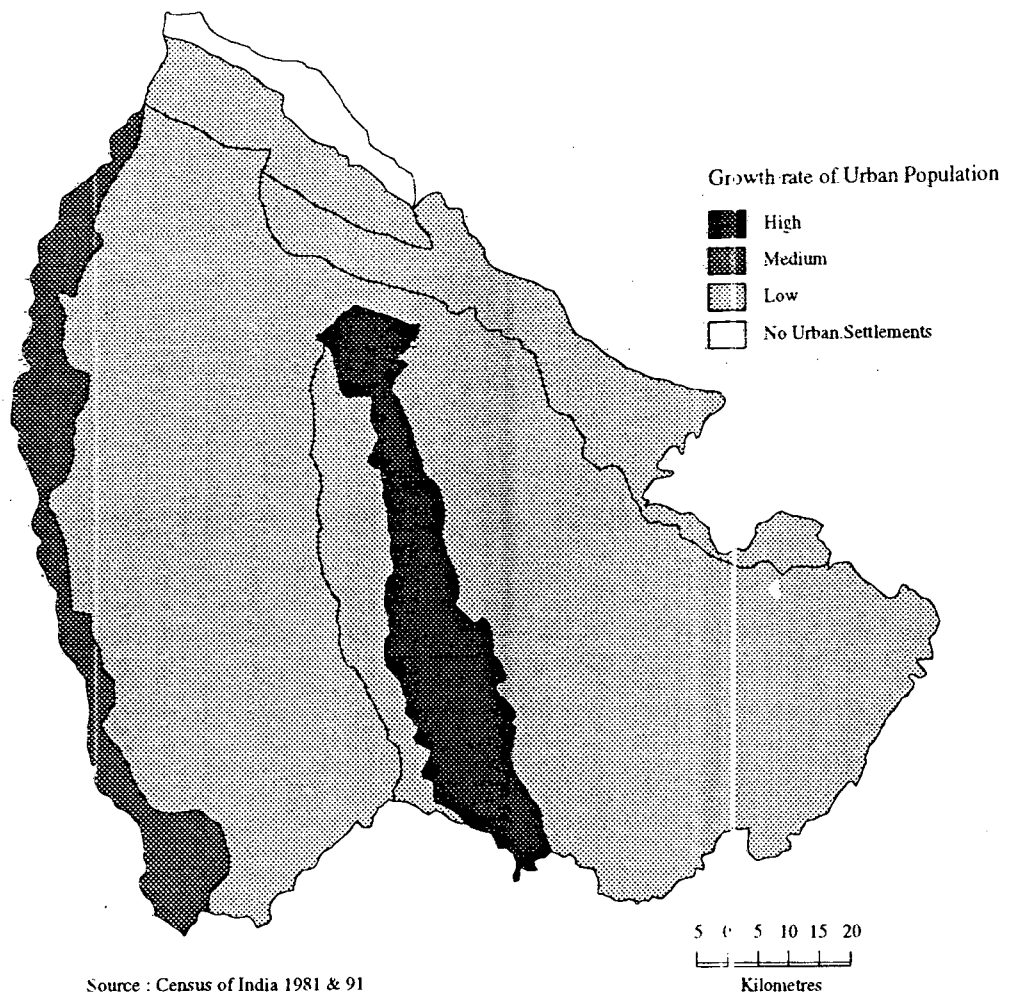
Source : Census of India 1971 & 81

(FIG.23)

Regionwise Growth Rate of Urban Population

in Northern Upper Ganga Plain

1981-91



Source : Census of India 1981 & 91
Series 22 Part II-A

(FIG.2.4)

followed by Yamuna Khadar (127.8 percent). The lowest growth in 1981-91 was observed in the Babhar region. (see fig.2.3 & 2.4 and table2.15)

TABLE :2.15
REGION WISE GROWTH RATE (1971-1991)
(IN PER CENT)

REGION	1971-81	1981-91
SHIWALIKS	-	-
BHABAR	84.10	24.40
TARAI	298.56	50.75
YAMMUNA KHADAR	135.63	127.83
GANGA KHADAR	63.79	158.66
BHUR TRACT	145.19	30.47
PLAIN	66.82	40.22

Source : Census of India

2.6 DENSITY OF POPULATION (1971-1991)

2.6 (a) Density of population in urban centres (1971-1991)

The density of population gives the number of persons per unit of area. In this study, we have examined the density of population in various towns of the study area for three decades viz. 1971, 1981 and 1991. We have categorised them into five classes as shown -

- i. Density less than 2500 persons/km²
- ii. Density between 2501-5000 persons/km²
- iii. Density between 5001-10,000 person/km²
- iv. Density between 10,001-25,000 person/km²
- v. Density above 25001 person/km²

(i) Density below 2500 persons/km² In 1971, there were 12 (twelve) towns in this class, the number increased to 14 (fourteen) towns in 1981 and to 18 (eighteen) in 1991. In the 12 towns in 1971 there were three towns which had their density of population below 1000 persons/km². These towns were Seohara (839), Rasulpur Dhulri (709) and Garhmukteshwar (704).

In 1981, there were four towns having their population density below 1000 persons/km². These towns were Joya (703), Garhmukteshwar (560), Babugarh (445) and Ordnance factory Muradnagar (359). The towns having their population density below 1000, in 1991 were only two, namely Bahsuma (954) and Garhmukteshwar (789). Garhmukteshwar had its population density very low in all the three decades owing to its large area but low population. The reason for this can be because of its location in the unsuitable Bhur tract.

(ii) Density between 2,501 to 5,000 There were 14 (fourteen) towns in this class in 1971, the number increased to thirty one in 1981 and to thirty four in 1991.

(iii) Density between 5,001 to 10,000 There were fifteen towns in this class during 1971. The number of towns increased to thirty in 1981 and thirty six in 1991.

(iv) Density between 10,001 to 25,000 This class had fifteen towns in 1971 however, the number of towns increased to thirty five in 1981. The number of towns decreased to thirty two in 1991.

(v) Density of population above 25,001 This class had least number of towns. There were only four towns in 1971, the number of towns increased to six each in 1981 and 1991. There was a large gap within the class in all the three decades.

In 1971, out of the total four towns, Muradnagar had a population density of 25,898 persons/km², followed by Miranpur (26,453). Nakur had a population density of 32,192 persons/km². Then there was a large gap and Sardhana had the highest density in 1971. Its population density was 64,950 persons/km².

In 1981, there were six towns in this class Kundarki had the highest population density of 97,792 persons/km² followed by Jhabrera (60,589). Nakur had a population density of 44,727 persons/km², while the remaining three towns namely Suar, Chandpur and Chilkana Sultanpur, had their population density 27657, 27159 and 26854 persons/km² respectively.

In 1991, there were seven towns having a very high population density. Jhabrera had the highest density (84,811 persons/km²)

It was observed that Nakur had a very high density of population in all the three decades. Similarly, Suar and Jhabrera were in this class since the last two decades. All the towns in

this category were either small or medium towns. The reason for very high density of population in these towns may be because their area was very less, and has remained unchanged since 1971, while their population grew considerably. (table2.16)

TABLE : 2.16

DENSITY OF POPULATION IN URBAN CENTRES (1971-91)

CLASS PERSONS/ Sq. Kms	NUMBER OF TOWNS IN EACH CLASS		
	1971	1981	1991
Below 2500	12	14	18
2501 to 5000	14	31	34
5001 to 10000	15	30	36
10001 to 25000	14	35	32
25001 and Above	4	6	6
Total	59	116	126

Source : Census of India

2.6 (b) Region wise density of Population

If we study the average density of population in various sub-regions, we find that in all the three decades, plain had the highest density, while the Ganga Khadar region was the region of lowest density in the study area.

In 1971, the plain had highest density of 6046 persons per sq. km followed by the Bhabar region (5261 persons/km²). The Bhur tract had the density of 4988 persons/km². The Ganga Khadar region had the lowest density (704 persons/km²) (see fig. 2.5)

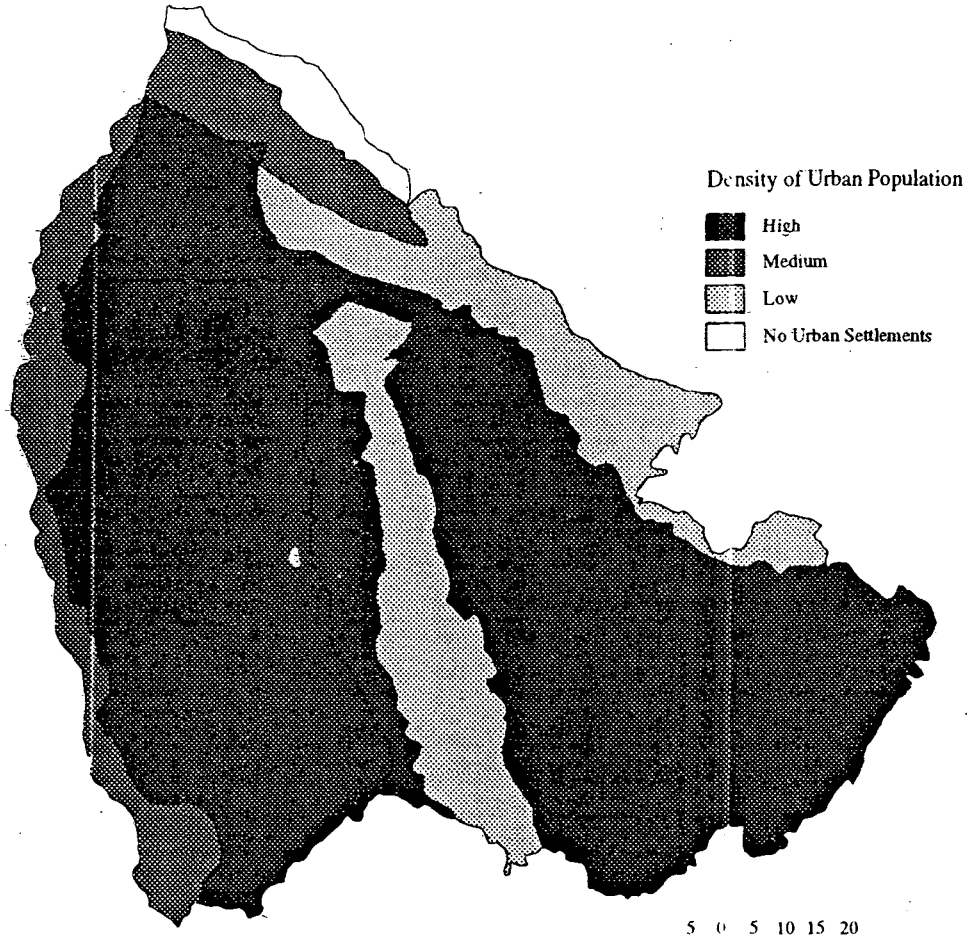
In 1981, too the plain had the highest density (7173 persons/km²), they were followed by the Bhur tract (5592 persons/km²). Again it was the Ganga Khadar region having the lowest density, (see fig.2.6)

In 1991, although the plain had the highest density (6856 persons/km²) but it has decreased considerably since 1971. The reasons attributed for this decrease may be that the growth rate of population has decreased to one third (i.e. from 111.28 in 1971-81 to 40.22 in 1981-91) (see fig.2.7 and table2.17)

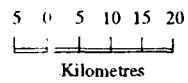
Regionwise Density of Urban Population

in Northern Upper Ganga Plain

1971



Source : Census of India 1971
Series 21 Part II-A

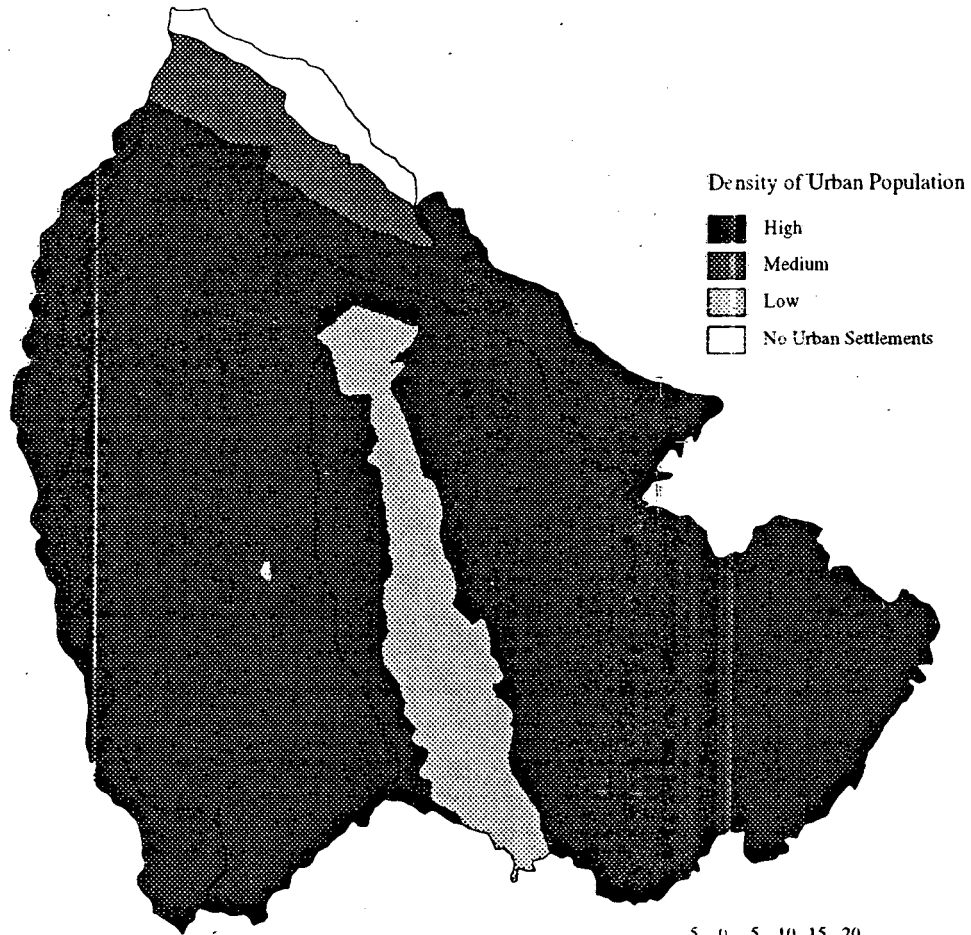


(FIG.2.5)

Regionwise Density of Urban Population

in Northern Upper Ganga Plain

1981



5 0 5 10 15 20
Kilometres

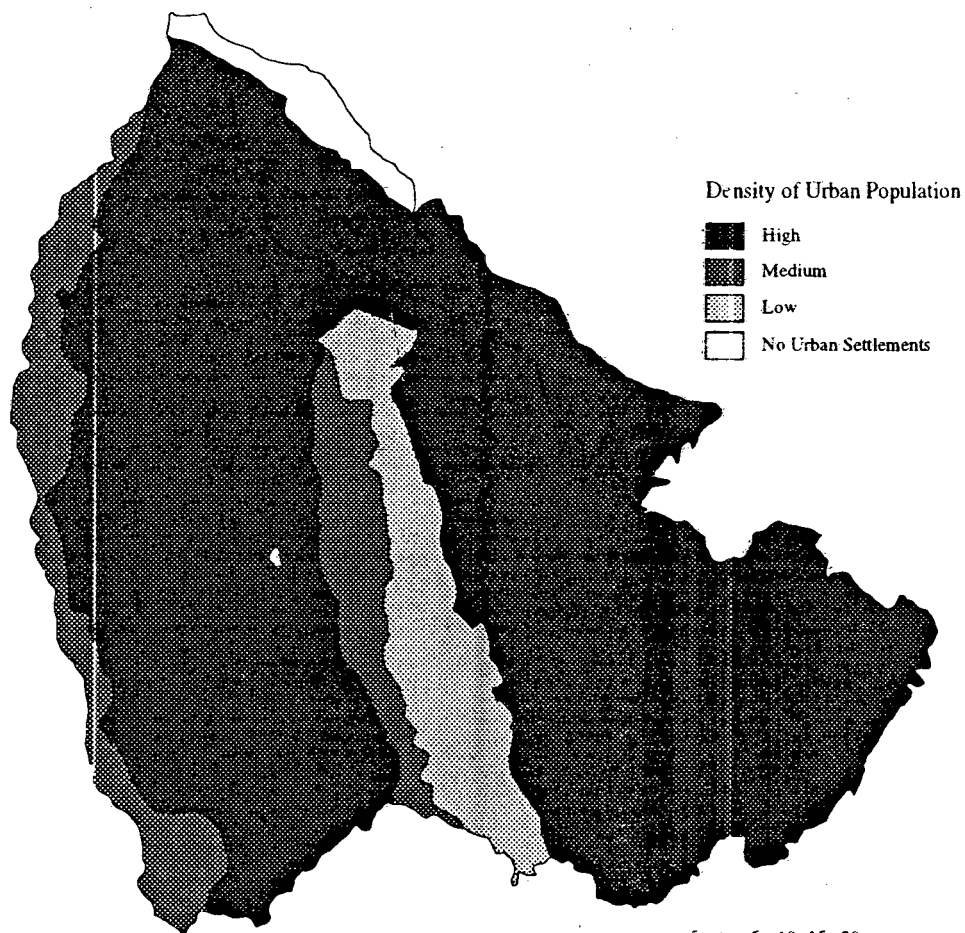
Source : Census of India 1981
Series 22 Part II-A

(FIG.2.6)

Regionwise Density of Urban Population

in Northern Upper Ganga Plain

1991



Source : Census of India 1991
Series 22 Part II-A

5 0 5 10 15 20
Kilometres

(FIG.2.7)

TABLE : 2.17

REGION WISE DENSITY OF POPULATION (1971-1991)

REGION	1971	1981	1991
SHIWALIKS	-	-	-
BHABAR	5261	3474	6554
TARAI	2532	5174	6524
YAMUNA KHADAR	3607	4537	4146
GANGA KHADAR	704	560	1003
BHUR TRACT	4988	5592	4858
PLAIN	6046	7173	6856

Source : Census of India

2.7 SPATIAL DISTRIBUTION OF TOWNS

The distribution of urban centres of varying sizes at different distances in a region is said to have certain relationship, which are to be constant under ideal theoretical conditions. A number of attempts have been made by scholars all over the world to formulate certain rules regarding the relationship between the spacing or distribution of urban centres, the population size and rank on one hand and the amenities available in an urban centre and the hierarchical order (in terms of spacing and size) on the other.

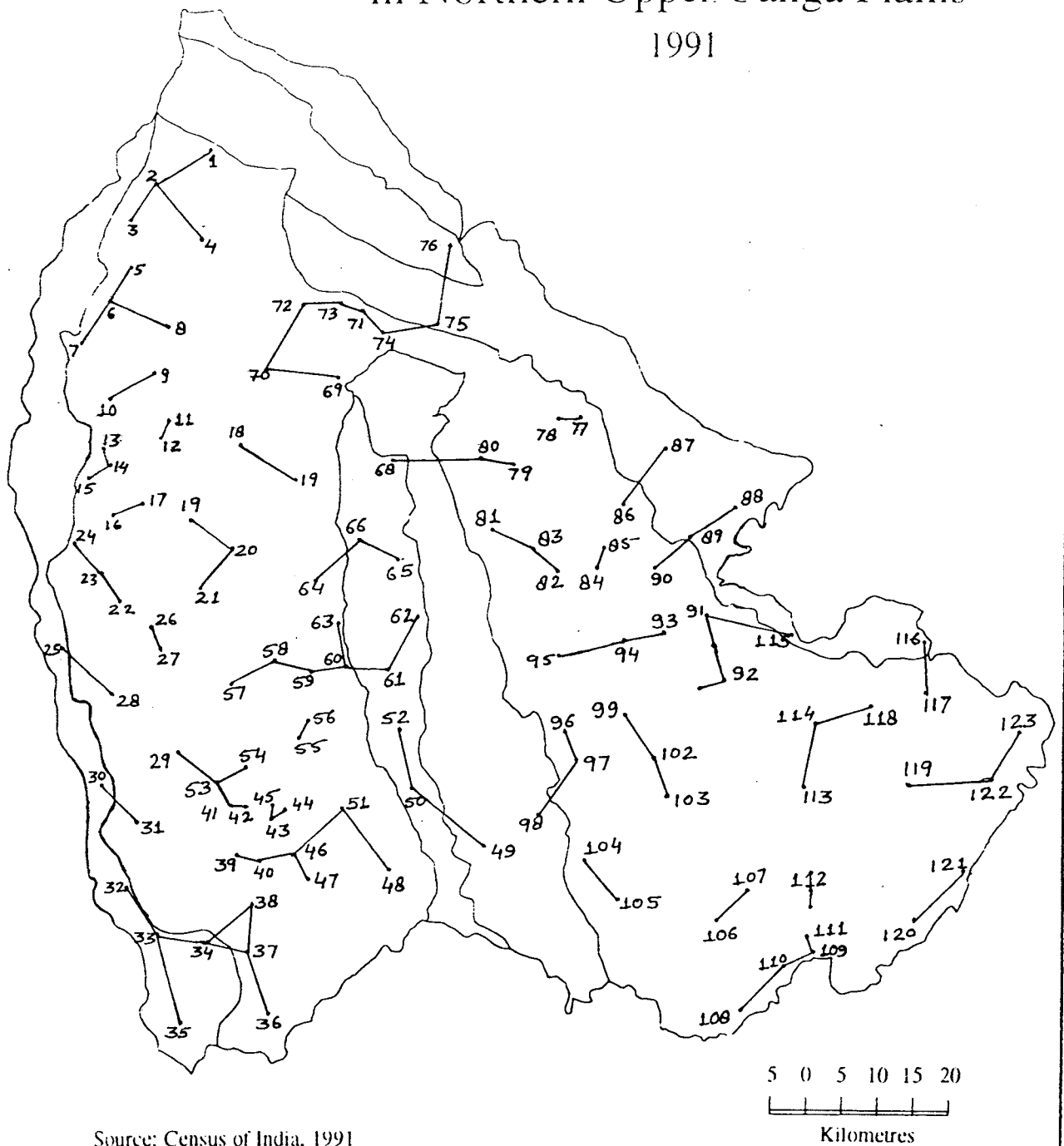
Supposing that such theorizations provide a useful means for urban analysis, an attempt is made in this chapter to examine the distributional pattern or spacing of urban centres using nearest neighbour technique. Rank size relationship has also been observed.

2.7 (a) Nearest Neighbourhood Analysis

Quantitative techniques are appropriate methods for quantification of geographical aspects and data. One such technique is nearest neighbourhood model. This technique was originally developed by plant ecologists, Clark and Evans⁶³, who were concerned with the distribution pattern of various plant species over the surface of the earth. Later M.F. Dacey followed this method in a geographical context.

Nearest Neighbour Distance of Towns in Northern Upper Ganga Plains

1991



(FIG.2.8)

This technique is a measurement of distance from an individual to its nearest neighbour irrespective of direction. The model indicates the degree to which any observed distribution of points deviate from what might be expected, if the points were distributed in a random manner within the same area. (A random distribution of points is defined as a set of points on a given area for which any point has had the same chance of occurring on any sub area as any other point). In our study the nearest neighbour Technique is used to analyse -

(a) The distribution of urban centres i.e. to test as to what extent a specific regional distribution of the urban settlements is random. This analysis has been done for all settlements, as well as class wise distribution of urban settlements is also seen.

Methodology

The following formula is used for measuring the distances -

$$R = \frac{\bar{r}_a}{\bar{r}_e}$$

where -

R = The measure of degree to which the observed distribution departs from random expectation with respect to the distance to nearest neighbour.

\bar{r}_a = mean of the series of distance to nearest neighbour i.e. observed distance in a given area.

$$\bar{r}_a = \frac{\sum r}{N}$$

\bar{r}_e = The mean distance to nearest neighbour expected in a given area assuming that the settlements are equally distributed.

⁶³ Clark P.J. and Evans F.C. "Distance to nearest neighbour as a measure of spatial relations" Ecology, vol. xxxv (1954) p445-453

i.e.,

$$\bar{r}_e = \frac{1}{2\sqrt{P}} \quad \text{where } P = \frac{N}{A}$$

P = Density of settlements.

N = Number of settlements in the observed sample

A = Area of the region or a geographical area

Hence, the ratio of the observed mean (\bar{r}_a) to the expected value (\bar{r}_e) is termed as (R) nearest neighbour statistic; which can be found out for any of the regions to study the nature of pattern of urban centres. This R value ranges from 0.0 (completely clustered) through 1 (random) to 2.149 (ideal hexagonal lattice)

Analysis - The R value has been worked out for our study area. The steps for calculation are as follows -

- (a) All the urban centres are taken into account and for each settlement its nearest neighbour is identified.
- (b) The distance to the nearest neighbour is measured on a map using direct distance.
- (c) This map distance is converted into ground distance using R.F. scale.
- (d) The arithmetic mean (\bar{r}_a) is calculated using the nearest neighbour distance of all the settlements of the study area. (See Appendix 2.5)
- (e) And finally the following values are obtained which are put in the formula.

As we know

$$R = \frac{\bar{r}_a}{\bar{r}_e}$$

$$\text{where } \bar{r}_a = \frac{\text{Sum of actual distance between points in a given area}}{\text{Total number of settlements}}$$

$$= \frac{765.8325}{123}$$

$$\text{and } \bar{r}_e = \frac{1}{2\sqrt{P}} \quad \text{where } P = \frac{N}{A}$$

$$P = \frac{\text{Total settlements}}{\text{Total area of the region}}$$

$$P = \frac{123}{29453}$$

$$R = \frac{1}{2\sqrt{(123/29453)}}$$

$$R = \frac{6.226280488}{\frac{1}{2\sqrt{4.176145045 \times 10^{-03}}}}$$

$$R = \frac{6.226280488}{\frac{1}{2 \times 0.064623099}}$$

$$R = \frac{6.226280488}{\frac{1}{0.129246199}}$$

$$R = \frac{6.226280488}{7.737171443}$$

$$R = 0.8047$$

Hence the value of $R = 0.8047$ indicating a distribution more random than regular.

2.7 (b) Rank size Distribution

The '*rank-size rule*' was first propounded during the first quarter of the present century. Though the geographical interest in the size distribution or rank size regularity owes much to Zipf's National Unity and Disunity, yet as Rosing (1966)⁶⁴ has remarked, Zipf was by no means the first person to point towards the regularity of city sizes. Auerbach (1913)⁶⁵ was perhaps the first scholar to record (in 1913), the existence of a regular relationship between the size of urban centres and their ranks. He was of the opinion that the population of the n^{th} city was $1/n^{\text{th}}$ the size of the largest city. But it was later in 1941 that it was popularised by Zipf's (1941) ⁶⁶"National Unity and Disunity" which is an investigative hypothesis, a theoretical modal or a norm to express the relationships of the empirical regularity in the urban centres. Investigations made by various scholars also indicate that a regular pattern of relationship between the rank and size of urban centres do persist. Very often a region or a large area contains a large number of small towns, lesser number of medium size towns and

⁶⁴ Rosing K.E " A rejection of the Zipf model (rank size rule) in relation to city size" Professional Geographer, vol.18, 1966

⁶⁵ Auerbach, " Das Gesepz Der Bevolkerunges Konzentration, Petermann Mitt, vol. 59. no.1, 1913 (As quoted by U.P Shahi in ' Urbanisation in the Gujarat, A Geographical Analysis, 1989.

⁶⁶ Zipf G.K, "National Unity and Disunity", Bloomington, 1941

a very few large cities. This pattern of distribution has been observed to be quite regular in many areas and regions of the world, though a perfect explanation of the rank size regularity is missing. The observation of the relationship between size and rank has encouraged both to initiate and to verify the theory. According to Zipf, if urban centres of a country or a region are arranged in order of size and if P_r is the population of the r^{th} ranked city and P_1 is the population of the largest city, their size can be described by the simple expression i.e.

$P_r = P_1 \cdot r^{-1}$, in other words, the second largest will have about half the population of the largest city, the third city about one-third of the largest city and the n^{th} rank city will be one n^{th} the size of the largest city.

On the other hand according to this rule the population of a town is related with its rank in the following form of Pareto's⁶⁷ distribution

$$P_r = KR^{-b}$$

Where,

P_r = The population of the town whose rank is R .

While K and b are the constants

This relationship gets transformed into the following linear form after taking the logarithms of both the sides.

$$Y = a - bx \quad \text{where } Y = \log P_r$$

$$X = \log r$$

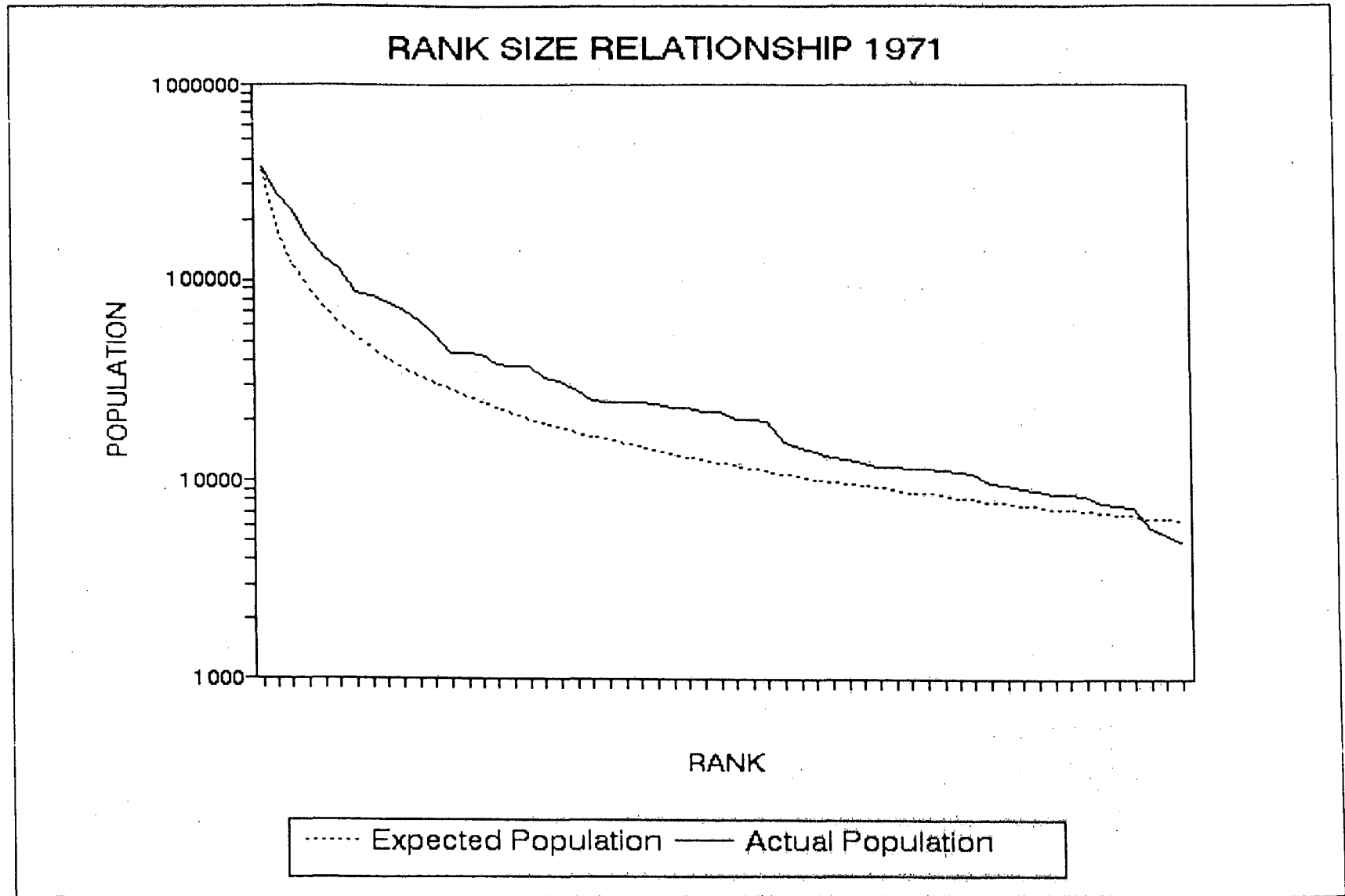
$$a = \log k$$

or $a = Y - bx$ and

$$b = \frac{\sum XY - X \cdot \sum Y}{\sum X^2 - \frac{(\sum X)^2}{n}}$$

$$k = \text{Antilog of 'a'}$$

⁶⁷ Mahmood, Aslam. "Statistical Methods in Geographical Studies", Rajesh Publications, New Delhi, 1997, pp. 77-81.



(Fig. 2.9)

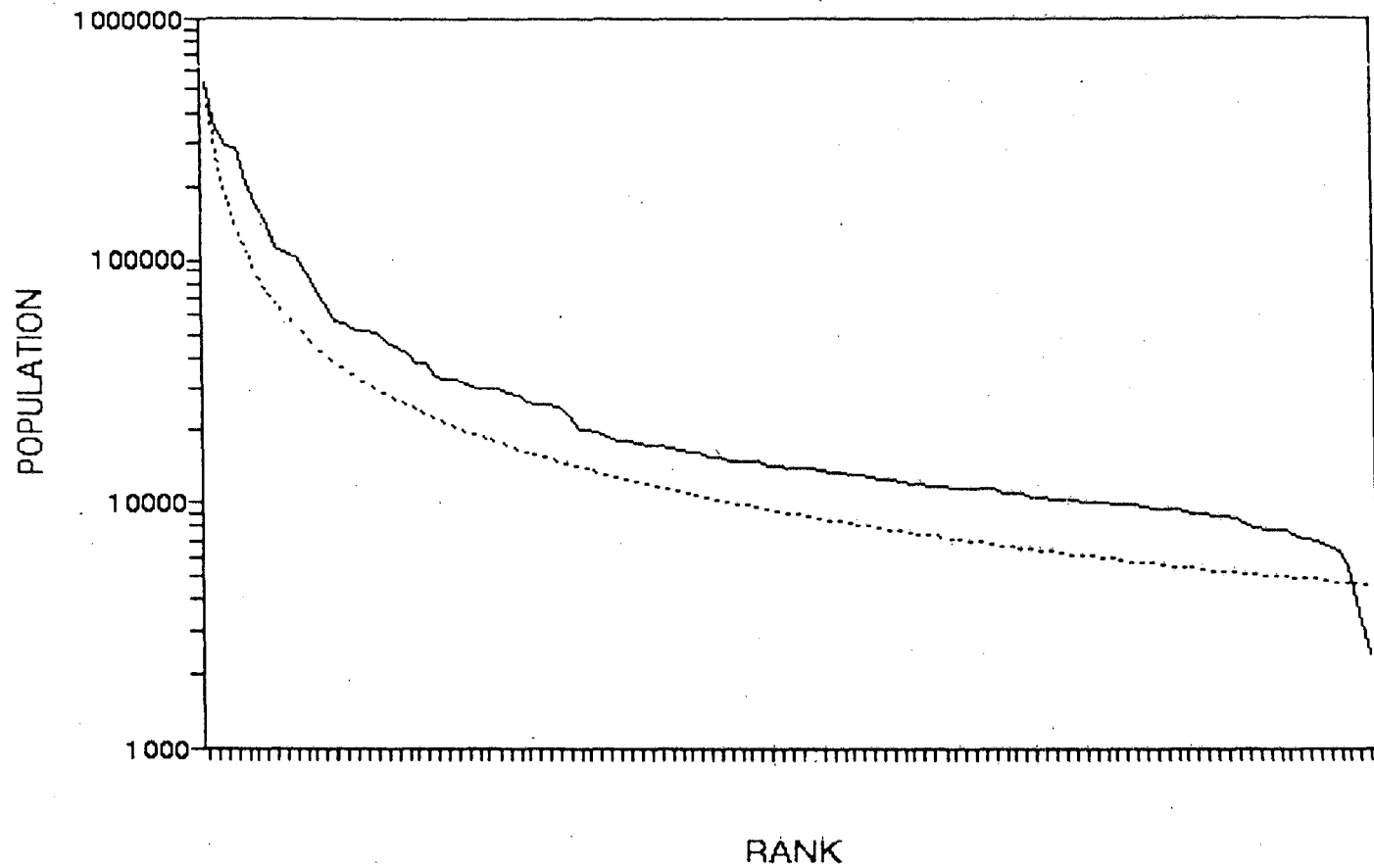
TABLE. 2-18
DISTRIBUTION OF TOWNS BY RANK SIZE 1971

TOWN/CITY/U.A	POPULATION	RANK	RECIPROCAL
Meerut U.A.	367754	1	367754
Moradabad U.A.	272652	2	183877
Saharanpur M.B.	225396	3	122585
Rampur M.B.	161417	4	91939
Ghaziabad U.A.	127700	5	73551
Muzaffarnagar U.A.	114783	6	61292
Sambhal M.B.	86323	7	52536
Amroha M.B.	82702	8	45969
Hardwar U.A.	79277	9	40862
Hapur M.B.	71266	10	36775
Roorkee U.A.	62456	11	33432
Chandausi M.B.	53393	12	30646
Modinagar U.A.	43470	13	28289
Bijnor U.A.	43290	14	26268
Najibabad M.B.	42586	15	24517
Deoband M.B.	38194	16	22985
Nagina M.B.	37066	17	21633
Shamli M.B.	36959	18	20431
Kairana M.B.	32354	19	19355
Baraut M.B.	31264	20	18388
Chandpur M.B.	28179	21	17512
Kiratpur M.B.	25147	22	16716
Mawana M.B.	24858	23	15989
Khatauli M.B.	24495	24	15323
Gangoh M.B.	24300	25	14710
Pilkhua M.B.	23941	26	14144
Seohara M.B.	22821	27	13621
Dhampur M.B.	22639	28	13134
Sardhana M.B.	22083	29	12681
Hasanpur M.B.	22063	30	12258
Nehtaur M.B.	20286	31	11863
Kandhla M.B.	20061	32	11492
Manglaur M.B.	19723	33	11144
Kankar Khera	15352	34	10816
Tanda M.B.	14628	35	10507

Muradnagar M.B.	13985	36	10215
Rampur Maniharan T.A.	12997	37	9939
Miranpur T.A.	12962	38	9678
Kanth T.A.	12232	39	9430
Baghpat M.B.	11666	40	9194
Bilari U.A.	11620	41	8970
Malayana	11346	42	8756
Bahjoi M.B.	11334	43	8552
Thakurdwara M.B.	11137	44	8358
Garh mukteshwar	10937	45	8172
Afzalgarh M.B.	10765	46	7995
Mandawar T.A.	9648	47	7825
Kaila	9333	48	7662
Ordnance Fty. Muradnagar C.T.	9026	49	7505
Hastinapur N.A.	8889	50	7355
Dhanaura M.B.	8410	51	7211
Nakur M.B.	8370	52	7072
Jansath T.A.	8202	53	6939
Faridnagar	7541	54	6810
Shahjahanpur C.T.	7340	55	6686
Tajpur C.T.	7275	56	6567
Aminagar Sarai T.A.	5637	57	6452
Rustamnagar Sahaspur	5391	58	6341
Rasulpur Dhulri	4944	59	6233

SOURCE : CENSUS OF INDIA, 1971

RANK SIZE RELATIONSHIP 1981



..... Expected Population — Actual Population

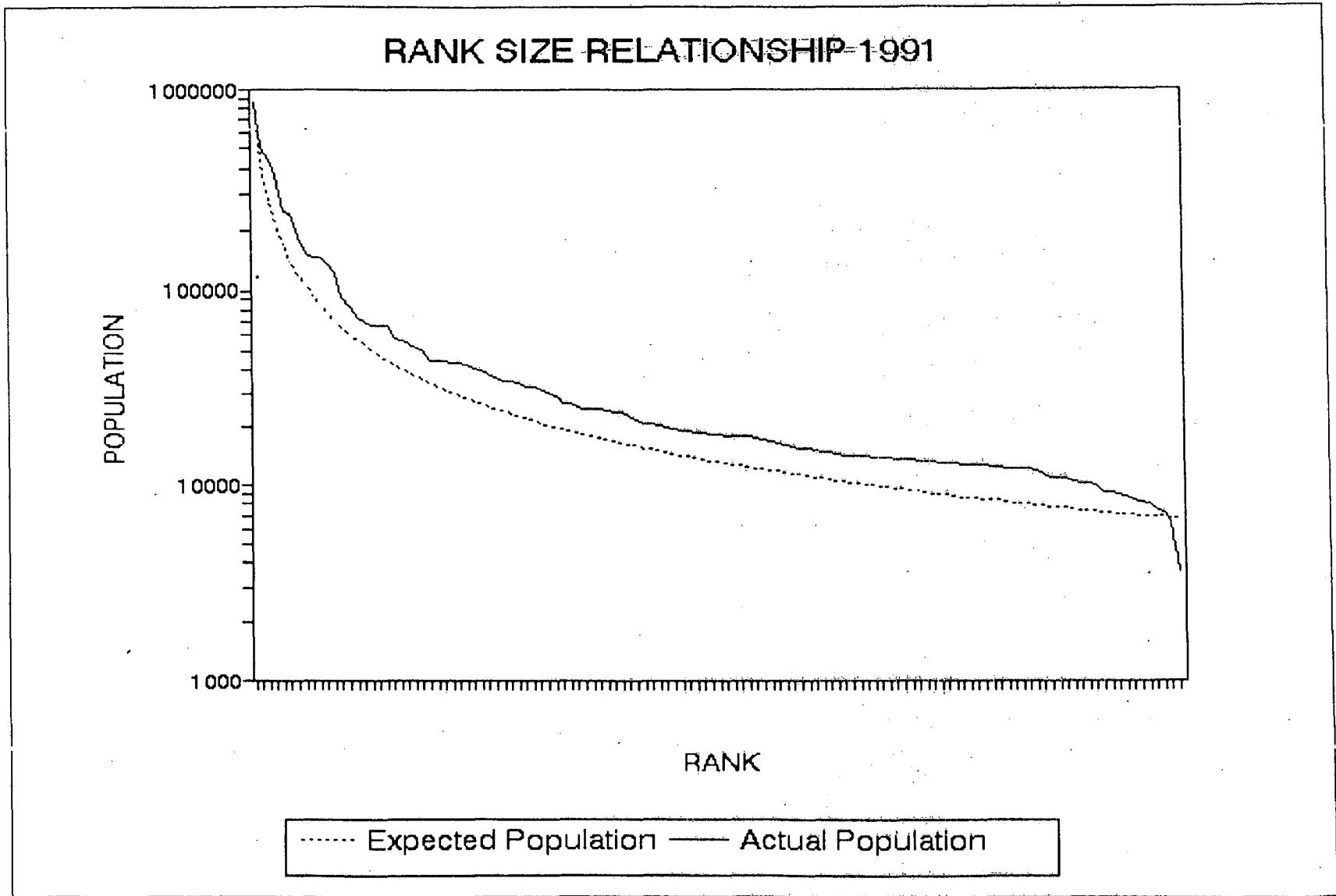
(Fig. 2.10)

TABLE . 2.19
DISTRIBUTION OF TOWNS BY RANK SIZE 1981

TOWN/CITY/U.A	POPULATION	RANK	RECIPROCAL
Meerut U.A.	536615	1	536615
Moradabad U.A.	345350	2	268308
Saharanpur M.B.	295355	3	178872
Ghaziabad U.A.	287170	4	134154
Rampur M.B.	204610	5	107323
Muzaffarnagar U.A.	171816	6	89436
Hardwar U.A.	145946	7	76659
Amroha M.B.	112682	8	67077
Sambhal M.B.	108232	9	59624
Hapur	102837	10	53662
Modinagar U.A.	87665	11	48783
Roorkee U.A.	79076	12	44718
Chandausi M.B.	66970	13	41278
Bijnor U.A.	56713	14	38330
Najibabad M.B.	55109	15	35774
Shamli M.B.	51850	16	33538
Deoband M.B.	51270	17	31566
Nagina M.B.	50405	18	29812
Baraut M.B.	46292	19	28243
Kairana M.B.	44505	20	26831
Chandpur M.B.	41552	21	25553
Pilkhua M.B.	37884	22	24392
Mawana M.B.	37620	23	23331
Sherkot M.B.	33191	24	22359
Gangoh M.B.	32713	25	21465
Kiratpur M.B.	32079	26	20639
Khatauli M.B.	31384	27	19875
Seohara M.B.	30198	28	19165
Sardhana M.B.	30138	29	18504
Hasanpur M.B.	29817	30	17887
Dhampur M.B.	29070	31	17310
Nehitaur M.B.	27621	32	16769
Muradnagar M.B.	26047	33	16261
Manglaur M.B.	25724	34	15783
Kandhla M.B.	25522	35	15332
Khokda T.A.	24984	36	14986
Bilari U.A.	23262	37	14503
Tanda M.B.	20424	38	14121
Bilaspur M.B.	20032	39	13759
Dadri M.B.	19723	40	13415
Thana Bhawan T.A.	18711	41	13088
Shahabad T.A.	18313	42	12777
Garhmukteshwar	17914	43	12479
Bachhron M.B.	17728	44	12196
Budhana T.A.	17532	45	11925
Baghat M.B.	17157	46	11666
Miranpur T.A.	17019	47	11417
Thakurdwara M.B.	16598	48	11179
Rampur Maniharan T.A.	16420	49	10951
Bahjoi M.B.	16073	50	10732

Kanth T.A.	15631	51	10522
Charthawal T.A.	15420	52	10320
Haldaur M.B.	15041	53	10125
Suar M.B.	14935	54	9937
Jalalabad T.A.	14929	55	9757
Afzalgarh M.B.	14892	56	9582
Milak M.B.	14470	57	9414
Sahaspur T.A.	14296	58	9252
Barhapur T.A.	13825	59	9095
Chhaprauli T.A.	13805	60	8944
Kithaur T.A.	13791	61	8797
Kemri T.A.	13537	62	8655
Purqazi T.A.	13412	63	8518
Naugawan Sadat N.A.	13311	64	8385
Ord. Factory Muradnagar	13147	65	8256
Sirsi N.A.	13096	66	8131
Kundarki	12713	67	8009
Noorpur M.B.	12465	68	7891
Jhahu T.A.	12461	69	7777
Bhokarhedhi T.A.	12148	70	7666
Bhojpur Dharampur T.A.	12049	71	7558
Dhanaura M.B.	11816	72	7453
Hastinapur N.A.	11637	73	7351
Nakur M.B.	11629	74	7252
Jhabra T.A.	5453	114	4707
Joya T.A.	3536	115	4666
Babugarh	2389	116	4626

SOURCE : CENSUS OF INDIA, 1981



(Fig. 2.11)

TABLE : 2.20
DISTRIBUTION OF TOWNS BY RANK
SIZE (1991)

TOWNS/CITY/U.A.	POPULATION	RANK	RECIPROCAL
Meerut U.A.	349799	1	849799
Ghaziabad U.A.	511759	2	424900
Moradabad U.A.	443701	3	283266
Saharanpur M.B.	374945	4	212450
Muzaffarnagar U.A.	247624	5	169960
Rampur M.B.	243742	6	141633
Hardwar U.A.	187392	7	121400
Sambhal M.B.	150869	8	106225
Noida C.T.	146514	9	94422
Hapur M.B.	146262	10	84980
Amroha M.B.	137061	11	77254
Modinagar U.A.	123279	12	70817
Roorkee U.A.	91139	13	65369
Chandusi M.B.	82748	14	60700
Bijnor U.A.	73900	15	56653
Shamli M.B.	70853	16	53112
Baraut M.B.	67705	17	49988
Najibabad M.B.	66860	18	47211
Deoband M.B.	66208	19	44726
Nagina M.B.	58513	20	42490
Kairana M.B.	56079	21	40467
Chandpur M.B.	55825	22	38627
Mawana M.B.	51701	23	36948
Pilkhua M.B.	50162	24	35408
Muradnagar M.B.	44395	25	33992
Khatauli M.B.	44319	26	32685
Kiratpur M.B.	43757	27	31474
Hasanpur M.B.	43383	28	30350
Sardhana M.B.	42980	29	29303
Sherkot M.B.	42230	30	28327
Gangoh M.B.	41198	31	27413
Dhampur M.B.	39179	32	26556
Seohara M.B.	37560	33	25751

Loni T.A.	36561	34	24994
Khekda T.A.	35191	35	24280
Nehtaur M.B.	34753	36	23606
Manglaur M.B.	34161	37	22968
Dadri M.B.	32883	38	22363
Kandhla M.B.	32513	39	21790
Bilari U.A.	31662	40	21245
Behra Hajipur C.T.	30360	41	20727
Tanda M.B.	29328	42	20233
Budhana T.A.	26931	43	19763
Bilaspur M.B.	26463	44	19314
Thana Bhawan T.A.	25577	45	18884
Thakurdwara M.B.	25279	46	18474
Garhmukteshwar M.B.	25241	47	18081
Shahabad T.A.	25128	48	17704
Baghpat M.B.	24939	49	17343
Bachhraon M.B.	24097	50	16996
Bachhraon M.B.	24097	51	16663
Miranpur T.A.	22796	52	16342
Bahjoi M.B.	21723	53	16034
Rampur Maniharan T.A.	21184	54	15737
Gajraula T.A.	21096	55	15451
Naugawan Sadat N.A.	20613	56	15175
Kanth T.A.	20297	57	14909
Suar M.B.	19782	58	14652
Jalalabad T.A.	19360	59	14403
Kithaur T.A.	19270	60	14163
Milak M.B.	18962	61	13931
Afzalgarh M.B.	18650	62	13706
Charthawal T.A.	18593	63	13489
Kundarki T.A.	18516	64	13278
Sirsi N.A.	18310	65	13074
Sahaspur T.A.	18198	66	12876
Bhojpur Dharampur	17996	67	12684
Barhapur T.A.	17981	68	12497
Purqazi T.A.	17752	69	12316
Kenri T.A.	17481	70	12140
Dasna T.A.	16963	71	11969
Dhanaura M.B.	16484	72	11803

Chhaprauli T.A.	16008	73	11641
Haldaur M.B.	15830	74	11484
Laksar T.A.	15622	75	11331
Mandawar T.A.	15408	76	11182
Nakur M.B.	15182	77	11036
Hastinapur N.A.	15081	78	10895
Jhalu T.A.	14808	79	10757
Behat T.A.	14569	80	10622
Lawar T.A.	14471	81	10491
Sewal Khas T.A.	14402	82	10363
Sahanpur T.A.	14299	83	10239
Ujhari T.A.	14125	84	10117
Bhokarhedi T.A.	14006	85	9998
Phalanda T.A.	13970	86	9881
Jansath T.A.	13865	87	9768
Parikshitgarh T.A.	13677	88	9657
Banat T.A.	13634	89	9548
Narauli T.A.	13630	90	9442
Sisauli T.A.	13437	91	9338
Un T.A.	13303	92	9237
Shahpur T.A.	13287	93	9138
Jhunjhana T.A.	13062	94	9040
Ailum T.A.	13044	95	8945
Nanauta T.A.	12993	96	8852
Tajpur C.T.	12898	97	8761
Ord. Fac. Muradnagar	12792	98	8671
Tikri T.A.	12784	99	8584
Chilkana Suhanpur	12647	100	8498
Jalalabad T.A.	12468	101	8414
Shahjahanpur C.T.	12443	102	8331
Pasaunda C.T.	12387	103	8250
Sarsawan T.A.	12384	104	8171
Doghat T.A.	12309	105	8093
Landhaura T.A.	12195	106	8017
Maswasi T.A.	11830	107	7942
Umri Kalan T.A.	11365	108	7869
Karnawal T.A.	11047	109	7796
Faridnagar T.A.	10940	110	7725

Mandawar T.A.	11587	75	7155
Lawar T.A.	11535	76	7061
Parikshitgarh T.A.	11328	77	6969
Tikri T.A.	11315	78	6880
Un T.A.	11302	79	6793
Behat T.A.	11076	80	6708
Sisauli T.A.	11057	81	6625
Sahanpur T.A.	11023	82	6544
Jansath T.A.	10460	83	6465
Narauli T.A.	10414	84	6388
Phalauda T.A.	10357	85	6313
Sewal Khas T.A.	10278	86	6240
Loni	10259	87	6168
Ujhari T.A.	10198	88	6098
Jhunjhana T.A.	10123	89	6029
Doghat T.A.	10019	90	5962
Chilkana Sultanpur T.A.	9936	91	5897
Karnawal T.A.	9895	92	5833
Tajpur C.T.	9721	93	5770
Jalalabad T.A.	9561	94	5709
Shahpur T.A.	9516	95	5649
Agarwal Mandi T.A.	9353	96	5590
Nanauta T.A.	9288	97	5532
Umri Kalan T.A.	9190	98	5476
Daurala T.A.	9146	99	5420
Faridnagar T.A.	9116	100	5366
Shahjahanpur C.T.	8867	101	5313
Maswasi T.A.	8786	102	5261
Kharkhoda T.A.	8708	103	5210
Landhaura T.A.	8077	104	5160
Bahsuma T.A.	7906	105	5111
Patala T.A.	7847	106	5062
Ambekta T.A.	7814	107	5015
Sarsawan T.A.	7696	108	4969
Garhi Pukhta T.A.	7279	109	4923
Niwadi T.A.	7078	110	4878
Aminagar Sarai T.A.	6837	111	4834
Titron N.A.	6646	112	4791
Abdulpur	6383	113	4749

Agarwal Mandi T.A.	10871	111	7656
Kharkhoda T.A.	10550	112	7587
Kalchhina C.T.	10373	113	7520
Ambehita T.A.	10297	114	7454
Daurala T.A.	10025	115	7390
Garhi Pukhta T.A.	9195	116	7326
Patala T.A.	9181	117	7263
Bahsuma T.A.	9060	118	7202
Niwadi T.A.	8841	119	7141
Rori C.T.	8473	120	7082
Aminagar Sarai T.A.	8274	121	7023
Titron N.A.	8045	122	6966
Jhabrera T.A.	7633	123	6909
Dujana C.T.	7313	124	6853
Joya T.A.	6514	125	6798
Babugarh T.A.	3581	126	6744

Thus, if we plot the population (P_r) of towns of an area on the Y axis and their ranks (R) on the X axis, on a double log paper, we will get a scatter diagram which will closely form a straight line having a negative slope.

Such diagram of town's population for 1971, 1981 and 1991 and their ranks, on a double log paper, are shown in the figures. These show that the size distribution of the urban centres of the study area does not conform to the rank size rule.

The Rank Size distribution in 1971 do not follow the theoretical norms given by Rank Size rule and almost all urban centres (except the three smallest towns) had their population more than the expected or theoretical rank size relationship. The three urban centres namely Aminagar Sarai, Rasulpur Dhulri and Rustamnagar Sahaspur had their actual population below the estimated population. (refer table 2.18 and (fig. 2.9)

The graphs showing the rank size distribution for 1981 (Table 2.18 and fig. 2.10) clearly indicates that here too, all the urban centres have their population above the estimated population and only two urban centres namely Joya and Babugarh (class VI) have their population below the theoretical population. The second largest city, Moradabad had a population 345350, although (theoretically) according to the rank size rule its population should have been 268308. Thus its population was more by 77042 persons.

The rank size distribution for the decade 1991 (Table 2.19 and fig. 2.11) show no conformity with the rank size rule. All the urban centres are larger in size as all of them lie above the exponential line except in two, class VI towns, where the actual population is lower than as expected by the rule.

2.8 CONCLUSION

The urban population of the study area was 25.73 lakh in 1971 which increased to 63.09 lakh in 1991. It showed an increase of approximately 2.5 times.

It was observed that the level of urbanisation was highest in Meerut in 1971 and later with the formation of Ghaziabad district, it ranked highest both in 1981 and 1991 in terms of proportion of population living in urban areas. The proximity of the district to the national

capital can be one of the factors. Muzaffarnagar has been the least urbanised district of the study area in all the three decades. The district has pronounced agricultural character.

Examining the district wise growth rate it was seen that Muzaffarnagar had the highest growth rate in 1971-81 followed by Ghaziabad. In 1981-91, Ghaziabad experienced highest growth rate. On an average, the growth rate of population decreased from 69.3 percent to 44.85 percent from 1971-81 to 1981-91. Ghaziabad was the only exception where the growth rate increased, otherwise all the districts experienced lower growth rates. In district Saharanpur, there was negative growth, where the population declined. This can be attributed to the formation of a new district Hardwar in 1991, wherein, whole of Roorkee tehsil was transferred from Saharanpur to form the new district.

Only 17 towns had shown an increase in their growth rates in both the decades. Not a single class V or VI town registered any increase. Many of the towns showing increase were class III towns. Also, three of class I towns, namely Meerut, Moradabad and Sambhal showed increase in their growth rate from 1971-81 to 1981-91. As many as 14.8 percent of towns showed more than 50 percent increase in their population in 1971-81 while only 9.25 percent towns showed more than 50 percent increase in 1981-91.

Analysing the growth rate of population regionwise, we observed that in 1971-81 the Tarai region experienced highest growth (298.56 percent) which was followed by the Yamuna Khadar (135.6 percent). The plain had the growth rate of 111.28 percent. The Ganga Khadar had lowest growth rate (64 percent approx.).

In 1981 - 91 the order was reversed, the Ganga khadar region had the highest growth rate i.e., 159 percent followed by the Yamuna khadar (128 percent). The Bhabar region had least growth (24 percent).

As for the density, all the urban agglomerations had low population density this was because of the fact that the area considered for these towns was of the main town and its outgrowths and thus it reduced the density of population. Apart from this the general trend was that the density decreased as we moved from class II towns towards the lower classes. It was observed that the towns which have shown a drastic fall in their population density, are the

ones which have experienced an increase in their area without a corresponding increase in their population. Thus, although the population of these towns increased but the population density has shown decrease. For example, Sardhana town of Meerut district had an area of 0.34 km² and population 22083. Thus its population density was 64950 in 1971, while its population density fell to 2145 persons per sq. km, when its area increased from 0.34 sq. km to 14.05 sq. km. There were also instances where the area decreased resulting in an increase in their population density. There were 44 towns which have not shown any change in their area. Except these all other towns have shown a change in their area. Overall it was seen that there was predominance of low density towns over the high density towns. Observing the region-wise density of population we find that the plain had highest density among region in all the three decades while the lowest density was observed in the Ganga Khadar region. The unsuitable terrain is one of the major reason attributed for its lowest density as it retards the growth of large settlements in this region.

The analysis of the growth of population by size class reveals that there was uneven distribution of percent of urban population and towns over the various size classes. Class I towns occupied as much as 57 percent of the total urban population of the study area with only 9 percent of the towns. The population in class V and class VI towns formed only 0.4 percent (1971) of the total urban population and even this declined to meagre (0.06 percent) in 1991 and the number of towns in these class have also declined since 1971.

The nearest distance technique used for all the towns of the study area in 1991 gives the R value of 0.8047. This R value shows that the distribution of towns is more towards random.

The rank size distribution for all the three decades show no conformity with the rank size rule. Almost all the urban centres except three towns in 1971, two towns each in 1981 and 1991 were larger in size as they lie above the exponential line where the actual population of the towns is higher than the expected population by the rule.

CHAPTER - III

FUNCTIONAL CLASSIFICATION OF TOWNS (1971-1991)

3.1 INTRODUCTION

Urban centres once created by man depends for their continuance on the socio-economic and politico-historical background of the area which have given rise to them. (Shahi U.P,1981)⁶⁸. These urban centres exist to perform certain economic activities for themselves and for the area around them too. These activities of the people for an urban centre make up the functions of the centre concerned. The term 'function' comes from physiology and was first used by F. Ratzel in 1891, and has been applied since then by various scholars.

These functions are not only the very basis of the existence of an urban centre but also provide a necessary motivational force for further growth and development of the area. A functional base of a town is related to the economy and culture of a region. The growth of these functions further stimulates the growth of the urban centre, which provides various services, caters to the economic and social needs of the urban community as well as its surrounding region or the whole country. The status of any town can be determined by the number and nature of functions it performs. With rapid growing urban population, the functional character of cities and towns has become increasingly complex. This complexity in the functional character and the explosive rate of urbanisation has motivated various geographers to study urban functions. Thus, the study of urban functions is an important aspect of research in urban geography.

The methods of functional classification of towns can be divided into qualitative and quantitative scheme. In the qualitative schemes Aurousscau's classification (1921)⁶⁹ is doubtless the best known. He postulated six urban functions through a combination of observation and logical deductions. These urban functions were namely - administration, defence, culture, production, communication and recreation. He noted that while a

⁶⁸ Shahi, U.P (1989) op.cit.

⁶⁹ Aurousscau, M "Distribution of Population, A Constructive Problem", The Geographical Review, vol.11, no.4, 1921.

combination of these functions were performed by any given city, one function usually tended to overshadow the rest. Thus, he enunciated the concept of functional differentiation and specialisation.

Studies based on quantitative data are far numerous. It has been assumed that the occupational or employment⁷⁰ structure of a town's labour force reflects the economic, political and social activities in which the residents of the town engage and so industry, employment and occupational data have been used in different ways, to establish the groups of towns having similar functional specialisation.

Harris, C. D. (1943)⁷¹ did the authentic study of town classification on the statistical criterion. He treated the functional structure of certain typical centres of US and fixed certain percent and ratio for each function separately on an empirical basis. He assigned higher percent to some functions than to the others on the basis of analysis made on cities of all well recognised types. His method was followed by several scholars with certain modifications, as Kneedler (1945)⁷² and Victor Jones (1954)⁷³. Hart (1953)⁷⁴ reclassified the American cities using this method with modifications. Pownell (1953)⁷⁵ made an authentic classification of New Zealand's towns on the basis of functional structure.

He emphasised that the significance of the functions can be ascertained only by a positive simple percentage deviation after calculating the national average or mean for towns of different sizes.

⁷⁰ Employment Statistics are collected at the place of work while occupational statistics are collected from the place of the residence

⁷¹ Harris, C.D. "A Functional Classification of the Cities in the United States", *Geographical Review*, vol. 33, 1943.

⁷² Kneedler, G.M. "Economic Classification of the Cities and Metropolitan Arousscau", *The Municipal Year Book*, Chicago, 1945

⁷³ Jones, V "Economic Classification of the Cities and Metropolitan Arousscau", *The Municipal Year Book*, Chicago, 1954

⁷⁴ Hart, F.J. "Functional and Occupational Structure of Cities in American South, *AAAG*, vol. 45, pp. 269-286, 1955

⁷⁵ Pownell, L.L. "Functions of New Zealand Towns", *AAAG*, vol. 43, 1953

Nelson (1955)⁷⁶ developed a method on the basis of Pownell's ideas by using averages of percentage of employees engaged in various functions in all towns. He calculated the mean of percent and standard deviation for each function and town.

Mattila and Thompson (1955)⁷⁷ developed an index of surplus workers over the national average for functional classification of towns.

The pioneering systematic work on functional attributes of Indian cities is of Lal's⁷⁸. He determines functional specialisation of cities on the basis of Location Quotient (LQ)

He defines LQ for the city X in industry Y as -

$$\frac{\text{Percent of all workers in city X in industry Y}}{\text{The median percent of all workers in Y industry in all the cities.}}$$

The median percent of all workers in Y industry in all the cities.

Thus, he decides to consider cities with LQ values between 90-109 in any industry or services as having a 'normal' specialization in that function.

Qazi Ahmad (1965)⁷⁹, chooses 62 variables covering a variety of relevant aspects of urban structure in India. These variables were related to the following attributes of Indian cities like population size, structure, population change, households and housing, occupational structure, health, spatial structure, migration and social amenities.

Principal Component Analysis was run and 102 Indian cities were differentiated on the basis of 10 factors (Therefore on the basis of the original 62 variables) and thus an optimal classification comprising relatively homogenous group of cities was developed.

A composite classification based on the predominant function of a town was attempted in 1961 by Asok Mitra⁸⁰. The broad industrial classification of all workers into 9 divisions adopted at 1961 and 1971 census provided a basis for the classification of towns attempted at the close of 1961 census.

⁷⁶ Nelson, H.J, "A Service Classification of American Cities", *Economic Geography*, vol. 31, July, 1955

⁷⁷ Mattila, J.M. and Thompson, W.R, "The Measurement of the Economic Base of Metropolitan Area", *Land Economics*, vol.51, 1955

⁷⁸ Lal Amrit, "Some Aspects of Functional Classification of Cities and a Proposed Scheme for Classifying Indian Cities", *National Geographical Jour. of India*, vol. 5, 1959, pp. 12-24

⁷⁹ Ahmad, Qazi. "Indian Cities-Characteristics and Correlates", University of Chicago Press, 1965.

⁸⁰ Mitra Asok, "Functional Classification of India's Towns", Institute of Economic Growth, Delhi, 1973

In the present study, an attempt has been made to present a composite classification of towns based on the predominant function of a town using Asok Mitra's methodology (Ternary diagram) for the period of 1971 and 1991.

3.2 DATA BASE

The nine fold industrial classification of 1971 and 1991 census is used for present analysis. It broadly corresponds to the Divisions of the Standard Industrial Classification. The nine-fold industrial classification is as follows-

	BRIEF DESCRIPTION	CENSUS-INDUSTRIAL CATEGORIES OF WORKERS
1.	Cultivators	I
2.	Agricultural Labourers	II
3.	Forestry, Fishing, Plantations	III
4.	Mining and Quarrying	IV
5.	Manufacturing, Processing , Servicing and repairs	V
6.	Construction	VI
7.	Trade and Commerce	VII
8.	Transport, Storage, and Communications.	VIII
9.	Other Services	IX
10.	Non - Workers	X

Objectives

- (1) To find out what shifts and changes have occurred in the functions of towns and cities that were common to both 1971 and 1991 census.
- (2) To classify the new towns which have come up in the time being.

3.3 METHODOLOGY

All towns and urban agglomerations for which an account of all workers in the above nine industrial categories was available were considered. They were 58 in number in 1971 and increased to 126 in 1991. The town groups which have been incorporated into urban agglomerations and towns groups have not been separately accounted in this study.

Briefly speaking, Ternary diagram' makes use of an equilateral triangle whose sides are graduated 0 to 100 percent so that the percentage of three variables viz. Industry, Trade and Transport and Service can be represented on the diagram.

For each town a percentage distribution was made up of all workers into seven non-agricultural census industrial categories i.e. III to IX. The agricultural categories I and II were excluded in each case as it was intended to study the inter relationships of only the non-agricultural categories.

Besides, these seven (7) groups of non-agricultural categories were further clubbed under three rubrics A, B, C in order to take the advantage of the triangular co-ordinates. The sum of the workers in census industrial categories III to IX was taken as 100 and the number of workers classified in each of the seven categories was worked out as percentage of this sum. Thus, the 7 non-agricultural (Industrial) categories are clubbed under the following groupings -

GROUP OF TOWNS	RUBICS	CENSUS INDUSTRIAL CATEGORIES
INDUSTRY	A	III, IV, Va, Vb and VI
TRADE & TRANSPORT	B	VII and VIII
SERVICES	C	IX

The three broad functional classifications were attempted next as follows -

- (1) Where the percentages in III, IV, V and VI under group A was greater in value than the sum of percentages of VII and VIII in B or percentages of IX in C, the town was called as **Industrial Town.**
- (2) Where the sum of percentages of VII and VIII in group B was greater in value than the sum of values in A or in C, the town was called as **Trade and Transport Town.**
- (3) Where the percentage of IX in group C was greater in value than the sum of percentage in A or in B, the town was called as **Service Town.**

Towns which fall within the above three categories invariably satisfy what is later described as towns with '*Predominant function accentuated*'

A further refinement can be made from this threefold broad classification: -

- (1) Where the percentage of III was observed to be greater than that of any of IV, V or VI, the town was called a Livestock, Forestry, Fishing or Plantation Town.
- (2) Where the percentage of IV was observed to be greater than that of any of III, V or VI, the town was called Mining and Quarrying Town.
- (3) Where the percentage of V(a) was observed to be greater than III, IV, V(b) or VI, the town was called an Artisan Town.
- (4) When the percentage of V(b) was observed to be greater than III, IV, V a or VI, the town was called a Manufacturing Town.
- (5) When the percentage of VI was observed to be greater than III, IV or V, the town was called a Construction Town.
- (6) When the percentage of VII was observed to be greater than VIII, the town was called Trade Town.
- (7) Where the percentage of VIII was observed to be greater than that of VII the town was called a Transport Town.

The above categories invariably satisfy what is later described as towns with '*Predominant function moderately diversified or accentuated*'. But it is seen that there were numerous instances where the percentage differences were by no means so clear cut. These were the towns which were described as towns with '*functions diversified*' and in the case of number of towns with functions highly diversified or accentuated the only method was to label a town according to the highest percentage value of any one category and even then if that value failed to qualify for the predominance tests, the need Aurousscau of further stratification to distinguish the strong and weak strains of functional characteristics of towns. This was accomplished with the help of triangular co-ordinates.

A specific property of an equilateral triangle is used in this method (fig. 3.1). In an equilateral triangle of sides A,B,C, if we put a point anywhere within the enclosed field of triangle then according to the property of an equilateral triangle the length of perpendiculars let fall from X on the sides A, B and C of the triangle, it will always be a constant K (which can be denoted as 100). Thus, if we take a number of towns $X_1, X_2, X_3, \dots, X_n$ and if we club the attributes of each town into 3 mutually exclusive identifiable segments, the percentage ratios of which to the total of attributes in each case add up to a constant K (=100) then each of these towns can be plotted on different positions within the same equilateral triangle. Thus K is equated to 100 for our convenience, so that the varying values can form 3 percentage figures that always add up to 100.

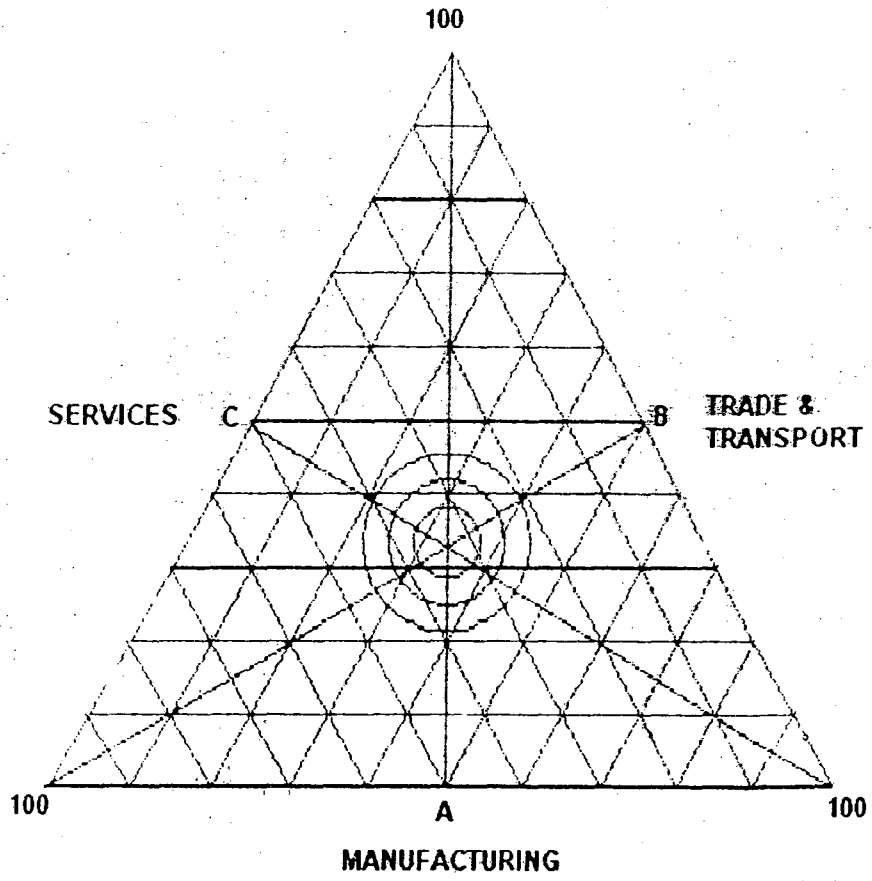
If we drop perpendiculars from each apex of the triangle on the opposite sides of A,B and C, then by virtue of its property these perpendiculars will intersect at a point called centroid and at this point the field of the triangle will be divided into six equal and symmetrical sub-triangles. The field of the triangle is thus conveniently divided first into six and then into any number of well defined spaces, which in their turn can be utilised to measure the functional distances between towns so plotted. And also the position of each town in the field of the triangle would facilitate its study with reference to the position of either town in the field of the triangle.

The closer the position of town to the point of intersection of the perpendiculars, the more balanced would be the functions of a town and vice versa.

The point of intersection of the perpendiculars represent a value of $33 \frac{1}{3}$ for each of the three perpendiculars from the apex. Three circles are drawn around this point of intersection in the field of the triangle with the intersection point at the centre. The first circle has the radius of $6 \frac{2}{3}$, the second a radius of $11 \frac{1}{3}$ and a third the radius of $16 \frac{2}{3}$. It will be seen that-

- (1) For any town falling inside the first or innermost circle will be highly balanced, that is, the function of the town will be composite in character i.e. diversified.
- (2) Any town falling outside of the first innermost but inside the second or Mattila circle will be moderately balanced with the major attribute sector value farthest away from

ASOK MITRA'S TERNARY DIAGRAM



(Fig.3.1)

the centre tending to disturb the equilibrium. Here also the functions of the town will be diversified.

- (3) Any town falling outside the Mattila circle but inside the third or outer circle will be ill balanced, the sector value farthest away from the centre accentuating the predominant characteristic of a town.
- (4) Any town falling outside of the three concentric circles will give the town a very pronounced character of that predominant sector, the value of which pushes it position farthest away from the centre.

We can further refine the categories by the six sub triangles which were formed by intersection of perpendiculars. A town according to its position within any of the sub triangles will have the following characteristics.

TABLE :3.1

**INTENSITY OF FUNCTIONS ACCORDING TO POSITION OF A TOWN
IN ANY OF THE SIX SUB-TRIANGULAR COORDINATES**

PREDOMINANT FUNCTIONS	SUB-TRIANGLE	SECONDARY FUNCTIONS
SERVICE TOWNS	I	Low industry Medium Trade & Transport High Services
	II	Low Trade & Transport Medium Industry High Services
	III	Low Trade & Transport Medium Services High Industries
INDUSTRIAL TOWNS	IV	Low Services Medium Trade & Transport High industries
	V	Low Services Medium Industries High Trade & Transport
TRADE AND TRANSPORT	VI	Low Industries Medium Trade & Transport High Trade & Transport

Source : Asok Mitra's Functional Classification

3.4 INTERPRETATION OF THE RESULTS

If we observe the distribution of towns of the study area in 1971 in various sub triangles (see fig 3.2 & table 3.2), we see that most of the towns are concentrated in the three circles. Out of the total 58 towns considered, 32 (thirty two) towns were in the three circles while only 16 towns i.e. 27.6 percent were outside the three circles.

TABLE 3.2
DEGREE OF INTENSITY OF FUNCTIONS ACCORDING TO THE POSITION
OF THE TOWN IN ANY OF THE SIX SUB-TRIANGULAR COORDINATES(1971)

FUNCTIONAL TYPE	FHD	FMD	PFHA	PFA	TOTAL
<i>Degree of functional diversification/accentuation.</i>					
(1) Service Towns	1	1	0	3	5
(a) Low Industry Moderate Trade & Transport	1	0	0	3	4
(b) Low Trade & Transport Moderate Industry	0	1	0	0	1
(2) Industrial Towns	4	12	8	10	34
(a) Low Trade & Transport Moderate Services	1	1	0	1	3
(b) Low Services Moderate Trade & Transport	3	11	8	9	31
(3) Trade & Transport towns	2	10	6	1	19
(a) Low Services Moderate Industry	1	9	5	1	16
(b) Low Industry Moderate Services	1	1	1	0	3
TOTAL	7	23	14	14	58

FHD = Functions Highly Diversified, FMD = Functions Moderately Diversified, PFA = Predominant Function Accentuated, PFHA = Predominant Function Highly Accentuated

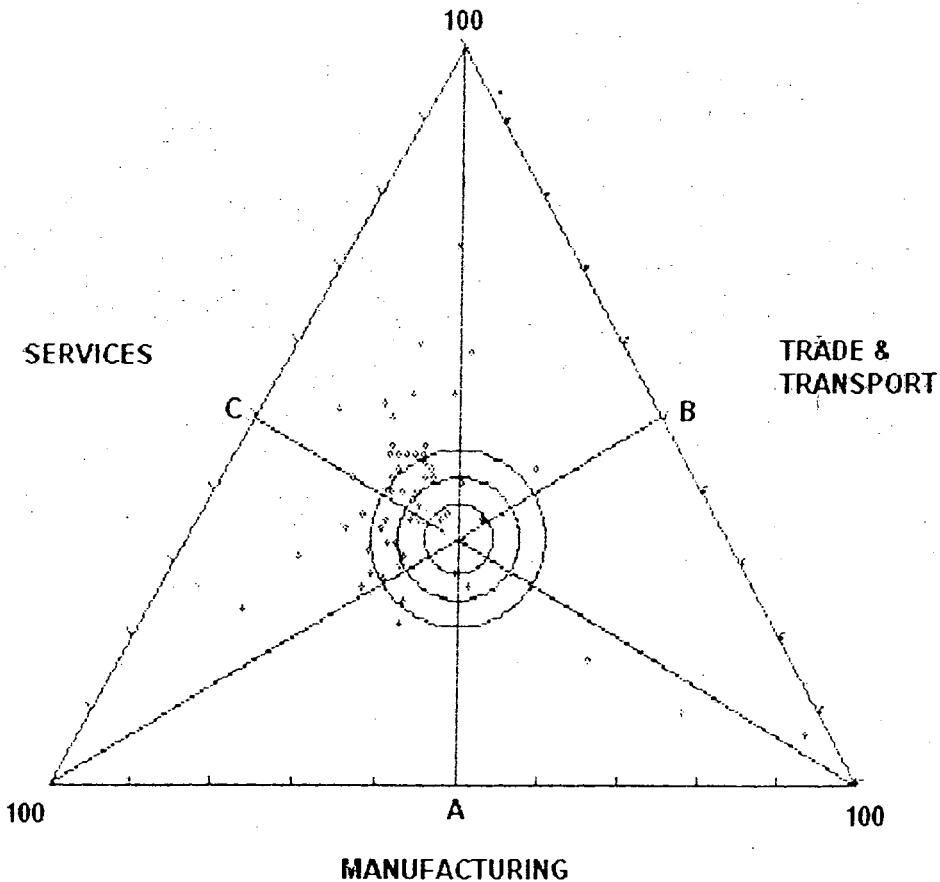
Source: Census of India, 1971, Series 21, Part VI-A, Town Directory

There were 7 (seven) towns within the first circle and 19 (nineteen) towns were enclosed in the second circle. There were 16 towns each in third circle and outside the circles.

The first sub-triangle represents higher service, moderate trade and transport and low industries. There are 4 (four) towns in this triangle. Two towns, Bijnor and Jansath have a highly balanced composition of all the three functions while the other two towns namely, Roorkee and Kankerkhara, lie outside the three triangles and have service functions highly accentuated.

The second sub triangle of the Ternary diagram represents higher service, moderate industries and lower trade and transport. There are two towns in this triangle, Meerut

FUNCTIONAL CLASSIFICATION OF TOWNS IN
NORTHERN UPPER GANGA PLAIN (1971)



(Fig.3.2)

represents a moderate balance in functions while the other town ordnance factory Muradnagar has service sector highly accentuated.

Higher industries, moderate service and lower trade and transport are represented by third sub triangle. There are only 4 (four) towns in this category. There is one town in each circle while one town is outside the three circles.

Thakurdwara has highly balanced functions, Hasanpur lies in the second circle with functions moderately balanced. Hastinapur town has industrial function accentuated while Rustamnagar Sahaspur has industrial function highly accentuated. There are 27 towns in the fourth sub-triangle. These sub-triangle represents higher industries, moderate trade and transport and lower services. There are only two towns, Nagina and Dhanaura in the innermost circle, which shows highly balanced composition of all functions.

There are eight towns in the second circle. These towns are Rampur, Nazibabad, Kiratpur, Nehtaur, Deoband, Shamli, Garhmukteshwar and Mandawar. The third circle has 9 towns Sambhal, Amroha, Hapur, Seohara, Sardhana, Miranpur, Muradnagar and Faridnagar. These towns have industrial sector accentuated. There are eight towns namely, Pilkhua, Modinagar, Afzalgarh, Kanth, Manglaur, Malayana, Shahajahanpur and Tajpur which lie outside all the three circles and there have industrial function highly accentuated.

The characteristic feature of the fifth sub triangle of the Ternary diagram is high trade and transport, moderate industry and low service. This sub triangle has 17 towns. There is only one town, Moradabad in the inner most circle showing highly balanced function. The second circle has eight towns viz. Saharanpur, Chandausi, Dhampur, Baraut, Bahjoi, Bilari, Rampur Maniharan and Kaila. These towns show moderate balance of all the three functions. The third circle has five towns. These are Gangoh, Khatauli, Kandhla, Mawana and Aminagar Sarai. These towns show trade and transport function accentuated. Three towns Hardwar, Tanda and Rasulpur Dhulri lie outside all the three circles and have trade and transport sector highly accentuated.

The sixth sub triangle of the ternary diagram represents higher trade and transport, moderate services and lower industry. There are only four towns in this sub triangle. The first i.e. the

innermost circle has only one town, Baghpat which has a highly balanced composition of all the three functions. There are two towns in the second circle. These are Muzaffarnagar and Kairana. These towns have moderately balanced composition of all the three functions. Only one town, Nakur is in the third circle and has trade and transport function accentuated. There is no town which lies outside the three circles.

Thus, it is clear from the above analysis that in 1971, majority of the towns in the study area were industrial towns with moderate trade and transport and low services. Out of the total 58 towns, 31 towns were in this category. There were 19 trade and transport towns. Hence, about 59 percent of towns were industrial towns. The trade and transport towns constituted 33 percent while the lowest percentage goes to the service towns, which comprises only 8 percent of the total towns in the study area.

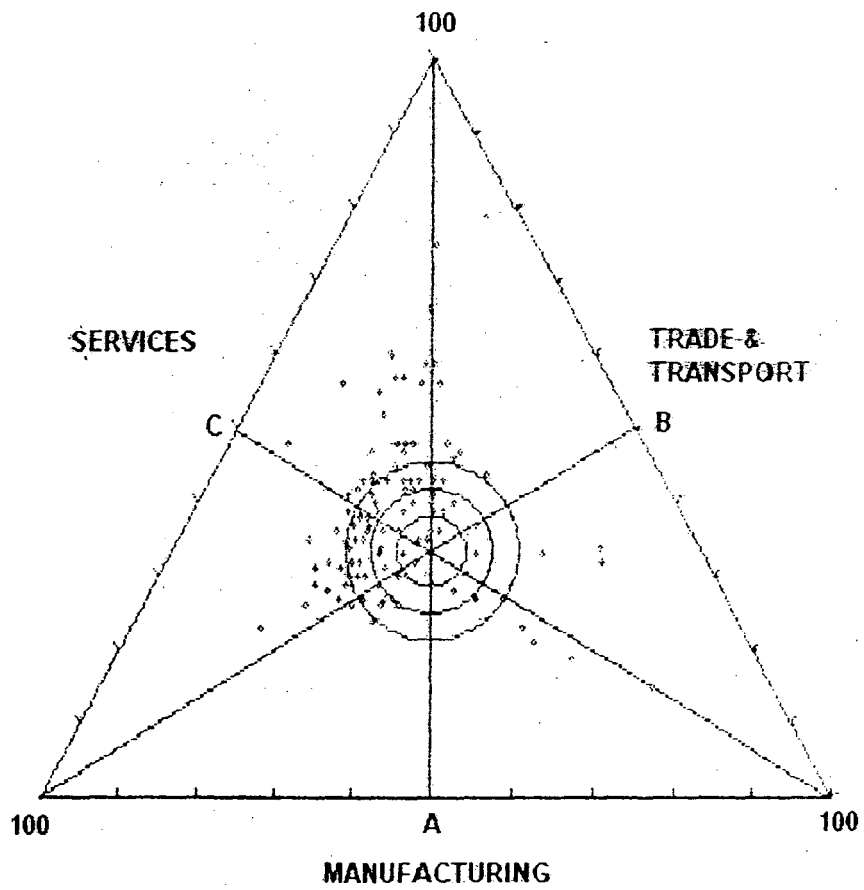
Observing the distribution of towns in 1991 in the various sub triangles of the Ternary diagram, we find that the concentration of towns is in the IV and V sub triangle. More than $\frac{2}{3}$ i.e. about 71 percent of the total towns lies in these two sub triangles.

It is also clear from the figure 3.3 that the concentration of the towns is close to the centre of the triangle. Out of the total 125 towns considered during 1991, 16 towns were in the first i.e. innermost circle, while the second i.e. middle circle had 51 towns with their functions moderately diversified. There were 37 towns in the third i.e. the outermost circle of the Ternary diagram while only 21 towns were outside the three circles.

Thus, about 54 percent of towns had their functions diversified and only 46 percent of the towns had their predominant function accentuated. The distribution of towns thus goes down as one moves away from the first circle of the Ternary diagram.

The first sub triangle has seven towns. The two towns, Dadri and Titron are within the first circle and thus represent highly balanced functions. The second circle of the same triangle again consists of two towns namely, Bijnor and Niwadi. They have all their three functions moderately diversified. There is only one town, Roorkee, in the third circle. It has services as predominant function accentuated. Two towns, namely Sarsawan and Babugarh lie outside all the three circles and have services function highly accentuated (table 3.3).

FUNCTIONAL CLASSIFICATION OF TOWNS IN
NORTHERN UPPER GANGA PLAIN (1991)



(Fig.3.3)

TABLE 3.3
DEGREE OF INTENSITY OF FUNCTIONS ACCORDING TO THE POSITION OF
THE TOWN IN ANY OF THE SIX SUB-TRIANGULAR COORDINATES(1991)

FUNCTIONAL TYPE-	FHD	FMD	PFHA	PFA	TOTAL
<i>Degree of functional diversification/accenuation</i>					
(1) Service Towns	2	3	2	5	11
(a) Low Industry Moderate Trade & Transport	2	2	1	2	7
(b) Low Trade & Transport Moderate Industry	0	1	1	3	5
(2) Industrial Towns	8	20	18	13	59
(a) Low Trade & Transport Moderate Services	6	5	4	4	19
(b) Low Services Moderate Trade & Transport	2	15	14	9	40
(3) Trade & Transport towns	6	20	17	7	54
(a) Low Services Moderate Industry	4	23	15	3	45
(b) Low Industry Moderate Services	2	5	2	0	9
TOTAL	16	41	37	21	125

FHD = Functions Highly Diversified, FMD = Functions Moderately Diversified
PFA = Predominant Function Accentuated, PFHA = Predominant Function Highly Accentuated
Source : Census of India, 1991, Series 21, Part VI-A, Town Directory

The second sub triangle of the diagram has five towns while there is no town in the first circle, the second circle has only one town, Behta Hazipur which has all functions moderately diversified. This town lies just on the boundary of the first circle. Patala is the only town which lies in the third circle and has service function accentuated. Three towns namely Kalchhina, Rori and Dujana lie outside the three circles and have service sector highly accentuated. Dujana lies on the boundary of the first and second sub triangle.

There are 19 (nineteen) towns in the third sub-triangle. The first circle has six towns namely Meerut, Ghaziabad, Khekda, Sahanpur, Kharkhoda and Ujhari. These towns have their functions highly diversified. The second circle has 5 towns namely Warahapur, Jhalu, Ailum, Faridnagar and Pasaunda. These towns have their functions moderately diversified. The third circle has four towns, Noida, Bhokerkhedi, Hastinapur and Karanwal. All these towns have industrial function accentuated.

Again there are four towns Naugaon Sadat, Landhaura, Tikri, Daurala and Ordnance factory Muradnagar which were outside all the three circles and have industrial function highly accentuated. The fourth sub-triangle of the Ternary diagram has four towns. The innermost circle has only three towns namely Deoband, Shahabad and Mandawar. All these towns have industrial, trade and transport and service sector highly balanced. The second circle has 15 (fifteen) towns viz Moradabad, Rampur, Saharanpur, Muradnagar, Loni, Chattarwal, Un, Sisauli, Banat and Doghat. These towns have their functions moderately diversified. The third circle has fourteen towns namely Amroha, Nagina, Kiratpur, Seohara, Nehtaur, Bachharaon, Sardhana, Afzalgarh, Tajpur, Phalaunda, Shahajahanpur, Bahsuma and Bilari. These towns have their industrial function accentuated.

There were nine towns outside the three circles. These were Modinagar, Sherkot, Kanth, Sahaspur, Bhojpur, Dharampur, Umri Kalan, Landhaura, Lawar and Dasna. These towns had industrial sector highly accentuated.

The fifth sub triangle of the Ternary diagram which has high trade and transport, moderate industries and low service has 46 towns in all. The innermost circle has three towns namely, Garhmukteshwar, Narauli and Agarwal Mandi. These three towns have their functions highly balanced. There were 23 towns in the second circle. These were Nazibabad, Mawana, Dhampur, Hasanpur, Gajraula, Bilaspur, Rampur Maniharan, Khatauli, Kandhla, Budhana, Thana Bhawan, Jalalabad, Sirsi, Haldaur, Dhanaura, Nanauta, Laksar, Purqazi, Kithaur, Sewal Khas, Joya, Jhinhina and Parikshitgarh. These towns had their functions moderately diversified.

There were fifteen towns in the third circle. They were Sambhal, Chandausi, Shamli, Kairana, Baraut, Tanda, Baghpat, Kundarki, Jalalabad, Suar, Behat, Chilkana Sultanpur, Ambetha, Shahpur, Garhi Pukhta. All these towns had trade and transport sector accentuated. There were only three towns which were outside all the three circles. These were Bahjoi, Kemri and Aminagar Sarai. They had their predominant function trade and transport highly accentuated.

The last sub-triangle of the Ternary diagram i.e. the sixth sub triangle had nine towns. There were two towns Maswasi and Jhabrera in this circle. The mattila circle had five towns namely Muzaffarnagar, Hapur, Gangoh, Jansath and Chapprauli. These towns had all their functions moderately balanced. The third circle had only two towns, Milak and Nakur. They had their predominant function accentuated. However, there was no town outside the three circles.

It is clear from the above analysis that 47 percent of towns were industrial towns while trade and transport towns had a share of 43.2 percent and service towns had a share of only 9.6 percent of the total towns.

If we compare the percentage share of towns in the three sectors viz. industrial, trade and transport and services during 1971 and 1991, we find that the share of industrial towns has been highest in both the decades, although it has decreased from 58.6 percent in 1971 to 47.2 percent in 1991. Trade and transport towns occupy second position in terms of percent share of towns and their percent increased from 32.8 percent during 1971 to 43.2 percent in 1991. The share of service town also increased by 1 percent i.e. from 8.6 percent in 1971 to 9.6 percent in 1991. This shows that the position of the towns is similar in both the decades with industrial towns having highest share followed by trade and transport towns while the service towns occupy the lowest position. This means that there is predominance of industrial towns in the region.

CHANGES IN

3.4 FUNCTIONAL CHARACTER OF URBAN CENTERS

(a) Classwise Functional Analysis of Towns

I. In 1971 - Examining the functional character of towns, we observe that out of the total fifty-eight towns considered thirty-four towns had manufacturing as their predominant function which was followed by nineteen towns in trade and transport while only five towns had service as their main activity.

TABLE : 3.4

CLASSWISE FUNCTIONAL DISTRIBUTION OF TOWNS (1971)

Category Class	Industrial		Trade & Transport		Service Towns		TOTAL	
	Absolute	Percent	Absolute	Percent	Absolute	Percent	Absolute	Percent
I	2	5.88	3	15.79	1	20	6	10
II	3	8.82	2	10.53	1	20	6	10
III	13	38.2	6	31.58	1	20	20	34
IV	8	23.5	5	26.31	1	20	14	24
V	7	20.6	3	15.79	1	20	1	19
VI	1	2.94	0	0.00	0	0.00	1	1.7
TOTAL	34	100	19	100	5	100	58	100

Observing the class wise distribution (Table 3.4) we analyse, that the towns having manufacturing as their main activity are mostly class III towns followed by class IV and class V while hardly 17 percent of towns lie in class I, II and VI together which have manufacturing as their predominant function.

In towns where trade and transport is the main activity, here too, the main concentration of towns is in class III, IV and VI which together form 74 percent of total towns having trade and transport as their dominant function.

In towns having services as their main activity, 20 percent of towns each are concentrated in class sizes viz. class I, II, III, IV and V.

We observe that the major concentration of towns in all the three main activities viz manufacturing, trade and transport and services is found in size classes III, IV and V.

If we further refine the categories and categorize them, we observe that there are 22.4 percent of Artisan Towns, 29.3 percent of towns are trade towns while manufacturing towns have highest share i.e. 34.5 percent and services towns form only 9 percent of the total towns.

Considering these categories separately we see that out of the 12 functional subtypes taken by Mitra, only 6 sub types are found in the study area (Table 3.5). There is only one construction town (Hapur) in 1971 which was class II town. Similarly Kaila (Class V) was the only transport town in the study area and Afzalgarh (Class IV) was a forestry town.

Not even a single town is having mining, quarrying, fishing, plantation, livestock as main activity.

TABLE 3.5
CLASS WISE DISTRIBUTION OF TOWNS BY FUNCTIONAL SUB TYPES(1971)

CLASS CATEGORY	I		II		III		IV		V		VI		TOTAL	
	Absolute	Percent	Absolute	Percent	Absolute	Percent	Absolute	Percent	Absolute	Percent	Absolute	Percent	Absolute	Percent
MA	2	33.3	1	16.7	11	55	4	31	2	18	0	0	20	34
MMF	0	0	1	16.7	2	10	4	31	5	45	1	100	13	22
MC	3	50	2	33.3	6	30	5	31	2	18	0	0	17	29
TTG	0	0	0	0	0	0	0	0	1	9.1	0	0	1	1.7
TTf	1	16.7	1	16.7	1	5	1	7.7	1	9.1	0	0	5	8.6
SS	0	0	1	16.7	0	0	0	0	0	0	0	0	1	1.7
TOTAL	6	100	6	100	20	100	14	100	11	100	1	100	57	100

(MA = Artisan towns, MMf = Manufacturing, TTg = Trading,
TTf = Transport & SS = Service towns)

Manufacturing towns were well distributed in the study area, 55 percent of these towns were concentrated in class III followed by class I and class IV. However there was no manufacturing town in class VI.

Similarly the trade towns were mainly concentrated in class III and followed by class IV.

Observing the functional distribution of towns class wise, we analyse that class I urban centres formed 33 percent of manufacturing, 17 percent of service and 50 percent of trade towns.

Class II towns had 16.67 percent of each manufacturing, service, artisan, and construction towns while 33 percent of trade towns.

In class III urban centres manufacturing towns formed 55 percent share which was followed by trade towns (30 percent) and artisan towns (10 percent).

Class IV urban centres had equal share of artisan (30.8 percent), manufacturing and trade towns (30.8 percent) each, while it had 8 percent of service towns.

In case of class V towns, concentration was in artisan towns which formed 45 percent of total towns followed by manufacturing and trade towns having share of 18.2 percent each and transport and service towns have 9.1 percent in each.

In class VI there was only one town which was functionally classified as artisan town.

In 1991, out of the total 126 towns in the study area 60 were manufacturing, 54 were trade and transport and only 12 were service towns.

TABLE : 3.6
CLASSWISE FUNCTIONAL DISTRIBUTION OF TOWNS (1991)

Category Class	Industrial		Trade & transport		Service Towns		TOTAL	
	Absolute	Percent	Absolute	Percent	Absolute	Percent	Absolute	Percent
I	9	15.00	3	5.55	0	0.00	12	9.50
II	4	6.66	6	10.11	2	16.70	12	9.50
III	16	26.70	14	25.93	2	16.70	32	25.00
IV	30	50.00	27	50.00	2	16.70	59	47.00
V	1	1.66	4	7.41	5	41.70	10	7.90
VI	0	0.00	0	0.00	1	8.33	1	0.80
TOTAL	60	100.00	54	100.00	12	100.00	126	100.00

M = Manufacturing Towns , T = Trade and Transport Towns , S = Service Towns

Source: Census of India, 1991

TABLE :3.7

CLASS WISE DISTRIBUTION OF TOWNS BY FUNCTIONAL SUB-TYPE (1991)

CLASS/	I		II		III		IV				VI		TOTAL	
	Total	Percent	Total	Percent	Total	Percent	Total	Percent	Total	Percent	Total	Percent		
MA	0	0	0	0	2	6.25	5	8.5	0	0	0	0	7	5.6
MMF	9	75	4	33.3	13	40.6	25	42	1	10	0	0	52	41
MC	0	0	0	0	1	3.12	0	0	0	0	0	0	1	0.8
TTG	3	25	6	50	14	43.8	27	46	4	40	0	0	54	43
TTf	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS	0	0	2	16.7	2	6.25	2	3.4	5	50	1	0	12	9.5
TOTAL	12	100	12	100	32	100	59	100	10	0	1	100	126	100

(MA = Artisian towns, MMf = Manufacturing, TTg = Trading, TTt = Transport & SS = Services)

In the towns having manufacturing as their predominant function, 50 percent of them were concentrated in class size IV, 27 percent in class III and 15 percent in class I. Class V had only one town (Bahsuma), while there was no town in class VI which had manufacturing as their main activity.

Similarly, 50 per cent of towns having trade and transport as predominant function, were in class IV followed by 26 percent in class III. Here also there was no town in class VI.

Observing the functional subtype, we analyse that 83 percent of towns were either manufacturing or trade towns.

41.27 percent of towns were manufacturing towns while 43 percent of towns had trade as their predominant function, while service towns had 9.5 percent of the total share.

While analysing the functional distribution of towns classwise, we observe that 75 percent of class I towns were manufacturing towns and 25 percent were trade towns (Table 3.7).

In case of class II towns, 50 percent of these towns were trade towns and 33 percent were manufacturing towns followed by service towns (17 percent). We observe that 83 percent of the total town in class III were either manufacturing or trade towns.

Class V is an exceptional case where 50 percent of the towns (i.e., 5 out of total 10 towns) have service as their functional subtype followed by trade (40 percent) and manufacturing 10 percent.

(b) Region wise functional Analysis of Towns

Analysing the towns region wise, we observe that Shivaliks did not have any urban centres either in 1971 nor in 1991. (See fig. 3.4 & 3.5 and Table 3.8(a) & 3.8(b)).

TABLE : 3.8(a)
REGIONWISE FUNCTIONAL DISTRIBUTION OF TOWNS (1971)

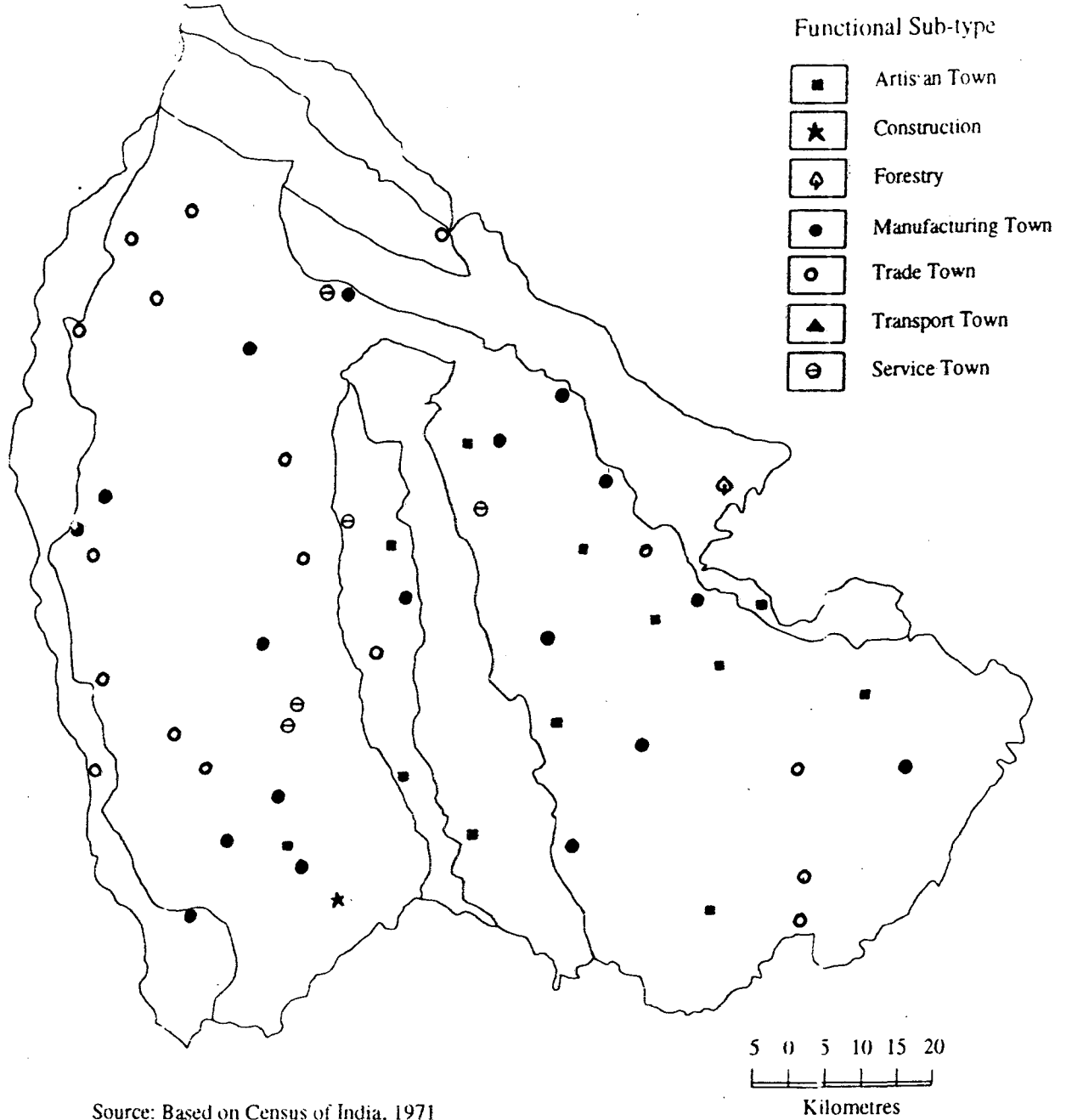
SUB REGIONS	MA	MMf	MC	TTg	TTt	SS	Mfy	TOTAL
SHIWALIKS	0	0	0	0	0	0	0	0
BHABAR	0	0	0	0	1	0	0	1
TARAI	1	0	0	0	0	0	0	1
YAMUNA KHADAR	0	1	0	1	0	0	0	2
GANGA KHADAR	1	0	0	0	0	0	0	1
BHUR TRACT	2	1	0	1	0	1	0	5
PLAIN	9	17	2	13	0	4	0	45
TOTAL	13	19	2	15	1	5	1	56

(MA = Artisan towns, MMf = Manufacturing, TTg = Trading, TTt = Transport & SS = Services)

Source: Census of India, 1971

Regionwise Functional Classification of Towns in Northern Upper Ganga Plain

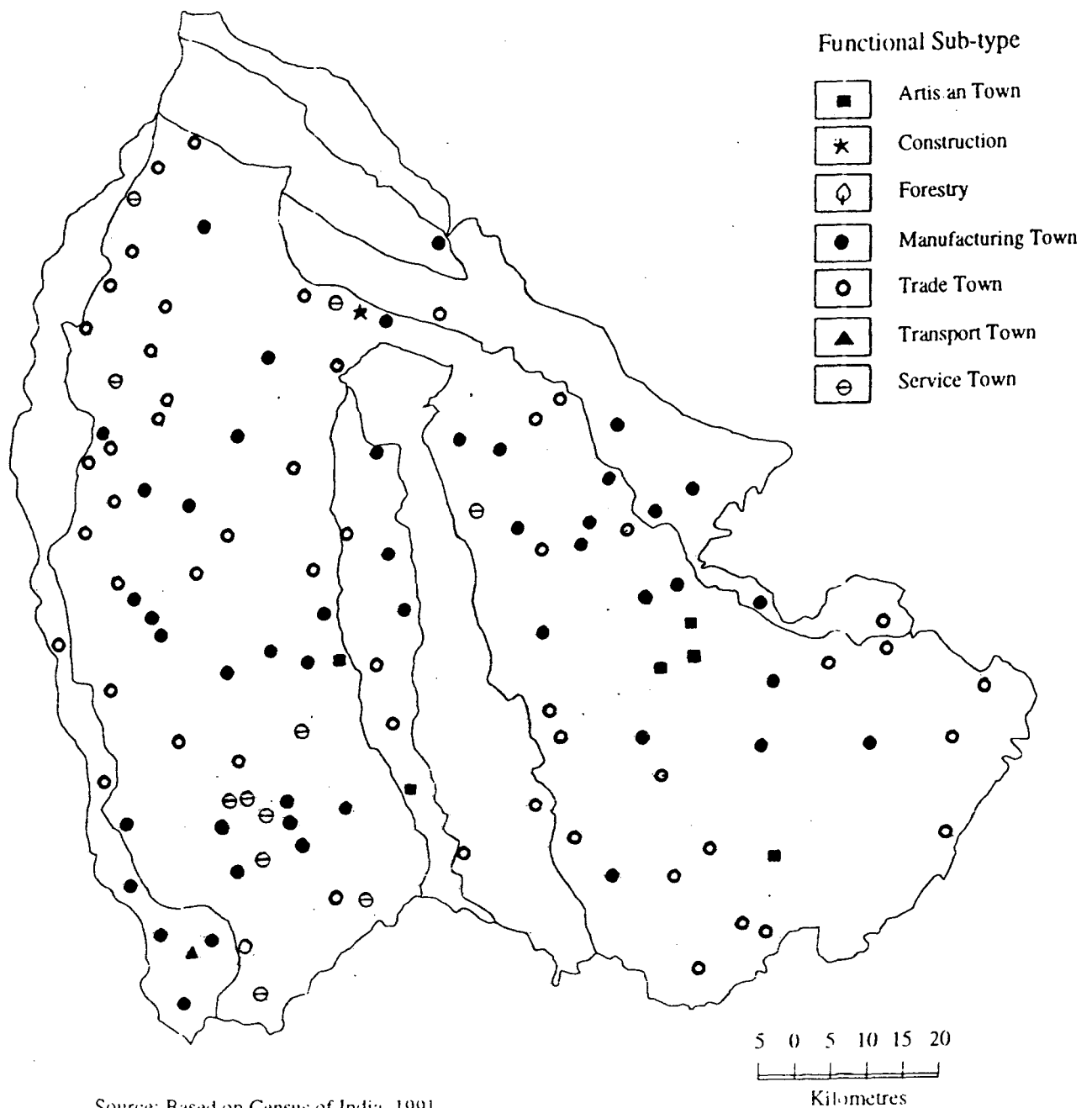
1971



Source: Based on Census of India, 1971

(Fig.34)

Regionwise Functional Classification of Towns in Northern Upper Ganga Plain 1991



Source: Based on Census of India, 1991

(Fig.3.5)

TABLE : 3.8(b)

REGIONWISE FUNCTIONAL DISTRIBUTION OF TOWNS (1991)

SUB REGIONS	MA	MMF	MC	TTg	TTt	SS	TOTAL
SHIWALIKS	0	0	0	0	0	0	0
BHABAR	0	1	0	0	0	0	1
TARAI	0	4	0	2	0	0	6
YAMUNA KHADAR	0	4	0	2	0	0	6
GANGA KHADAR	0	0	0	2	0	0	2
BHUR TRACT	1	4	0	3	0	0	8
PLAIN	5	37	1	44	0	12	99
TOTAL	6	50	1	53	0	12	122

(MA = Artisan towns, MMf = Manufacturing, TTg = Trading, TTt = Transport & SS = Services)

Source: Census of India, 1991

Bhabar - Hardwar was a trade town in 1971 and during 1991 its function changed and it became a manufacturing town.

Tarai - In 1971, there were two urban centres one was artisan town and other was forest town, while the number of urban centres increased to six in 1991 four of which were manufacturing and two were trade towns.

Yamuna Khadar - There were two urban centres one was manufacturing town and the other was trade town. However, the number of towns rose to six, four of which were manufacturing and two were the trade centres.

Ganga Khadar - This region had one artisan town in 1971 and during 1991 there were two trade towns.

Bhur Tract - The Bhur region had five towns during 1971, two of these towns were artisan towns and others were manufacturing, trade and a service town each.

In 1991, the number of towns increased to eight, one of these was an artisan town and four were manufacturing and three were trade towns.

Plain - The Plain had the highest number of towns both during 1971 and 1991.

In 1971, there were 45 urban centres in Plain. The highest number of towns i.e. 17 were manufacturing towns followed by trade towns (13) and artisan towns (9). However, there were only 4 service towns.

During 1991, there was a shift in functions of the towns. Out of total 99 towns, 44 were trade towns, 37 manufacturing towns and 12 were service towns.

Thus, we have seen that during 1991, of the total 122 towns 53 were trade towns and 50 were manufacturing towns while there were only 12 service towns all of which were in Plain.

3.5 CHANGE IN THE FUNCTIONAL CHARACTER OF TOWNS DURING (1971-1991)

The changes in the functional character of towns was analysed to study and understand the facts properly. Hence, in this section we have tried to examine the changes in the functional character of towns during 1971 and 1991, if any. For this analysis we classify the towns into two broad categories.

(A) The towns which have undergone a change in this period.

(B) The towns which have not undergone any change in their functions in this period.

Regionwise change in the functional character of towns common during (1971-1991)

There were no urban centres in Shiwaliks both during 1971 and 1991.

Bhabar had only one urban centre during 1971 i.e. Hardwar and it has changed its functional character from trade town in 1971 to manufacturing town in 1991.

There were two urban centres in Tarai region, Thakurdwara and Afzalgarh and both have shown change in their functional character from artisan to manufacturing.

Yamuna Khadar region also had two towns, Baghpat and Ghaziabad common during 1971 and 1991 and both of them had similar functions in two decades thus, there was no change in their functional characters.

Ganga Khadar had one town, Garhmukteshwar and its function changed from artisan to trade town.

The Bhur region of the study area had five common towns during 1971 and 1991 and of these, two towns namely, Jansath and Miranpur have changed their functions from services to trading and from artisan to manufacturing respectively.

Similarly, in the Plains, of the total 45 common urban centres, 17 have changed their functions. The details of the functional changes of the towns have been shown in the table. 3.9.

Table No.3.9

**TOWNS SHOWN (REGION WISE) WHICH HAVE UNDERGONE
CHANGE IN THEIR FUNCTIONAL CHARACTER (1971-91)**

SUB-REGIONS	TOWNS	FUNCTIONAL CHANGES	
		1971	1991
Bhabar	Hardwar	TTg	MMf
Tarai	Thakurdwara	MA	Mmf
	Afzalgarh	Mfy	MMf
Ganga Khadar	Garhmukteshwar	MA	TTg
Bhur Tract	Jansath	SS	TTg
	Miranpur	MA	MMf
Plain	Manglaur	MMf	MC
	Saharanpur	TTg	MMf
	Shamli	MMf	TTg
	Kairana	MMf	TTg
	Mandawar	MA	MMf
	Najibabad	MMf	TTg
	Nehtaur	MA	Mmf
	Tajpur	MA	Mmf
	Moradabad	TTg	MMf
	Faridnagar	MA	MMf
	Hapur	MC	TTg
	Bilari	TTg	MA
	Bahajoi	MMf	TTg
	Dhanaura	MA	TTg
	hasanpur	MMf	TTg
	Sambhal	MA	TTg
	Tanda	MA	TTg

(MA = Artisan towns, MMf = Manufacturing, TTg = Trading, TTt = Transport & SS = Services)

SOURCE: ASOK MITRA'S METHOD OF FUNCTIONAL CLASSIFICATION

3.5(A) The towns which have undergone change in this period-

This category has 42.6 percent of towns of the study area. In these towns the change has taken place into intra-functional and inter-functional character. On this basis we can further sub-divide them into two categories-

- (1) Intra-functional change:- It can be further sub divided into three parts.

- a) Service to service towns,
 - b) Industrial to industrial towns,
 - c) Trade and transport to trade and transport towns.
- (2) Inter functional change:- This category comprises of towns which have changed their predominant function from one functional category to another. It can be further sub-divided into six parts-
- a) Service to industrial towns.
 - b) Service to trade and transport towns.
 - c) Industrial to service towns.
 - d) Industrial to trade and transport towns.
 - e) Trade and transport to service towns.
 - f) Trade and transport to industrial towns.

Now we will discuss these categories and their changes one by one.

1) Intra functional change:-

Intra-functional change means when there has been a change within the same function. This sub-category comprises of only 15 percent of the towns which have undergone changes during this period.(Table 3.10)

TABLE : 3.10

**TOWNS WHICH HAVE UNDERGONE
INTRA-FUNCTIONAL CHANGE (1971-91)**

TOWNS	1971		1991	
(A) Service to service towns				
(1) Roorkee	SS	SS	PFHA	PFA
(2) Bijnor	SS	SS	FHD	FMD
(B) Industrial to Industrial towns				
(1) Afzalgarh	Mfy	MMf	PFHA	PFA
(2) Chandpur	MMf	MMf	PFA	FMD
(3) Deoband	MMf	MMf	FMD	FHD
(4) Faridnagar	MA	MMf	PFA	FHD
(5) Ghaziabad	MMf	MMf	FMD	FHD

Table 3.10 Cont.....

Table 3.10 concl....

(6) Hastinapur	MMf	MMf	FMD	PFA
(7) Kiratpur	MMf	MMf	FMD	PFA
(8) Mandawar	MA	MMf	FMD	FHD
(9) Manglaur	MMf	MC	PFHA	FMD
(10) Miranpur	MA	MMf	PFA	FMD
(11) Muradnagar	MMf	MMf	PFA	FMD
(12) Nagina	MMf	MMf	FHD	PFA
(13) Nehtaur	MA	MMf	FMD	PFA
(14) Pilkua	MMf	MMf	PFHA	FMD
(15) Shahajahanpur	MA	MA	PFHA	PFA
(16) Tajpur	MA	MMf	PFHA	PFA
(17) Thakurdwara	MA	MMf	FHD	PFA
(C) Trade and transport to trade and transport towns				
(1) Aminagar Sarai	TTg	TTg	FMD	PFA
(2) Baghpat	TTg	TTg	FMD	PFA
(3) Bahjoi	TTg	TTg	FMD	PFHA
(4) Baraut	TTg	TTg	FMD	PFA
(5) Chandausi	TTg	TTg	FMD	PFA
(6) Gangoh	TTg	TTg	PFA	FMD
(7) Kandhla	TTg	TTg	PFA	FMD
(8) Khatauli	TTg	TTg	PFA	FMD
(9) Mawana	TTg	TTg	PFA	FMD
(10) Tanda	TTg	TTg	PFHA	PFA

(MA = Artisan towns, MMf = Manufacturing, TTg = Trading, TTt = Transport & SS = Services)

Source : Census of India

- a) *Service to service towns*- This category include those towns where the functional character of a particular town remains service town in both the decades, but the degree of functional intensity changes. In can be determined according to position of town in the six sub triangles of the Ternary diagram.

There are only two towns in this category. Roorkee was a service town in both the decades but in 1971, the function of the town was highly accentuated, while in 1991, the service sector was only accentuated.

- b) *Industrial to Industrial Towns* - There are 17 towns in this sub-category. This sub-category comprised of 31.5 percent of the total towns taken for the study. There were 8 towns namely Ghaziabad, Nagina, Chandpur, Kiratpur, Deoband, Pilkhua, Muradnagar and Hastinapur which had manufacturing as their predominant function while only the degree of functional intensity has changed. Two towns, Ghaziabad and Deoband had

their industrial sector moderately diversified during 1971 but it became highly diversified in 1991. In 1971, Muradnagar and Chandpur had industrial function accentuated while it became moderately diversified during 1991. Hastinapur and Kiratpur had their industrial sector moderately diversified in 1971, while in 1991 their industrial function became accentuated.

In 1971, Nagina town had all the three functions highly diversified while in 1991 its industrial function became accentuated. On the other hand, Pilkhua had its industrial function highly accentuated in 1971 while its industrial function became moderately diversified in 1991. There were six towns in 1971 which were artisan towns but their functional character changed to manufacturing during 1991. These were Nehtaur, Thakurdwara, Miranpur, Faridnagar, Mandawar and Tajpur.

In 1971, Nehtaur was artisan town with function moderately diversified while in 1991 its functional character changed to manufacturing function accentuated. Thakurdwara had all three functions highly balanced during 1971 but in 1991 it changed to manufacturing function accentuated.

Miranpur and Faridnagar were towns with artisan function accentuated while in 1991 its functions became moderately diversified.

Mandawar had all its functions moderately diversified in 1971 but it became highly diversified in 1991.

In 1991, Tajpur had artisan function highly accentuated and in 1991 its function changed to manufacturing accentuated.

Shahjahanpur is an artisan town in both the decades while its function was highly accentuated in 1971 and became accentuated in 1991.

Manglaur was a manufacturing town with function highly accentuated but its function changed to construction functions moderately diversified in 1991.

- c) *Trade and transport to trade and transport towns*- There were ten towns in this functional sub-category. There were four towns namely Gangoh, Khatauli, Kandhla and

Mawana which had trading function accentuated in 1971 but their functions became moderately diversified in 1991.

Three Towns Chandausi, Baraut and Baghpat had their functions moderately diversified in 1971, while in 1991 their trading function became accentuated.

In 1971, Bahjoi had its functions moderately diversified or balanced but in 1991 its trading function became highly accentuated.

Tanda-town had trading function highly accentuated in 1971 while in 1991 its function was only accentuated. On the other hand, Aminagar Sarai had trading function accentuated in 1971 and it became highly accentuated in 1991.

2) Inter Functional Change

Inter functional change means a change in functional character of a particular town from one sector to another. In this study, there are six sub categories, which are-

- a) Service to industrial towns
- b) Service to trade and transport towns
- c) Industrial to service towns
- d) Industrial to trade and transport towns
- e) Trade and transport to service towns
- f) Trade and transport to industrial towns

Out of 54 towns considered, 15 had shown inter functional changes during the decades 1971 to 1991 (i.e., 20 percent approx).

TABLE : 3.11
TOWNS WHICH HAVE UNDERGONE
INTER-FUNCTIONAL CHANGE (1971-91)

TOWNS	1971		1991	
(A) Change from service to industrial towns				
(1) Meerut	SS	FMD	MMf	FHD
(2) Ord.fac.Muradnagar	SS	PFHA	MMf	PFHA
(B) Change from industrial to trade and transport towns				
(1) Dhanaura	MMf	FHD	TTg	FMD

Table 3.11 Cont.....

Table 3.11 concl....

(2) Garhmukteshwar	MA	FMD	TTg	FHD
(3) Hapur	MC	PFHA	TTg	FMD
(4) Hasanpur	MMf	FMD	TTg	FMD
(5) Jansath	MA	FHD	TTg	FMD
(6) Kairana	MA	FMD	TTg	PFA
(7) Najibabad	MMf	FMD	TTg	FMD
(8) Sambhal	MA	PFA	TTg	PFA
(9) Shamli	MMf	FMD	TTg	PFA
(C) Change from trade and transport to industrial towns				
(1) Bilari	TTg	FHD	MA	PFA
(2) Hardwar	TTg	PFHA	MMf	FMD
(3) Moradabad	TTg	PFHA	MMf	FMD
(4) Saharanpur	TTg	FMD	MMf	FMD

(MA = Artisan towns, MMf = Manufacturing, TTg = Trading, TTt = Transport & SS = Services)

Source: Census of India

- a) *Service to industrial Towns*- There are only two towns which have changed their function from service to industrial. These towns are Meerut and Ordnance Factory Muradnagar. On 1971, Meerut had all its functions moderately diversified, but in 1991, it became industrial towns its functions became highly diversified.

The town Ordnance Factory Muradnagar had its service function highly accentuated but in 1991 it came an industrial town with its functions highly accentuated.

- b) *Service to trade and transport*- There was no town where function changed from service to trade and transport.
- c) *Industrial towns to service towns* - In this sub-category too there was not a single town ie no town has changed its functional character from industrial town to service town.
- d) *Industrial to trade and transport towns*- There are nine towns which have changed their functions from industrial to trade and transport. These towns are Sambhal, Hapur, Naziabad, Hasanpur, Shamli, Kairana, Garhmukteshwar, Jansath and Dhanaura. The town Sambhal was an artisan town with its function accentuated in 1971, but its functional character changed to trading with this function accentuated in 1991. In 1971, Hapur town was a construction town highly accentuated, but in 1991, it became trade town with functions moderately diversified.

In 1971, Shamli was an industrial town with functions moderately diversified while its functional character changed and it became a trading town with function accentuated in 1991.

Both Kairana and Garhmukhteshwar were artisan towns in 1971 with functions moderately diversified but in 1991 Kairana was a trade town with functions accentuated and Garhmukhteshwar had functions highly diversified.

In 1971, Dhanarua was an artisan town and Jansath was a manufacturing town both had their functions highly diversified in 1971 but in 1991 their trading function was moderately diversified.

e) *Trade and transport to service towns*- There was no town in this sub category ie no trade and transport town has undergone change of function to service towns during these decades.

f) *Trade and Transport to industrial towns*- There are only four towns which have changed their functions from trade transport town in 1971 to industrial town in 1991.

These towns are Moradabad, Saharanpur, Hardwar and Bilari. Moradabad was a trade town with functions highly diversified in 1971, but during 1991 its functions shifted to manufacturing with functions moderately diversified.

In 1971, the trading function of town Saharanpur had moderately diversified but in 1991 its industrial function was moderately diversified.

In 1971, town Hardwar had trading function highly accentuated but in 1991 its industrial function was moderately diversified. The last town of the sub category was Bilari whose trading function was moderately diversified in 1971 but in 1991 it became an artisan town with its function accentuated.

3.5(b) Towns which have not undergone any change in this period ie (1971-91)

There are ten towns in this sub-category which have not undergone any change in their functional character in both the decades. They are Rampur, Muzaffarnagar, Amroha, Seohara, Dhampur, Sardhana, Modinagar, Rampur Maniharan, Kanth and Nakur. Kanth is a

town with artisan function highly accentuated similarly Modinagar has manufacturing function highly accentuated in both the decades. Amroha, Sardhana and Seohara all had manufacturing function accentuated in 1971 as well as in 1991.(see table 3.12)

TABLE :3.12

**TOWNS WHOSE FUNCTIONS
HAVE REMAINED UNCHANGED(1971-91)**

SUB-REGION	TOWNS	FUNCTIONAL SUB-TYPE
Yamuna Khadar	Ghaziabad	MMf
	Baghpat	TTg
Bhur Tract	Hastinapur	MMf
	Mawana	TTg
	Shahajanpur	Ma
Deoband Plain	Deoband	MMf
	Roorkee	SS
Saharanpur Plain	Gangoh	TTg
	Nakur	TTg
	Rampur Maniharan	TTg
Muzaffarnagar Plain	Khatauli	TTg
	Muzaffarnagar	TTg
Shamli Plain	Kandhla	TTG
Bijnor Plain	Bijnor	SS
	Chandpur	MMf
	Kiratpur	MMf
	Dhampur	TTg
Upper Ramganga Plain	Kanth	MA
	Nagina	MMf
	Seohara	MMf
	Aminagar Sarai	TTg
Hindan Plain	Baraut	TTg
	Sardhana	MMf
Meerut Plain	Modinagar	MMf
	Muradnagar	MMf
	Pilkwa	MMf
Sambhal Plain	Bahajoi	TTg
	Chandausi	TTg
Amroha Plain	Amroha	TTg
Rampur Plain	Rampur	MMf
	Tanda	TTg

Source:Census of India

TABLE :3.13

SHIFT IN FUNCTIONAL CHARACTER OF TOWNS (1971-91)

		Absolute	Percent
I	Towns which have not undergone any change.	10	18.5
II	Towns which have undergone any functional change	44	81.48
	TOTAL	54	100.00
1.	Intra functional change	29	53.70
	(a) Service to Service Towns	2	3.7
	(b) Industrial to Industrial Towns	17	31.48
	(c) Trade and Transport to Trade and Transport Towns	10	18.52
2	Inter functional change	15	27.78
	(a) Service to industrial towns	2	3.70
	(b) Service to trade and transport towns	--	--
	(c) Industrial to service towns	--	--
	(d) Industrial to trade and transport towns	9	16.67
	(e) Trade and transport to service towns	--	--
	(f) Trade and transport to industrial towns	4	7.40
	TOTAL	54	100.00

Source: Census of India, 1971 & Census of India, 1991 Series 21, Part VI-A

Three towns namely Muzaffarnagar, Dhampur and Rampur Maniharam had their functions moderately diversified.

Nakur remained a trade town with functions accentuated in both the decades.

The town Rampur had its functions moderately diversified in 1971 as well as in 1991.

From the above analysis, we observe that there are only 10 towns, out of the total 58 towns, which have not undergone any change in 1971 and 1991, while all the other towns have experienced some change or the other. It means that the towns of the study area are rapidly developing with some functional character.

On the other hand, if we consider only the functional change (excluding the change in their intensity) of towns, we find that there are as many as 31 towns whose basic functions have remained the same.

The highest number of towns which have undergone any change are in industrial to industrial towns followed by change from trade and transport to trade and transport towns. While there are three sub-categories in which towns have not observed any change. These are service towns to trade and transport towns, trade and transport to service towns and manufacturing to service towns. There are however only two towns each in service to service towns and service to industrial towns sub-category. (Table No. 3. 13).

3.6 CONCLUSION

It has been observed that the major concentration of towns is in the Plain. There were 58 towns in 1971, and only eleven of these were situated outside the Plain. Five of these towns were in the Bhur Tract. The eastern part of the study area comprising of Rampur, Amroha, Sambhal and Bijnor Plain and Hapur Plain in south western part have high concentration of artisan towns.

There is concentration of manufacturing towns mainly in Shamli, Hapur, Bijnor, Upper Ramganga, Sambhal and Amroha Plain. The trade and transport towns have their predominance in the western part i.e., Saharanpur, Meerut, Shamli, Hindan plain and also Sambhal Plain. There is no concentration of service towns and they are dispersed.

In 1991, industrial towns become more evenly distributed although the major concentration was in the eastern part during 1971. Similarly, the trade and transport towns have maximum concentration in the western part of the study area, covering Saharnpur, Shamli, Meerut, Hindan and Hapur Plain but a major concentration of trade and transport towns was also seen in Rampur, Amroha, Sambhal and Bijnor Plain. In case of service towns during 1991, all the 12 service towns were in the Plain and of these 6 were in Hapur Plain itself while other were dispersed.

Analysing the class wise distribution of various towns we observed that in 1971 the manufacturing towns were concentrated in class III (38 percent) followed by class IV (24 percent) and class V (21 percent). The trade and transport towns were more evenly distributed, class III contributed 32 percent, class V, 26 percent of the trade and transport towns. There were 16 percent of towns each in class I and class V while class II had 10.5 percent of towns.

The service towns were more evenly spaced between various class sizes. There were 5 towns one each in class I, II, III, IV and V while there was no service towns in class VI in 1971.

In 1991, it is observed that the manufacturing towns had their major concentration in class III and class IV which had 27 and 50 percent of the total manufacturing towns respectively. Similar pattern was found in case of trade and transport towns too, 50 percent of towns were in class IV while class III had 26 percent of the total trade and transport towns. In case of service towns, class V had 42 percent of share while class II, III and IV (each) had 17 percent of service towns.

Analysing the degree of functional intensity of towns according to their position in sub-triangles of the ternary diagram, it can be concluded that in 1971 the concentration of towns is away from the centre of the equilateral triangle. About 45 percent of the towns have their functions diversified while 55 percent of the towns had their predominant function accentuated. There were only seven towns which had all their three functions highly balanced. These towns are Moradabad, Nagina, Bijnor, Thakurdwara, Baghpat and Jansath. The second circle of the ternary diagram had twenty three towns. These towns have their functions moderately diversified.

There were fourteen towns in the third i.e. outer most circle and thus these towns had their predominant function accentuated. Again there were fourteen towns outside the three circles and these towns had their predominant function highly accentuated.

In 1971, of the total thirty four industrial towns we see that majority of the towns lie in the middle or outermost circle i.e. They have their functions moderately diversified or their predominant function is accentuated.

Similarly, the concentration of trade and transport towns in the sub-triangle of the ternary diagram was in the second and third circle. These towns also had their functions either moderately diversified or their predominant function was accentuated. The characteristic feature of the service towns in 1971 was that of the total five towns, three had their predominant function highly accentuated.

In 1991, the 125 towns are taken for analysing the functional character of these towns, we observe that of these towns the industrial towns again (as in 1971) have maximum share i.e. 47 percent. These industrial towns are followed by trade and transport towns which have 43 percent of the total towns. The share of service towns was approx. 10 percent.

The degree of intensity of functions according to their position in any of the six sub-triangles of the ternary diagram reveals that 54 percent of the towns have their functions highly or moderately diversified while remaining 46 percent of the towns have their predominant function accentuated or highly accentuated.

The maximum concentration of towns is in the second circle followed by the third circle. Thus we conclude that the pattern is almost similar to the 1871 where the maximum number of towns have their functions moderately diversified or they had their predominant function accentuated.

The intensity of the functions reveals that the pattern again is almost similar in the three functional types viz. industrial, trade and transport and services.

In the industrial towns, the major concentration of towns is in the mattila circle. This circle has twenty towns having their functions moderately diversified. There are eighteen (18) towns in the third circle, thus these towns have their predominant function accentuated.

Similar pattern was observed with trade and transport towns. It had 51 (fifty one) towns in the second circle. These towns had their functions moderately diversified. The third circle

has 37 (thirty seven) towns thus, having their predominant functions accentuated. There were 21 towns which had their predominant function highly accentuated.

There were 12 service towns in 1991, of these five had their predominant function highly accentuated while there were two towns each in the first and the third circle. The mattila circle had only one town. This town has its functions moderately diversified.

Finally, we can say that the industrial towns outnumbered the other two functions i.e. trade and transport towns and service towns both during 1971 and in 1991. But the percent share of industrial towns declined from 59 percent in 1971 to only 47 percent in 1991, while the share of trade and transport towns has gone up from 33 percent in 1971 to 43 percent in 1991. There was one percent increase in the share of service towns. Their percentage increased to 9.6 percent in 1991 from 8.6 percent in 1971.

To observe the change in the functional character of the towns which were common both during 1971 and 1991, the towns have been classified into two broad categories

- (a) The towns which have undergone change during this period and,
- (b) The towns which have not undergone any change during 1971-91.

It is observed that there were 54 towns for this analysis, out of the total 58 towns in 1971. Two towns Kaila and Kankerkhara were declassified in 1991 while of the other two towns, Malayana was merged into Meerut urban agglomeration and Rustamnagar Sahaspur was included in Bilari urban agglomeration in 1991.

Thus, of the remaining 54 towns 44 towns i.e. 61.5 percent have undergone change in their functional character while 10 towns had their functional composition similar as in 1971. Of the 44 towns which have undergone change 29 (twenty nine) have undergone intra functional change and only 15 towns have observed inter functional changes.

In the towns which have observed intra-functional changes, seventeen (17) towns were industrial towns, there were ten trade and transport towns, while only two service towns have observed intra-functional changes.

In the fifteen towns which have inter functional changes, nine towns changed their functions from industries to trade and transport towns. Four towns have undergone change from trade and transport towns to industrial towns, while only two towns have undergone change from service towns to industrial towns.

There were no towns which have changed their functions from services to trade and transport, industries to services and trade and transport to services towns. There were ten towns i.e., 18.5 percent of towns which have not undergone any type of change in their functional character. Therefore, we can say that majority of towns have undergone major or minor change in their functions.

But if we strictly observe only the inter functional change we can conclude that only 28 percent of towns changed their functions from one main functional type to another. Thus, the towns are rapidly heading towards developing their predominant functions and also have retained their functional character as was in 1971.

CHAPTER - IV

HIERARCHY OF URBAN SETTLEMENTS

4.1 INTRODUCTION

Hierarchy can be described as a stepwise differentiation which depends on the size and kind of services offered by a town. It is a system of ranking the towns and cities into successive groups based on certain criteria like size, function, etc.

In the present chapter an attempt has been made to analyse the extent of availability of infrastructural facilities in the towns of the Northern Upper Ganga plain. A composite index has been prepared for all the infrastructural facilities for which data is available in 1971 and 1991 census. On the basis of composite Index, a hierarchy of the urban settlements has been identified.

4.2 DATA BASE

The data for 1971 and 1991 on infrastructural facilities have been collected from the statements IV, V and VI of the town directory of U.P (1971). Data for 1991 has been collected from the Electronic Data Processing Division, Census of India. (Direct Data Entry System) Pushp Bhawan, New Delhi.

4.3 METHODOLOGY

This chapter has been divided into two major parts. In the first section the variables showing availability of infrastructural facilities have been assigned weightage and standardized (By dividing them with per lakh population). The unit of analysis is number of facilities per lakh population in each decade, except for road length which is shown as road length (in kilometres) per square kilometre of the area and number of road lighting points per kilometre of road length.

The levels of existence of these facilities have been analysed for all the towns, which were common both in 1971 and 1991 and also in all the towns of the Northern Upper Ganga plain in 1991.

In the second section, the centrality score has been calculated for each town on the basis of selected indicators. The values have been standardized and the score of each town has been summed up to reflect the final centrality score. Finally, a hierarchy of towns and cities has been worked out on the basis of these facilities and the towns have been arranged in descending order according to the values of composite Index.

4.4 ANALYSIS OF INFRASTRUCTURAL FACILITIES

In the present study fifty-five variables have been identified from the Town Directory, census of India (Table 4.1). All these variables have been combined under nine sub-heads and composite scores for each facility has been computed. These nine facilities are-

- i. Road Length (in kilometres) per square kilometre of area,
- ii. Sanitation, which includes system of sewerage, method of disposal of night soil and number of latrines per lakh population,
- iii. Number and percent of towns having fire fighting services,
- iv. Sources of drinking water,
- v. Number of electricity connections per lakh population,
- vi. Number of medical facilities per lakh population,
- vii. Number of educational facilities per lakh population,
- viii. Number of recreational facilities per lakh population and
- ix. Number of banks per lakh population.

Further, Hierarchy of towns existing both in 1971 and 1981 has been worked out for each facility.

(i) Road Length - Road length reflects the accessibility and connectivity of a place, which is an important indicator and contributes to the importance of the settlements. In analysing the total road length in kilometre per square kilometre of area, we find that in 1971 the total road length was 1958 kilometres, i.e., 4.6 kilometres per square kilometre of area while in 1991 it increased to 5.4 per sq.km of area.

Table:4.1

**MAJOR FUNCTIONS, THEIR SUB-FUNCTIONS AND THEIR WEIGHTAGES
IN THE NORTHERN UPPER GANGA PLAIN**

S.No	VARIABLES	WEIGHTS
1.	Road Length(In Kms.)	1
2.	System of sewerage	
	(a)Open Surface Drains	2
	(b)Box Surface Drains	3
	(c)Pit System	4
	(d)Cesspool Method	5
	(e)Sewerage	6
	(f)Others	1
3.	Type of Laterins(In number)	
	(a)Service/Dry Type	2
	(b)Water Borne/Flush	3
	(c)Others	1
4.	Method of Disposal of Soil	
	(a)Head Load	2
	(b)Basket	3
	(c)Wheel Barrow/Hand Cart	4
	(d)Pit System	5
	(e)Septic Tank	6
	(f)Sewerage	7
	(g)Others	1
5.	Source of Drinking Water	
	(a)Well	1
	(b)Tank	2
	(c)Hand pump	3
	(d)Tube-Well	3
	(e)taps	4
6.	Fire Fighting Services	
	(a)Yes	1
	(b)No	0
7.	Electricity (Number of Connections)	
	(a)Domestic	2
	(b)Industrial	3
	(c)Commercial	3
	(d)Road Lighting (No. of Points)	4
	(e)Others	1
8.	Type of Medical Facilities	
	(a)Health Centre	2
	(b)Family Planning Centre	3
	(c)Dispensary	4
	(d)Tuberculosis Centre	5
	(e)Nursing Home	6
	(f)Hospitals	7
	(g)Others	1
9.	Type of educational Facilities	
	(a)Primary School	2
	(b)Junior/Middle School	3
	(c)Senior Secondary School	4
	(d)Vocational Training Institute	4
	(e)Polytechnic	4

	(f)Arts College	5
	(g)Science College	5
	(h)Commerce College	5
	(i)Arts & Science College	6
	(j)Arts & Commerce College	6
	(k)Art, Science & Commerce College	6
	(l)Engineering college	7
	(m)Medical College	7
	(n)Law College	7
	(o)Others	1
10.	Recreational College	
	(a)Cinema	1
	(b)Stadia	2
	(c)Auditoria	3
	(d)Public Library	4
	(e)Reading Room	5
11.	Banking Facilities	1

Source : Census of India,
Series 22, Part-XA Town Directory

In 1971, the highest proportion of road length per square kilometre of area was found in Nakur i.e. 50 kms/sq.km of area of the town. This was followed by Sardhana (41.2 kms/sq.km) while in 1991 Afzalgarh had highest score with 64.5 kms of road length per square kilometre of area, this again was followed by Nakur (45 km/sq.km of area). On the other hand, Tanda and Seohara towns were at the lowest position with only 0.55 kms and 0.33 kms of road length per square kilometre of area in 1971, respectively.

In 1991, town Shahjahanpur was at the base with only 0.17 kms of road/sq.km of area. The higher proportion of road length (per square kilometre of area) of towns like Nakur and Sardhana is not because they really have a long road length, but because these towns have been less area. The total area of Nakur was 0.26 square kilometre and that of Sardhana was 0.34 sq.km in 1971 and similar was the case in 1991.

On the basis of individual scores the road length of towns have been categorised into five classes. There are shown in table 4.2.

a) Very high density of Road length. (Score value 2 and above)

In 1971, there were eight (13.8%) towns having very high density of road length per square kilometre of area. The towns are namely Nakur, Sardhana and Manglaur, Muradnagar, Chandpur, Faridnagar, Meerut and Dhampur. In 1991, the number of towns were reduced to four (7.3%) these are Afzalgarh, Nakur, Manglaur and Bijnor.

b) High density of road length (Score Value between 1 to 2)

There were nine towns in this category Faridnagar, Meerut, Dhampur, Afzalgarh, Shamli, Miranpur, Jansath, Hapur, Rampur, Mandawar, Bijnor and Khatauli. In 1991, the number of towns increased to twelve (21.8%) the towns are Faridnagar, Muzaffarnagar, Kairana, Shamli, Miranpur, Hapur, Khatauli, Gangoah, Gaziabad, Hasanpur, Dhampur and Saharanpur.

c) Medium density of road length (score value between 0.5-1)

This class had sixteen towns (27.6%) in 1971 and the number of towns remained unchanged in 1991.

TABLE:4.2
DENSITY OF ROADS (1971-91)

Class/Score Value	1971	1991	
Very High (2 & Above)	Nakur	Afzalgarh	
	Sardhana	Nakur	
	Manglaur	Manglaur	
	Muradnagar	Bijnor	
	Chandpur		
	Faridnagar		
	Meerut		
	Dhampur		
	Absolute & Percent of towns	8(13.8%)	4(7.3%)
	High (1.00 to 2.00)	Afzalgarh	Faridnagar
Shamli		Muzaffarnagar	
Miranpur		Kairana	
Jansath		Shamli	
Hapur		Miranpur	
Rampur		Hapur	
Mandawar		Khatauli	
Bijnor		Gangoh	
Khatauli		Ghaziabad	
		Hasanpur	
		Dhampur	
		Saharanpur	
Absolute & Percent of towns		9(15.5%)	12(21.8%)
Medium (0.5 to 1.00)		Saharanpur	Najibabad
		Aminagar Sarai	Mandawar
	Mawana	Rampur Maniharan	
	Rampur Maniharan	Baghpat	
	Sambhal	Mawana	
	Hastinapur	Rampur	
	Baghpat	Roorkee	
	Kairana	Moradabad	
	Hardwar	Modinagar	
	Amroha	Seohara	
	Najibabad	Kandhla	
	Pilkhua	Kiratpur	
	Moradabad	Deoband	
	Modinagar	Sambhal	
	Nagina	Jansath	
	Muzaffarnagar	Amroha	
Absolute & Percent of towns	16(27.6)	16(29.1%)	
Low (0.25 to 0.5)	Kanth	Hardwar	
	Kankar Khera	Chandausi	
	Roorkee	Sardhana	
	Hasanpur	Baraut	
	Kandhla	Dhanaura	
	Kiratpur	Meerut	

	Gangoh	Nagina
	Baraut	Chandpur
	Garh mukteshwar	Bilari
	Chandausi	Hastinapur
	Bilari	Thakurdwara
	Dhanaura	
	Deoband	
Absolute & Percent of towns	13(22.4%)	11(20%)
Very Low	Nehtaur	Bahjoi
(Below 0 .25)	Ghaziabad	Garhmukteshwar
	Thakurdwara	Kanth
	Rasulpur Dhulri	Pilkhua
	Tajpur	Aminagar Sarai
	Rustamnagar Sahaspur	Meerut Cantt.
	Kaila	Muradnagar
	Malayana	Tanda
	Bahjoi	Nehtaur
	Shahjahanpur	Rustamnagar Sahaspur
	Tanda	Tajpur
	Seohara	Shahjahanpur
Absolute & Percent of towns	12(20.7%)	12(21.8%)

d) Low density of road length (Score value between 0.25 and 0.50)

In 1971, there were thirteen towns in this category, however the number of towns decreased to eleven (20%) in 1991. The towns in 1991 were Hardwar, Chandausi, Sardhana, Barant, Dhanaura, Meerut, Nagina, Chandpur, Bilari, Hastinapur and Thakurdwara.

e) Very low density of roads (score values below 0.25)

In 1991, there were twelve towns (20.7%) having very low density of road length. The towns are Nahtaur, Ghazaiabad, Thakurdwara, Rasulpur-Dhulri, Tajpur, Rustamnagar-Sahaspur, Kaila, Malayana, Shahjahanpur, Tanda and Seohara. The number of towns remained same in 1991, but the towns changed. The towns in this class during 1991 are namely Bahjoi, Gahmukteshwar, Kanth, Pilkhua, Aminagar Sarai, Meerut Cant., Muradnagar, Tanda, Nehtour, Rustamnagar-Sahaspur, Tajpur and Shahjahanpur.

(ii) Sanitation

a) System of Sewerage

The system of sewerage, generally implies the network of drains and branches of underground conduits for the conveyance of sewerage to the point of disposal.⁸¹ These sewers can carry household and industrial waste and also carry storm waters from roofs, streets and other surfaces. Where this system of underground sewerage is not available, there may be other methods, like open surface drainage system or box surface drainage, these are the open drains and covered drains, respectively.

The sylk drains are the vertical drains meant for draining, waste water from height (ie roofs etc.) to the ground, i.e, pipes used to drain out the water from first and second floors, roof etc. Pit system is yet another method of disposing household waste.

In 1971, out of the total fifty-eight towns, thirty six (i.e., 62%) of them had box surface drains as most prevalent system of sewerage. Both pit system and open surface drains were in as many as fifteen towns. There were four towns having both sewerage and open surface drains while only two towns had a combination of sewerage and pit system. There was only

⁸¹ Census of India 1991 - Circular Number 6. Subject : Census of India 1991, District Census handbook compilation.

one town Deoband, which had only sewerage system as most prevalent method of disposing waste water.

In 1991, there was an increase in towns having open surface drains as a system of sewerage. Forty-four towns had this system of disposing waste water. The combination of sewerage and open surface drains are found in seven towns. Two towns had both sewers and pit system as system of sewerage. Meerut was the only town which had sewerage for disposing waste water. One town, Muzaffarnagar had both Cesspool method and open surface drains as a system of sewerage. Thus, it was observed that open surface drains dominated other methods of sewerage in both the decades. Only sewerage system as method of disposing waste water was found in one town each in 1971 and 1991. Thus, it may be concluded that system of sewerage for disposal of waste-water. is more of a rudimentary nature.

b) Method of disposal of night soil-

The method of disposal of night soil shows the use of human labour in the process of disposal of night soil and manual scavenging. In 1971, there were nine towns (15.5%) where head load was most prevalent method of disposal of night soil. There were eight towns where baskets were used. In as many as eleven towns both baskets and head load were used for disposing night soil. In ten towns, hand carts (wheel barrows) were used for disposing the night soil. Only in 10 towns, (i.e., 17%) mechanical transport was used for disposal of night soil and even in these towns, this method was prevalent only in combination with other methods.

In 1991, there were very few towns where only one method alone is involved for the disposal of night soil. In most of the cases, there has been a combination of two most prevalent methods. There was only one town each, where either head load, basket, septic tank pit system or sewer was the most prevalent method of disposal of night soil. Basket was used in only five towns. There were only seventeen towns where wheel barrow was used for night soil disposal. In twelve towns both wheel Barrow and septic tanks were used. While in 1971, there were forty-eight towns (82.7%) where night soils was disposal either by head load or baskets or these methods were prevalent in combination with other methods.

In 1991, however the percent decreased to 65 and these methods (head load and basket were used in combination with methods like Pit System, septic tank or sewerage.

c) Number of Latrines-

The number of latrines are further categorised into three sub-types - (i) the water borne or flush type of latrines, (ii) service or dry type of latrines and other than these

In 1971, there were 11,525 latrines per lakh population and these decreased to 3,570 latrines per lakh population in 1991.

There were only 906 water borne latrines per lakh population in 1971, while the number further decreased to 670 per lakh population in the common towns and 1,991 per lakh population for all the towns of the study area in 1991.

The service latrines outnumbered the water borne latrines. There were 69,627 service latrines pre lakh population i.e. 10,297 per lakh population in 1971, the number however, increased to 1,28,501 as a whole while the per lakh share decreased, it was only 2,354 service latrines per lakh population in the common towns and 3,065 latrines per lakh population in all the towns in 1991. Thus, the service or dry type of latrines were more common in both the decades. This shows the prevalence of manual scavenging in the towns where high percent of service latrines are prevalent.

The town, Garhmukteshwar had highest number of latrines per lakh population i.e. 73,146 per lakh in 1971 and it was followed by Amroha i.e. 50,857 latrines per lakh population, while in 1991, Nagina secured highest position with 41,358 latrines per lakh population in the common towns in 1991. Noida had highest number of latrines if all the towns of the study area are considered in 1991.

The composite score of sanitation facilities for all the common towns in 1971 and 1991 is categorized into five classes viz. very high, high medium, low and very low levels of sanitation facilities. (see table 4.3)

TABLE : 4.3
LEVELS OF SANITATION FACILITIES 1971-91

Class/Score Value	1971	1991
Very High (3.5 & Above)	Garh mukteshwar Amroha Jansath Bijnor Saharanpur Dhampur Roorkee Afzalgarh Miranpur Nehtaur Chandpur Muradnagar	Nagina Manglaur Hasanpur Mawana Garhmukteshwar Hastinapur Kiratpur Chandpur Baraut Sambhal Bahjoi Kandhla Khatauli Thakurdwara Shamli
Absolute & Percent of towns High (3.00 to 3.5)	12(20.7%) Manglaur Shahjahanpur Moradabad Baraut Najibabad Mawana Bahjoi Mandawar Modinagar Nagina Nakur Kiratpur Tajpur Baghpat Rasulpur Dhulri	15(29.1%) Dhanaura Jansath Seohara Najibabad Shahjahanpur Afzalgarh Hapur Baghpat
Absolute & Percent of towns Medium (2.5 to 3.00)	15(25.9%) Aminagar Sarai Thakurdwara Rampur Maniharan Malayana Rampur Seohara Hardwar Kankar Khera Kandhla Pilkhua	8(14%) Bilari Bijnor Nehtaur Nakur Chandausi

	Chandausi	
	Kairana	
	Tanda	
	Hasanpur	
	Khatauli	
Absolute & Percent of towns Low	15(25.9%)	5(9.1%)
(2.00 to 2.50)	Rustamnagar	Tajpur
	Sahaspur	
	Kaila	Faridnagar
	Bilari	Kairana
	Hastinapur	Roorkee
	Dhanaura	Miranpur
	Ghaziabad	Dhampur
	Hapur	Gangoh
	Sambhal	Rampur Maniharan
	Muzaffarnagar	Sardhana
	Kanth	Muzaffarnagar
	Shamli	Deoband
Absolute & Percent of towns	11(19%)	11(20%)
Very Low	Gangoh	Rustamnagar Sahaspur
(Below 2.00)	Deoband	Mandawar
	Sardhana	Moradabad
	Meerut	Saharanpur
	Faridnagar	Hardwar
		Meerut Cantt.
		Modinagar
		Ghaziabad
		Meerut
		Amroha
		Pilkhua
		Muradnagar
		Kanth
		Aminagar Sarai
		Rampur
		Tanda
Absolute & Percent of towns	5(8.6%)	16(29.1%)

*Fifty-Eight towns were considered in 1971, but in 1991 the no. of towns are fifty-five as three towns namely Malayana & Kanker khera are included in Meerut U.A, while one town Kaila was declassified.

(a) Very high levels of sanitation facilities - (score value above 3.5)

There were twelve towns in this class in 1971. These towns in order of their rank are Garhmukteshwar, Amroha, Jansath, Bijnor, Saharanpur, Dhampur, Roorkee, Afzalgarh, Miranpur, Nehtaur, Chandpur and Muradnagar. In 1991, the number of towns having very high levels of sanitation facilities increased to fifteen.

(b) High level of sanitation facilities - (Score value between 3 and 3.5)

In 1971, fifteen towns had high level of sanitation facilities, however the number of towns in this class decreased to only eight in 1991. These are Dhanaura, Jansath, Seohara, Najibabad, Shahjahanpur, Afzalgarh, Hapur and Baghpat.

(c) Medium level of sanitation facilities (score value between 2.5 and 3)

In 1971, there were as many as fifteen towns (25.9%) having medium level of sanitation facilities, while the number of towns in this class decreased to only five (9.1%) in 1991. These towns were Bilari, Bijnor, Nehtaur, Nakur and Chandausi.

(d) Low level of sanitation facilities (score value between 2 and 2.5)

There were eleven towns (19%) in this class in 1971. These are Rustamnagar-Saharpur, Kaila, Bilari, Hastinapur, Dhanaura, Ghaziabad, Hapur, Sambhal and Muzaffarnagar. The number of towns remained same in 1991. However, these towns were Tajpur, Faridnagar, Kairana, Roorkee, Miranpur, Dhampur, Gangoh, Rampur-Maniharan, Sardhana, Muzaffarnagar and Deoband. Tajpur had the highest score in 1991 in this class while Deoband was at the base. It was observed that Roorkee and Muzaffarnagar were class II and class I towns respectively but they had low level of sanitation facilities.

(e) Very low level of sanitation facilities (score value below 2)

There were five towns namely Gangoh, Deoband, Sardhana, Meerut and Faridnagar in 1971, while the number of towns rose to sixteen in 1991. Rustamnagar-Saharpur had highest score, followed by Mandawar, while Tanda was at the base of this class in 1991.

(iii) Fire fighting services -

In case of fire fighting services, in 1971 these services were present in only sixteen towns (i.e. 28% of towns had this facility). This facility however improved in 1991 and almost 35% of the common towns had this service. But, if we consider all the towns of the study area, only 18.4% of towns had fire fighting facilities. This shows that most of the towns which came up during 1971-91 did not have fire fighting services.

(iv) Sources of drinking water -

The major sources of drinking water in the northern upper Ganga plains are wells, tube well and hand pumps. In 1971, forty-six of the fifty eight towns (i.e. 79%) had tube wells as a major source of drinking water. In five towns wells were most prevalent while in six towns a combination of wells and tube wells was most prevalent.

In 1991, we find that the tube wells remain the most important source of drinking water, as many as, thirty-one towns (i.e. 56%) depend on this source for drinking water supply. This is followed by a combination of tap and tube well. There were twelve towns (i.e. 22%) where tap and tube well are most prevalent. In four towns, both wells and tube wells were the major sources of water supply. A combination of tank and tube well was most prevalent in four towns. There were three towns where tank was most prevalent source of drinking water. Well was a major source in only town, Rampur-Maniharan.

The northern upper Ganga plains is a aggradational plain (except Shiwaliks) area where the water table is high because of dense network of rivers, the river Ganga and Yamuna and their tributaries and sub-tributaries hence tube wells, hand pumps and also wells are important sources of drinking water. The high water table, makes the trapping and extracting of underground water cheaper and easier.

(v) Electrification

The nature of electrification has been divided under four heads- the number of domestic connections, number of industrial connections, the number of commercial connections and number of road lighting points per kilometre of road length.

In 1971, the number of electric connections were 7,532 per lakh of population. However in 1991, the total number of electricity connections were 5,25,748 ie 10,369/lakh of population. Thus there was an overall increase in number of connections in the towns which were existing both in 1971 and 1991. If we consider all the towns in 1991, the number of connections were 9,393 per lakh population.

In 1971, the number of domestic connections were 6,095 per lakh population in 1991 while it increased to 8,141/lakh population in the towns which were common in 1971 and 1991 and 8,227/lakh when we consider all the towns.

The number of commercial connections were 404 per lakh population in 1971 but they decreased to 354/lakh population in the common towns of 1971 and 1991 but increased to 439/lakh population, if we consider all the towns of the study area during 1991.

The number of industrial connections were 1,035/lakh population in 1971, they increased to 1,652/lakh population in the common towns and 1,453/lakh population in all the towns.

The number of road lighting points were 24.35/lakh kilometre of road length in 1971 and this decreased to only 16 points per kilometre in the common towns and 23 points per kilometre, when we consider all the towns of northern upper Ganga plain

The number of industrial connections per lakh population and road lighting points per kilometre of road length had decreased. This may be because of the fact that number of commercial connections have not grown in the same proportion as the population has grown since 1971. In case of road lighting, it was observed that there was 2.5 times increase in the total road length but the number of road lighting points have grown by only two times.

The Town Hastinapur had highest number of electricity connections i.e., 87,411 per lakh population in 1971. It was followed by Pilkhua with 73,948 connections per lakh population. In 1991, in the common towns of 1971 and 1991, Baghpat scored highest rank with 72,633 connections per lakh population followed by Afzalgarh. However, if

we consider all the towns during 1991, Noida had highest with 1,86,330 connections per lakh population.

The composite score of electricity facilities for all the common towns of 1971 and 1991 is also categorised into five classes viz very high, high, medium, low and very low level of electrification facilities (See table 4.4)

(a) *Very high level of electricity facilities (Score value above 2)*

There were only three towns (5.17%) having very high level of electricity facilities. These towns in order of their ranks are Hastinapur, Pilkhua and Modinagar.

In 1991, the number of towns decreased to only two. Bagpat and Afzalgarh had very high level of electricity facilities. Afzalgarh had very low levels of this facility in 1971 while it jumped to this class in 1991.

On the other hand, Hatinapur slipped to the second category ie having high level of electricity facilities, Modinagar slipped to class III ie having medium level of facilities while Pilkhua which had very high level of this facility in 1971, had very low level of electricity facility in 1991.

(b) *High level of electricity facilities (Score value between 1 and 2.00)*

In 1971, there were seventeen towns i.e., 29.3% having high level of electricity facilities. Moradabad was at the apex of this class having highest score while Meerut was at the base in 1971. However, the number of towns decreased in fifteen in 1991. Roorkee was at the top most position (1.05) while Muradanagar was at the base of this class having score value of 0.53 in 1991.

(c) *Medium level of electricity facilities (Score value between 0.75 and 1.00)*

In 1971, there were fifteen towns having medium level of electricity facilities, while in 1991 there were maximum number of towns, nineteen i.e., 34.5% in this class. Six towns namely Moradabad, Garhmukteshwar, Rampur Miranpur, Barant and Khatauli which had high level of this facility in 1971 were in this class in 1991.

(d) *Low level of electricity facilities (Score value between 0.5 and 0.75)*

TABLE 4.4
LEVELS OF ELECTRICITY FACILITIES (1971-91)

Class/Score Value	1971	1991
Very High (2 & Above)	Hastinapur	Baghpat
	Pilkhua	Afzalgarh
	Modinagar	
Absolute & Percent of towns	3(5.17%)	2(3.6%)
High (1.00 to 2.00)	Moradabad	Roorkee
	Miranpur	Shamli
	Aminagar Sarai	Bijnor
	Baghpat	Saharanpur
	Hardwar	Hapur
	Saharanpur	Muzaffarnagar
	Jansath	Meerut Cantt.
	Dhampur	Aminagar Sarai
	Khatauli	Kanth
	Muzaffarnagar	Sambhal
	Garh mukteshwar	Hardwar
	Baraut	Hastinapur
	Rampur	Meerut
	Ghaziabad	Dhampur
	Roorkee	Muradnagar
	Dhanaura	
	Meerut	
Absolute & Percent of towns	17(29.3)	15(27.3)
Medium (0.75 to 1.00)	Rasulpur Dhulri	Moradabad
	Chandausi	Amroha
	Bahjoi	Jansath
	Rampur Maniharan	Nakur
	Shamli	Chandausi
	Bijnor	Garhmukteshwar
	Najibabad	Mawana
	Bilari	Rampur
	Hapur	Miranpur
	Kanth	Baraut
	Kandhla	Gangoh
	Hasanpur	Khatauli
	Sambhal	Modinagar
	Chandpur	Sardhana
	Amroha	Tajpur
		Najibabad
	Dhanaura	
	Bahjoi	
	Hasanpur	
Absolute & Percent of towns	15(25.9%)	19(34.5%)
Low (0.5 to 0.75)	Gangoh	Kandhla
	Nakur	Bilari
	Nagina	Seohara

	Nehtaur	Manglaur
	Kairana	Nagina
	Mawana	Shahjahanpur
	Kankar Khera	Kairana
	Thakurdwara	Faridnagar
	Mandawar	Ghaziabad
	Malayana	Nehtaur
	Muradnagar	
	Tanda	
Absolute & Percent of towns	12(20.7%)	10(18.2%)
Very Low (Below 0.5)	Manglaur	Tanda
	Seohara	Thakurdwara
	Sardhana	Kiratpur
	Afzalgarh	Chandpur
	Kiratpur	Pilkhua
	Rustamnagar Sahaspur	Mandawar
	Kaila	Rustamnagar Sahaspur
	Tajpur	Rampur Maniharan
	Faridnagar	Deoband
	Deoband	
	Shahjahanpur	
Absolute & Percent of towns	11(19%)	9(16.36%)

There were twelve towns in this class in 1971. However, the number of towns decreased to ten in 1991. Two towns Nagina and Nehtaur were in this class in both the decades i.e., 1971 and 1991.

(c) *Very low level of electricity facilities (Score value below 0.5)*

There were eleven town, (19%) having very low level of electricity facilities in 1971, while the number of towns decreased to nine in 1991. The town in 1991 are Tanda, Thakurdwara, Kiratput, Chandpur, Pilkhua, Mandawar, Hustamnagar Sahaspur, Rampur- Maricharan and Deoband.

(vi) Medical Facilities

The various medical facilities available in the towns of northern upper Ganga plain range from health centre to hospitals. The lowest level of medical service available is the health centre. In 1971, there were only seventeen health centre ie only 0.7 health centre per lakh population, while in 1991, the number of health centres increased to fifty and there were 0.98 health centres per lakh population (in the common towns) and 1.47 per lakh population, if we consider all the towns of the study area in 1991.

There were, forty-one Family Planning Centres (FPCs) i.e., 1.6 per lakh population in 1971, but the number reduced to 0.47/lakh in the common towns in 1991 and 0.45/lakh if all the towns are considered. There was one Tuberculosis Centre (TBC) for 2,85,714 persons in 1971 i.e. 0.35 TBC per lakh population. However, the population served by one TBC decreased to 2,27,273 persons in 1991.

In 1971, there were two dispensaries per lakh population, but in 1991, there was only one dispensary per lakh population in the towns existing both in 1971 and 1991 as well as in all the towns in 1991. In case of hospitals, there were 3.7 hospitals per lakh population in 1971, while this proportion decreased to 2.05 per lakh population in the common towns of 1991 and 2.42 per lakh population in all the towns.

Observing the total availability of health services, on an average, there were forty four health services per lakh population in 1971 and these decreased to twenty-two per lakh population in 1991. Thus, the availability of the health services per lakh population

was just halved. This may be because of the fact that the health facilities have not grown in similar proportion as the population.

The availability of hospitals and dispensaries is more than the lower order services like health centres, Family Planning Centres etc the reason may be that if there is a higher order service in any town, it must be offering the lower order services too and so in most of the cases, where higher order services like hospitals and dispensaries were present, the lower order services like health centres were almost non-existent.

In 1971, Jansath Town, had highest number of medical facilities ie 207/lakh population, followed by Aminagar Sarai (142/lakh). In 1991, Rustamnagar Sahaspur ranked first in terms of medical facilities in the common towns as well as in all the towns in 1991. The reason for this small town scoring higher value is because of presence of a hospital and dispensary in the town inspite of its population of 10,153 persons in 1991.

The centrality score of availability of medical facilities in the common towns of 1971 and 1991 is categorised into five classes (Table -4.5)

(a) Very high levels of medical facilities (score value above 2)

There were six towns in this class in 1971. They were Jansath, Aminagar Sarai, Hastinapur, Baraut, Dhampur and Bahjoi, while in 1991 the number of towns having very high levels of medical facilities were only five, these were Rustamnagar-Sahasrpur, Rampur Maniharan, Baghpat, Afzalgarh and Pilkhua. Two towns Pilkhua and Afzalgarh had medium level of this facility in 1971 while they had very high level of health is facilities in 1991.

(b) High level of medical facilities (score value between 1.00 and 2.00)

In 1971, there were seventeen towns (29.5%) having high level of medical facilities, while the number of towns in this class decreased to fifteen in 1991. Three towns namely Nakur, Mandawar and Garhmukteshwar were in the same class both, during 1971 and 1991.

TABLE:4.5
LEVELS OF MEDICAL FACILITIES (1971-91)

Class/Score Value	1971	1991
Very High 2 & Above)	Jansath	Rustamnagar Sahaspur
	Aminagar Sarai	Rampur Maniharan
	Hastinapur	Baghpat
	Baraut	Afzalgarh
	Dhampur	Pilkhua
	Bahjoi	
Absolute & Percent of towns	6(10.3%)	5(9.1%)
High (1.00 to 2.00)	Tanda	Thakurdwara
	Nakur	Garhmukteshwar
	Baghpat	Gangoh
	Garh mukteshwar	Bahjoi
	Muradnagar	Hastinapur
	Modinagar	Nakur
	Khatauli	Shahjahanpur
	Bijnor	Hasanpur
	Mandawar	Tanda
	Sardhana	Jansath
	Chandpur	Mawana
	Najibabad	Mandawar
	Nagina	Kanth
	Kairana	
	Roorkee	
	Chandausi	
	Rampur Maniharan	
Absolute & Percent of towns	17(29.3%)	13(23.6%)
Medium (0.5 to 1.00)	Hardwar	Chandpur
	Rampur	Muradnagar
	Shamli.	Roorkee
	Pilkhua	Hardwar
	Thakurdwara	Manglaur
	Kandhla	Tajpur
	Mawana	Deoband
	Muzaffarnagar	Bilari
	Saharanpur	Dhampur
	Hapur	Chandausi
	Afzalgarh	Kandhla
	Hasanpur	Rampur
	Manglaur	Nehtaur
	Malayana	Aminagar Sarai
	Meerut	Shamli
	Moradabad	
	Nehtaur	
	Ghaziabad	
	Gangoh	
	Deoband	

Absolute & Percent of towns	Faridnagar 21(36.2%)	15(27.3%)
Low (0.25 to 0.5)	Dhanaura Amroha Bilari Kanth Sambhal Seohara	Hapur Saharanpur Faridnagar Modinagar Sardhana Kiratpur Ghaziabad Najibabad Amroha Muzaffarnagar Moradabad Dhanaura Nagina Sambhal Bijnor
Absolute & Percent of towns	6(10.34%)	15(27.3%)
Very Low (Below 0.25)		Meerut Kairana Miranpur Meerut Cantt. Seohara Khatauli Baraut
Absolute & Percent of towns	0	7(12.7%)
Towns Having no Medical Facility	Miranpur Shahjahanpur Kiratpur Tajpur Kankar Khera Rasulpur Dhulri Rustamnagar Sahaspur Kaila	
Absolute & Percent of towns	8(13.8%)	

(c) Medium level of medical facilities (score value between 0.5 and 1.00)

In 1971, there were maximum number of towns having medium level of medical facilities, the number of towns were 21 i.e. 36.2%. Hardwar had highest score (0.96) in this class followed by Rampur (0.78) while Faridnagar was at the bottom of this class in 1971.

In 1991, there were fifteen towns having medium level of medical facilities. Chandpur had the highest score (0.93) while Shamli was at the base.

(d) Low level of medical facilities (score value between 0.25 and 0.5)

There were six towns in 1971 having low levels of medical facilities Dhanaura, Amroha, Bilari, Kanth, Sambhal, Seohara while the number rose to fifteen (27.3%) in 1991.

(e) Very low levels of medical facilities (Score value below 0.25)

There was no town in this class in 1971 while they were seven towns (12.7%) having very low medical facilities in 1991. These towns were Meerut, Kairana, Miranpur, Meerut Cantt., Seohara, Khatauli and Baraut.

It was also observed that there were eight towns namely, Miranpur, Shahjahanpur, Kiratpur, Tajpur, Kanker Khera, Rasulpur Dhulri, Rustamnagar Sahaspur and Kailahaving no medical facilities. However, Rustamnagar-Sahaspur and Shahajahanpur had very high and high levels of medical facilities, respectively in 1991, while Tajpur had medium level of this facility in 1991.

(vi) **Educational facilities**

In 1971, there were forty primary schools per lakh population, but the number decreased to 34.16 per lakh population in 1991. There was marked increase in number of middle schools per lakh population, the number increased from eight in 1971 to forty-four middle schools per lakh population in 1991. The number of senior secondary schools increased from 249 in 1971 to 270 in 1991, but the proportion decreased from 9.7 senior secondary schools per lakh to 5.33 per lakh population in 1991.

There were 1.44 colleges per lakh population during 1971 and this proportion increased to 1.8 colleges/lakh population in 1991 (the towns which were common in 1971 and 1991) and to 1.9/lakh in all the towns. The number of medical, law and engineering colleges have remained same in both the decades. There were two medical and engineering colleges each, while there was only one law college in both the decades, in the study area. Thus, the population served by these facilities has increased.

There were 0.03 engineering and medical college each per lakh population in 1971 and this further decreased to 0.02/lakh population in 1991.

There were 1.4 vocational colleges per lakh population in 1971 and these decreased to 0.89 in the common towns (1991) and 0.75/ lakh population in all the towns during 1991. Similarly, there were only 0.31 polytechnics per lakh population in 1971 and this decreased to 0.2 per lakh population in 1991.

It was observed from the above analysis that, although the educational facilities have increased in absolute terms in 1991, but they have shown decline in relation to population served by each of them (except in case of middle schools and colleges where these facilities have shown proportionate increase) This shows the growing pressure of population on the existing services.

Among the towns 1971, Muradnagar had highest score value, this town had 386 educational institutions per lakh population followed by Mamana, while in 1991, town Pilkhua stood first with 669 educational institutions per lakh population. Pilkhua was followed by Jansath (375/lakh population) in the common towns. Pilkhua again had the highest score if of all the towns of the study area are considered. It was followed by Babugarh.

Centrality score of the level of educational facilities is calculated for the towns common in 1971 and 1991 and Hierarchy of urban settlements is worked out. The towns are then categorised into five classes. Viz. very high, high, medum low and very low (see table 4.6) :

TABLE:4.6
LEVELS OF EDUCATIONAL FACILITIES 1971-91

Class/Score Value	1971	1991
Very High (1.25 & Above)	Muradnagar	Pilkhua
	Mawana	Jansath
	Rampur Maniharan	Baraut
	Sardhana	Khatauli
	Dhampur	Nakur
	Shamli	Kanth
	Aminagar Sarai	Rampur Maniharan
	Faridnagar	Shamli
	Khatauli	
	Hastinapur	
	Garh mukteshwar	
	Shahjahanpur	
	Hardwar	
	Roorkee	
Absolute & Percent of towns	14(24.1%)	8(14.5)
High (1.00 to 1.25)	Saharanpur	Mawana
	Kanth	Dhampur
	Kanarkhera	Miranpur
	Chandpur	Saharanpur
	Bahjoi	Roorkee
	Baraut	Muzaffarnagar
	Manglaur	Bijnor
	Jansath	Hastinapur
	Tanda	Najibabad
	Pilkhua	
	Chandausi	
	Dhanaura	
	Bilari	
	Hapur	
Absolute & Percent of towns	14(24.1%)	9(16.4%)
Medium (0.75 to 1.00)	Hasanpur	Chandpur
	Rasulpur Dhulri	Chandausi
	Miranpur	Amroha
	Najibabad	Baghpat
	Kiratpur	Deoband
	Gangoh	Kandhla
	Nagina	Meerut Cantt.
	Sambhal	Sardhana
	Nehtaur	Aminagar Sarai
	Ghaziabad	Manglaur
	Muzaffarnagar	Bahjoi
	Rampur	Hardwar
	Deoband	Garhmukteshwar
	Afzalgarh	Moradabad
Baghpat	Hasanpur	

	Amroha	Thakurdwara
	Thakurdwara	Dhanaura
	Nakur	
Absolute & Percent of towns	18(31.03%)	17(30.9%)
Low	Malayana	Seohara
(0.5 to 0.75)	Bijnor	Rustamnagar Sahaspur
	Tajpur	Faridnagar
	Meerut	Rampur
	Modinagar	Nagina
	Rustamnagar Sahaspur	Gangoh
	Kaila	Kairana
	Seohara	Sambhal
	Mandawar	Modinagar
	Kairana	Meerut
		Afzalgarh
Absolute & Percent of towns	10(17.24%)	11(20%)
Very Low	Kandhla	Tajpur
(Below 0.5)	Moradabad	Hapur
		Kiratpur
		Muradnagar
		Tanda
		Nehtaur
		Ghaziabad
		Bilari
		Shahjahanpur
Absolute & Percent of towns	2(3.45%)	10(18.2%)

(a) *Very high level of Educational facilities (Score value above 1.25)*

In 1971, there were fourteen towns in this class. These are namely, Muradnagar Maurana, Rampur-Maniharan, Sardhana Dhampur, Shamli, Aminagar Sarai, Faridnagar, Khatauli, Hastinapur, Garhmukteshwar, Shahjahanpur, Hardwar and Roorkee. In 1991, the number of towns decreased to eight (14.5%) in this class, they were Pilkhua, Jansath, Baraut, Khatauli, Nakur, Kanth, Rampur, Manicharan and Shamli.

(b) *High levels of educational facilities (Score value between 1.00 and 1.25)*

In 1971 again there were fourteen towns in this class. Saharanpur, was at the apex having centrality score of 1.24 while Hapur was at the base. In 1991, the number of towns in this class decreased to nine. These were Mawana, Dhampur, Miranpur, Saharanpur, Roorkee, Muzaffanagar, Bijnor, Hastinapur and Najibabad.

(c) *Medium level of Educational facilities (Score value between 0.75 and 1.00)*

In 1971, there were eighteen towns having medium levels of educational facilities while in 1991 the number of towns were seventeen (30.9%).

(d) *Low levels of Educational facilities (Score value between 0.5 and 0.75)*

In 1971, there were ten towns (17.24%) having low level of educational facilities, while the number of towns increased to eleven in 1991. These towns were namely, Seohara, Rustamnagar- Sahaspur, Faridnagar, Rampur, Nagina, Gangoh, Kairana and Sambhal.

(c) *Very low levels of Educational facilities (Score value below 0.5)*

There were only two towns namely Kandhla and Moradabad having very low levels of educational facilities in 1971 while the number of towns rose to 10 (i.e., 18.2 percent) in this class during 1991. These towns in decending order of their ranks are Modinagar, Meerut, Afzalgarh, Mandawar, Nehtaur, Ghaziabad, Bilari and Shahjahanpur.

(viii) Recreational facilities

There were twenty-seven recreational facilities per lakh population in 1971, while the number decreased to 12.26 per lakh population in both the common towns and also if we consider all the towns of the study area in 1991. There was no change in number of cinemas/lakh of population. Their availability was three cinemas per lakh population in 1971, as well as, in 1991. There was only 0.9 stadia per lakh population in 1971 and this decreased to 0.37/lakh in 1991. The number of Auditoria were 0.86/lakh population in 1971 and this proportion further decreased to 0.56 per lakh population in 1991.

In 1971, there were 3.47 public libraries per lakh of population and this proportion decreased to 1.5 per lakh population in 1991. Similarly, in case of reading rooms, there were 1.5 reading rooms per lakh population in 1971 and this decreased to only 0.3 per lakh in 1991.

In Towns, Baraut had highest score for recreational facilities. It had 182 recreational facilities per lakh population. Seoshara was at the second position (131 per lakh population). In 1991, Pilkhua ranked highest (147/lakh population) followed by Saharanpur (42.67/lakh population). There was a large gap between the towns in terms of number of recreational facilities. If we Considering all the towns of the study area in 1991, Pilkura again had highest position (148/lakh population).

Further, all these recreational facilities were summed up and composite index was calculated, to work out the hierarchy of urban settlements. All the towns are categorised into five classes on the basis of their composite score (see table 4.7)

(a) *Very high level of recreational facilities (Score value above 1.5)*

There were ten towns (17.24%) having very high level of recreational facilities in 1971. These in descending order of their score were Baraut, Seohara, Nakur, Hardwar, Chandpur, Aminagar Sarai, Shahiahnpur, Dhampur, Shalyahanpur and Faridnagar.

TABLE:4.7
LEVELS OF RECREATIONAL FACILITIES(1971-91)

Class/Score Value	1971	1991
Very High (1.5 & Above)	Baraut	Pilkhua
	Seohara	Saharanpur
	Nakur	Rampur Maniharan
	Hardwar	Roorkee
	Chandpur	Dhanaura
	Aminagar Sarai	Dhampur
	Saharanpur	Afzalgarh
	Dhampur	Bijnor
	Shahjahanpur	
	Faridnagar	
Absolute & Percent of towns	10(17.24%)	8(14.5%)
High (1.00 to 1.5)	Mawana	Tajpur
	Baghpat	Deoband
	Kanth	Mawana
	Rampur Maniharan	Chandpur
	Roorkee	Baraut
	Hapur	Nakur
	Bijnor	Manglaur
	Sambhal	Najibabad
	Kairana	
	Tanda	
	Shamli	
Absolute & Percent of towns	11(19%)	8(14.5%)
Medium 0.5 to 1.00)	Muradnagar	Khatauli
	Najibabad	Sambhal
	Pilkhua	Rampur (UP)
	Manglaur.	Muradnagar
	Nehtaur	Hapur
	Modinagar	Kairana
	Amroha	Amroha
	Muzaffarnagar	Moradabad
	Moradabad	Aminagar Sarai
	Deoband	Kiratpur
	Rampur	Nagina
	Chandausi	Shamli
		Hardwar
	Chandausi	
Absolute & Percent of towns	12(20.7%)	14(25.4%)
Low (0.25 to 0.5)	Gangoh	Garhmukteshwar
	Ghaziabad	Muzaffarnagar
	Meerut	Meerut Cantt
	Khatauli	Gangoh
		Jansath
		Sardhana
	Hastinapur	
	Kandhla	

Absolute & Percent of towns 4(6.9%)

Very Low
(Below 0.25)

Kandhla
Hasanpur
Nagina

Modinagar
Hasanpur
10(18.2%)

Seohara
Nehtaur
Bilari
Meerut
Tanda
Thakurdwara
Baghpat
7(12.7%)
Ghaziabad

Absolute & Percent of towns 3 (5.17%)
Towns having no
Recreational Facilities

Afzalgarh
Thakurdwara
Garh mukteshwar
Jansath
Miranpur
Hastinapur
Mandawar
Kiratpur
Tajpur
Sardhana
Kankar Khera
Rasulpur Dhulri
Bilari
Bahjoi
Rustamnagar Sahaspur
Dhanaura
Malayana
Kaila

Miranpur
Shahjahanpur
Mandawar
Faridnagar
Kanth
Bahjoi
Rustamnagar Sahaspur

Absolute & Percent of towns 18(31.03%)

8(14.5%)

In 1991, there were eight towns (14.5%) having very high level of recreational facilities. These towns were Pilkhua, Saharanpur, Rampur-Maniharan, Roorkee, Dhanaura, Dhampur, Afzalgarh, and Bijnor.

(b) *High levels of recreational facilities (score value between 1.0 and 1.50)*

In 1971, there were eleven towns (19%) having high levels of recreational facilities. These were Mawana, Baghpat, Kanth, Rampur Maniharan, Roorkee, Hapur, Bijnor, Sambhal, Kairana, Tanda and Shamli. In 1991, there were again eight towns (14.5%) having high level of recreational facilities. These were Tajpur, Deoband, Mawana, Chandpur, Baraut, Nakur, Manglaur and Najibabad.

(c) *Medium level of recreational facilities (score value 0.5 and 1.00)*

In 1971, there were twelve towns having medium level of recreational facilities, while the number of towns increased to fourteen (25.4%) in 1991.

(d) *Low level of recreational facilities (score value between 0.25 and 0.5)*

In 1971, there were only four towns having low level of this facility. These were Gangoh, Ghaziabad, Meerut and Khatauli.

In 1991, however the number of towns increased to ten (18.2%). These are Garhmukteshwar, Muzaffarnagar, Meerut Cantt. Gangoh, Jansath, Sardhana, Hastinapur, Kandhla, Modinagar, Hasanpur.

(e) *Very low level of Recreational facilities (score value below 0.25)*

There were only three towns namely Kandhla, Hasanpur, Nagina having very low level of recreational facilities in 1971.

In 1991, there were seven towns (12.7%) in this class. These were Baghpat, Thakurdwara, Tanda, Meerut, Bilari, Nehtaur, Seohara and Ghaziabad.

It was observed that there were, as many as eighteen towns (31%) where there was no recreational facility at all. These towns are Afzalgarh, Thakurdwara, Garhmukteshwar, Jansath, Miranpur, Hastinapur, Mandawar, Kiratpur, Tajpur, Sardhana, Kanker Khera, Rasulpur Dhulri, Bilari, Bahjoi, Bustamnagar-Sahaspur, Dhanaura, Malayana and

Kaila. In these towns two were class III towns, seven were class IV towns, six were class V towns and two were class VI towns.

In 1991, however the number of towns having no recreational facilities were eight. These were namely, Miranpur, Shahjahanpur, Mandawar, Kanth, Bahjoi and Rustamnagar-Sahaspur, Miranpur, Bahjoi and Kanth were class III towns while Shahjahanpur and Mandawar are class IV towns.

(ix) Banking facilities :

There were 5.7 banks per lakh population in 1971, however this proportion almost doubled in 1991, with 11.1 banks per lakh population, in common towns and 11.5 banks per lakh population when all the towns of the study area during 1991 were considered.

Jansath town occupied first rank with thirty-seven banks per lakh population. In 1991, Pilkhua again scored highest rank in the common towns, while Babugarh was at first position with fifty-three banks per lakh population followed by Pilkhua (49 banks/lakh population) if all the towns are taken into account.

Hierarchy of urban settlements is calculated on the basis of this facility and the towns are categorized into five major classes-

(a) Very high level of Banking facilities (score value above 2.00)

In 1971, there were seven towns (12.1%) having very high levels of banking facilities. These towns were Jansath, Dhanaura, Nakur, Thakurdwara, Bahjoi, Bilari and Baghpat, while in 1991 there was only one town namely Pilkhua having very high level of banking facilities. TABLE:4.8

(b) High level of Banking facilities (Score value between 1.5 and 2.00)

There were four towns namely, Dhampur, Baraut, Khatauli and Mawana having high level of facilities in 1971. The number of towns however, decreased to three, in 1991. These are Tajpur, Jansath and Nakur.

TABLE:4.8
LEVELS OF BANKING FACILITIES (1971-91)

Class/Score Value	1971	1991	
Very High (2 & Above)	Jansath	Pilkhua	
	Dhanaura		
	Nakur		
	Thakurdwara		
	Bahjoi		
	Bilari		
	Baghpat		
Absolute & Percent of towns	7(12.1%)	1(1.81%)	
High (1.5 to 2.00)	Dhampur	Tajpur	
	Baraut	Jansath	
	Khatauli	Nakur	
	Mawana		
Absolute & Percent of towns	4(6.9%)	3(5.45%)	
Medium (1.00 to 1.5)	Hastinapur	Aminagar Sarai	
	Shamli	Baghpat	
	Deoband	Thakurdwara	
	Kandhla	Bahjoi	
	Najibabad	Dhampur	
	Afzalgarh	Hastinapur	
	Modinagar	Garhmukteshwar	
	Garh mukteshwar	Kanth	
	Hasanpur	Sardhana	
	Hardwar	Shamli	
	Malayana	Dhanaura	
	Hapur	Hardwar	
	Pilkhua	Miranpur	
	Gangoh	Roorkee	
	Kanth		
	Nagina		
	Kiratpur		
	Miranpur		
Absolute & Percent of towns	18(31%)	14(25.4%)	
Low (0.5 to 1.00)	Chandausi	Baraut	Ghaziabad
	Muzaffarnagar	Afzalgarh	Chandausi
	Tanda	Khatauli	Saharanpur
	Roorkee	Mawana	Nagina
	Moradabad	Bijnor	Tanda
	Manglaur	Rampur Maniharan	Rustamnagar
			Sahaspur
	Nehtaur	Hasanpur	Kandhla
	Amroha	Meerut Cantt.	Kiratpur
	Saharanpur	Seohara	Faridnagar
		Mandawar	Deoband
		Bilari	Muradnagar
		Hapur	Najibabad
		Gangoh	Modinagar

		Muzaffarnagar Chandpur Nehtaur	Manglaur Meerut
Absolute & Percent of towns	9(15.5%)		31(56.4%)
Very Low (Below 0.5)	Meerut Sambhal Kairana Rampur Ghaziabad	Shahjahanpur Amroha Moradabad Rampur Kairana Sambhal	
Absolute & Percent of towns	5(8.6%)	6(10.9%)	
	Shahjahanpur Mandawar Bijnor Chandpur Seohara Tajpur Aminagar Sarai Sardhana Kankar Khera Rasulpur Dhulri Faridnagar Muradnagar Rustamnagar Sahaspur Rampur Maniharan Kaila		
Absolute & Percent of towns	15(25.9%)		0

(c) *Medium level of banking facilities (score value between 1.00 - 1.5)*

There was maximum concentration of towns in this class in 1971 i.e. there were eighteen towns (31%) having medium level of banking facilities.

In 1991, the number of towns decreased to fourteen towns (25.4%). Aminagar Sarai had highest score (1.48) followed by Baghpat (1.46) while Roorkee (1.00) was at the base of this class in 1991.

(d) *Low level of banking facilities (Score value between (0.5-1.00)*

In 1971, there were nine towns (15.5%) having low level of banking facilities, these were Chandausi, Muzaffarnagar, Tanda, Roorkee, Moradabad, Manglaur, Nehtaur, Amroha and Saharanpur.

In 1991, there were thirty-one towns (56.4%) having low level of banking facilities, Baraut had the highest score(0.99) while Meerut (0.53) was at the base of this class.

(e) *Very low level of banking facilities (Score value below 0.5)*

In 1971, there were five towns (8.6%) having very low banking facilities. These are Meerut, Sambhal, Kairana, Rampur and Ghaziabad. In 1991, there were in Towns, (10.9%) namely Shahjahanpur, Amroha, Moradabad, Rampur, Kairana and Sambhal having very low levels of banking facilities.

In 1971, there were fifteen towns (25.9%) having no banking facilities. These were Shahjahanpur, Mandawar, Bijnor, Chandpur, Seohara, Tajpur, Aminagar Sarai, Sardhana, Kankar Khera, Rasulpur Dhulri, Faridnagar, Muradnagar, Rustamnagar Sahaspur, Rampur Maniharan and Kaila. However in 1991, all the towns of the study area had banking facilities.

4.5 HIERARCHY OF URBAN SETTLEMENTS

An attempt is made to study the hierarchy of towns in the Northern Upper Ganga plain in 1971 and 1991, on the basis of fifty-five variables which were clubbed under eleven indicators. The hierarchy has been worked out by summing up the standardised values of the

selected eleven indicators and then calculating the composite score the towns are then arrayed on the basis of this composite score (see appendices 4.1 and 4.2)

On the basis of their hierarchical scores the towns are categorised into three classes:

- a) Towns with high level of facilities
- b) Towns with medium level of facilities
- c) Towns with low level of facilities

a) Towns having high levels of facilities (Score value above 13.39)

In 1971, there are eleven towns in this class. Baraut had highest score of 23.27. Baraut was followed by Nakur, which had a centrality score 22.74. The score of Hardwar, Saharanpur and Baghpat was 18.40, 17.93 and 16.63, respectively (See table 4.9 and 4.10).

Among the common towns in 1991, there were only six towns in this class Pilkua had highest score (21.76) followed by Afzalgarh (17.13). The other towns along with their centrality scores are Roorkee (15.37), Saharanpur (14.64) Nakur (14.34) and Hapur (13.63). (See figure 4.1 and 4.2).

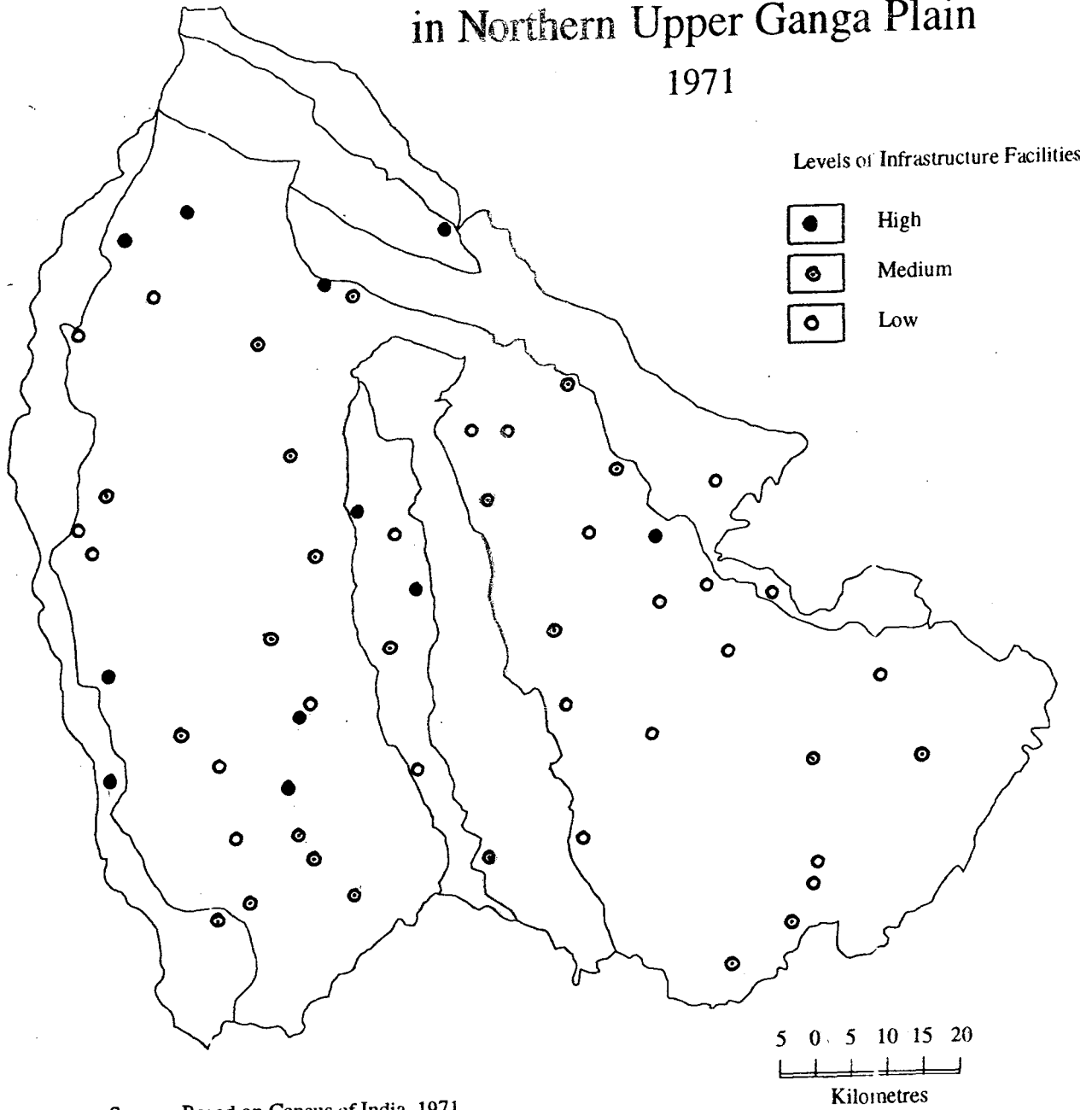
However, there are thirty-five towns in this class, if we consider all the towns during 1991. Barahpur, a class IV town, was at the apex position with a centrality score of 31.33. It was followed by Noida (28.88) a class I town and Pilkhua (24.34), a class II town in 1991. A large gap was observed between the centrality score of Barahpur (31.33) and Noida (28.8).

(b) Towns with medium level of facilities (Score value between 9.70 and 13.38)

In 1971, there were twenty-three in this class. Khatauli had highest centrality score of 13.29 followed by Hapur (13.27) However in 1991, the number of towns decreased to nineteen, in the common towns. Rampur Maniharan a class III town had highest score (13.11) followed by Shamli (12.92). Kandhla and Dhampur were at the bottom of this hierarchical class with centrality scores of 9.73 and 9.72, respectively.

Levels of Infrastructural Facilities in Northern Upper Ganga Plain

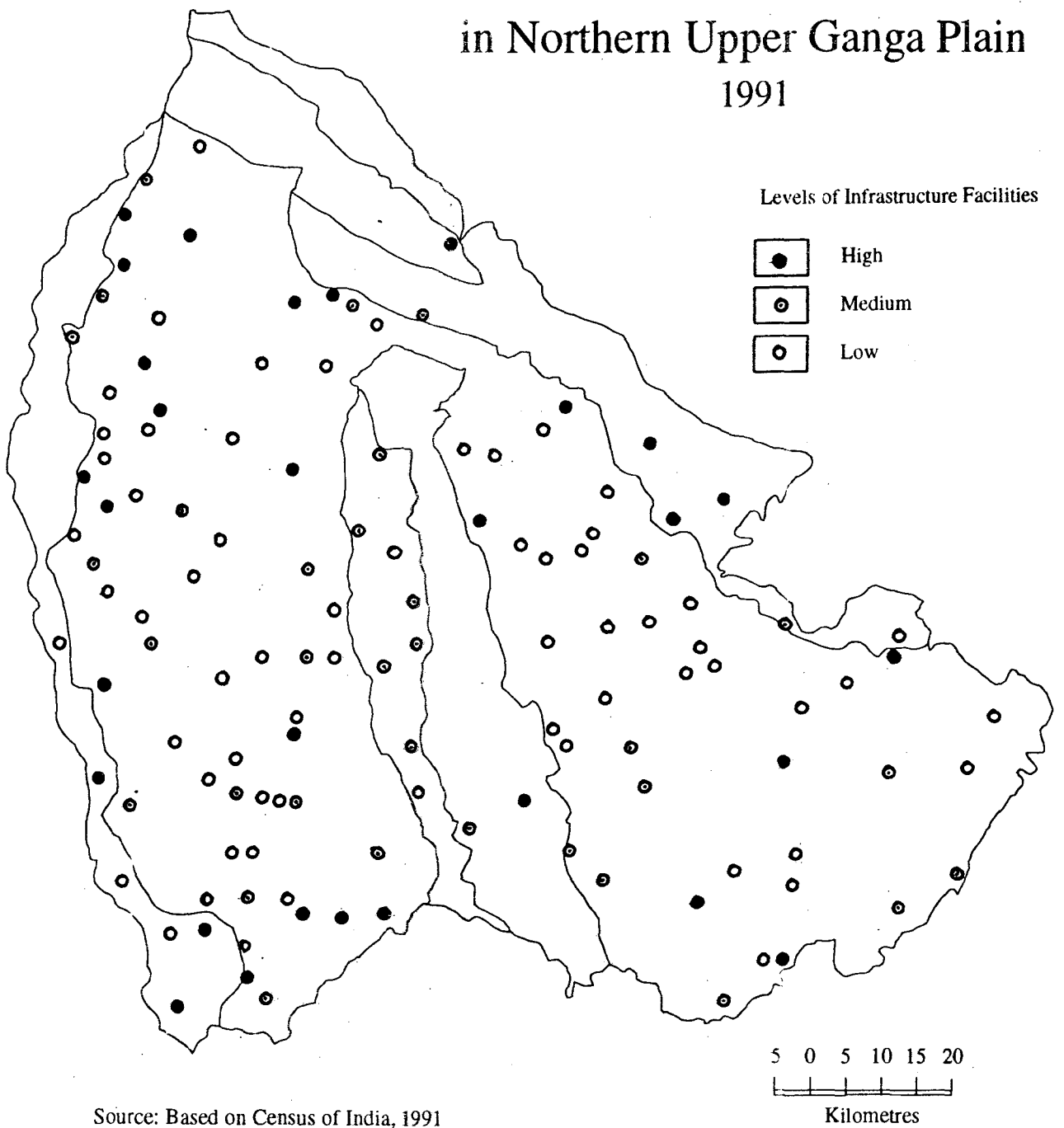
1971



Source: Based on Census of India, 1971

(Fig.4.1)

Levels of Infrastructural Facilities in Northern Upper Ganga Plain 1991



Source: Based on Census of India, 1991

(Fig.4.2)

TABLE:4.9

LEVELS OF INFRASTRUCTURAL FACILITIES (1971-91)

	1971	1991
Very High	Baraut Nakur Hardwar Saharanpur Baghpat Roorkee Jansath Hastinapur Dhampur Meerut Modinagar	Pilkhua Afzalgarh Roorkee Saharanpur Nakur Hapur
High	Khatauli Hapur Moradabad Bijnor Muzaffarnagar Manglaur Chandpur Chandausi Aminagar Sarai Rampur Sardhana Ghaziabad Nagina Pilkhua Deoband Muradnagar Mawana Shamli Bahjoi Garh mukteshwar Najibabad Faridnagar	Bijnor Rampur Maniharan Shamli Hardwar Muzaffarnagar Baghpat Baraut Meerut Cantt. Hastinapur Moradabad Jansath Manglaur Sambhal Najibabad Chandausi Mawana Garhmukteshwar Nagina Ghaziabad Hasanpur Kandhla Dhampur
Low	Miranpur Dhanaura Seohara Amroha Thakurdwara Bilari Afzalgarh Rampur Maniharan Tanda Kairana Kandhla Kanth Shahjahanpur Sambhal	Rampur Meerut Thakurdwara Amroha Bahjoi Gangoh Khatauli Modinagar Chandpur Dhanaura Tajpur Rustamnagar Sahaspur Kairana Miranpur

Hasanpur	Deoband
Mandawar	Kanth
Kiratpur	Muradnagar
Nehtaur	Aminagar Sarai
Malayana	Kiratpur
Gangoh M.B.	Sardhana
Kankar Khera	Seohara
Rasulpur Dhulri	Faridnagar
Rustamnagar Sahaspur	Bilari
Kaila	Shahjahanpur
Tajpur	Mandawar
	Nehtaur
	Tanda

TABLE :4.10

LEVEL OF INFRASTRUCTURAL FACILITIES IN ALL TOWNS (1991)

1991			
Very High	Barhapur	Nakur	
	Noida	Meerut Cantt.	
	Pilkhua	Baraut	
	BHEL Ltd. Ranipur	Moradabad	
	Babugarh	Jhabrera	
	Moradabad Rly. Settlement	Jalalabad	
	Ordinance Fty. Muradnagar	Dujana	
	Roorkee	Suar	
	Saharanpur	Rampur Maniharan	
	Gajraula	Najibabad	
	Roorkee Cantt.	Sambhal	
	Mukarampur Khema	Ghaziabad	
	Hapur	Jhunjhuna	
	Bijnor	Chandausi	
	Hardwar	Baghpat	
	Muzaffarnagar	Nagina	
	Shamli x	Sarsawan	
	Afzalgarh	Meerut	
	Medium	Khekra	Garhmukteshwar
		Rampur	Bahsuma
Hastinapur		Dhampur	
Amroha		Hasanpur	
Titron		Daurala	
Jansath		Kandhla	
Ambehta		Bhokarheddi	
Manglaur		Thakurdwara	
Laksar		Patala	
Parikshitgarh		Joya	
Kharkhoda		Milak	
Ujhari		Sisauli	
Behat		Bahjoi	
Modinagar		Doghat	
Shahpur		Shahabad	
Dadri		Kalchhina	
Nanauta		Gangoh	
Mawana		Khatauli	
		Chilkana Sultanpur	
Low		Niwadi	Landhaura
	Budhana	Karnawal	
	Dhanaura	Maswasi	
	Tikri	Kithaur	
	Chandpur	Lawar	
	Thana Bhawan	Loni	
	Bilaspur	Bhojpur Dharampur	
	Tajpur	Bilari	
	Un	Bachhraon	
	Ghaziabad Rly. Colony	Sirsi	

Rustamnagar Sahaspur	Pasaunda
Chhaprauli	Sherkot
Sahaspur	Sahanpur
Miranpur	Naugawan Sadat
Kairana	Jhalu
Dasna	Jalalabad
Agarwal Mandi	Purqazi
Kundarki	Phalauda
Deoband	Mandawar
Charthawal	Garhi Pukhta
Kanth	Nehtaur
Aminagar Sarai	Bisokhar
Noorpur	Shahjahanpur
Muradnagar	Tanda
Sardhana	Kemri
Haldaur	Ailum
Sewal Khas	Umri Kalan
Faridnagar	Banat
Kiratpur	Rori
Narauli	Razapur
Seohara	Behta Hajipur
	Begumabad Budhana

In all the towns of 1991 of the study area, we observed that there were as many as thirty-seven towns in this category. Khekra town had highest centrality score (13.37) followed by Rampur Maniharan (13.36). Khatauli and Chilkana Sultanpur were at the base having centrality score 9.77 and 9.76, respectively.

(c) *Towns having lowest level of facilities (Score below 9.69)*

This class had highest number of towns in both the decades. In 1971, there were twenty-five towns (43.10%) Dhanaura has a highest score of 9.46. it was followed by Seohara (9.24). Tajpur town had the lowest score value of 4.14. Thus, this town had lowest level of services.

In 1991, there were twenty-seven (49%) towns. Rampur was at the top with score of 9.58, it was followed by Meerut (9.48) Tanda was at the lowest level of hierarchy with score 4.48.

If we consider all the towns of the study area in 1991, there were as many as 63 towns (i.e. 48.1%) in this category. Niwadi was at the top followed by Budhana. Begumabad Budhana was at the bottom of the hierarchy with score value of 2.26.

4.6 CONCLUSION

It has been observed that although the services have increased in absolute numbers, they have shown decrease in proportion to population. However, there were certain exceptions where there has been proportionate increase in these services. The road length has increased from 4.6 km/sq. kms. of area in 1971 to 5.37 km/sq. kms. of area in 1991.

The number of latrines have decreased from 11,525 per lakh population in 1971 to 3570 per lakh population in 1991. In 1971, about 89% of the latrines were service or dry-type which shows the extent of manual scavenging. This share, however decreased to 71% in 1991.

The method of disposal of night soil is very crude and almost 83% of the towns dispose soil either by head loads or baskets. The percent remained high although it decreased to 65% in 1991.

The major sources of drinking water in the northern upper Ganga plains are wells, tube-wells and hand-pumps. This may be due to high water table in the study area owing to a dense network of rivers and their tributaries and sub-tributaries, which makes the extraction of underground water by wells, tube-wells, hand-pumps much easier and cheaper.

The condition of fire fighting services is very bad. There were only sixteen towns (ie 28%) which had this facility in 1971, while about 35% of the towns had this service in 1991. But the situation has worsened when all the towns of the study area (including new towns) are considered where only 18.4% of towns have fire fighting services. Thus, most of the new towns lacked this service.

The number of electricity connections per lakh population have shown an overall increase from 7,532/lakh-population to 10,369/lakh population in 1991 in the common towns while in all the towns the number of electricity connections again decreased to 9,393/lakh population.

The number of road lighting points have also experienced decline from 24.35 points/km of road length in 1971 to 16 points/km of road length in 1991.

In case of availability of health facilities, the number of health services per lakh population have reduced to half in the last two decades. There were forty four health services per lakh population in 1971, while they reduced to merely twenty-two per lakh population in 1991.

In case of educational facilities, all the facilities have shown decline (except middle school and colleges). They have decreased from 170 per lakh population in 1971 to 142 per lakh population in 1991 .However, the proportion of colleges have increased from 1.44/lakh population in 1971 to 1.9/lakh population in 1991 and the number of middle schools has increased from eight in 1971 to forty four per lakh of population in 1991.

In terms of recreational facilities too, it was observed that the per lakh recreational facilities have decreased. In 1971, there were twenty-seven recreational facilities per lakh population and they decreased to 12.26/lakh population in 1991. There were 3.47 public libraries/lakh population in 1971 which decreased to 1.5 in 1991. Similarly, the number of reading rooms decreased has from 1.5 per lakh population in 1971 to merely 0.3 per lakh population in 1991.

There was an overall improvement in banking facilities. There were 5.7 banks/lakh population in 1971 and this proportion increased to 11.1 banks in the common towns and 11.5 banks/lakh population when all the towns are considered.

Finally, it was analysed that the services have not increased in the same proportion as the population and this situation is putting a lot of pressure on the existing services. Comparing the hierarchical level of various towns which were common during 1971 and 1991, it was observed that the towns which had high ranks in terms of infrastructural facilities in 1971 need not have higher rank in 1991 i.e. the towns have not maintained their hierarchical levels.

Baraut, the town which had highest score in 1971 slipped to thirteenth position in 1991, while Nakur had second rank in 1971 and it dropped to fifth position in 1991. On the other hand, Pilkhua town had a score value of 11.9 and was on twenty-five position in 1971 while in 1991 it had highest score (21.76) among the common towns of 1971 and 1991.

In 1971, there were twenty-six towns (i.e., 45%) whose functional rank was higher than their population rank. On the contrary, thirty two towns (ie 55%) had their functional rank lower than their population rank.

In the towns common in 1971 and 1991, there were twenty six towns (i.e., 47%) whose functional rank was higher than their population rank, while twenty-eight (i.e., 53%) towns had their functional rank lower than their population rank. There was only one town Saharanpur which had equal functional and population rank.

In all the towns of the northern upper Ganga plains (i.e., including the new towns) in 1991, Seventy-nine towns (58%) had their population rank higher than their functional rank while, fifty-six towns (42%) had their functional rank higher than their population rank. Only one town, Shamli, had equal functional and population rank Thus, it was seen that level of infrastructural facilities have reduced in the common towns (because of high population pressure) from 1971 to 1991, while the same has increased if all the towns of the study area in 1991 are considered.

CHAPTER -V

SUMMARY AND CONCLUSION

The Northern Upper Ganga plain, (the area of present study) has the characteristics partly of Shiwaliks, Bhabar, Tarai, Bhur, Khadar and the Plain. In general, the vast area of the region is an aggradational plain and has various classes of fertile alluvial soil. It is predominantly an agricultural region, 60.8% of its total main workers are engaged in non-agricultural pursuits. The reason is that the region has favourable soil, suitable climatic conditions, ubiquitous supply of water for irrigation etc. The Ganga and the Yamuna are the two major rivers draining the region along with their tributaries and sub-tributaries.

Urban settlements of the study area have a well developed transportation network and are well connected by roads and railways. But this network is mainly governed by the streams. The roads mainly follow the streams and run parallel to them. So the major trend is in the north-south direction. Due to topographic limitations of the area it is difficult to traverse it from east to west direction especially in the Tarai.

There is no National Highway passing through three districts namely, Saharanpur, Bijnor and Hardwar. The National Highway no. 24 passes through Ganga Khadar while State Highway no. 12 and 49 pass through Bijnor Tarai. The area is served by the northern railways. To avoid the difficulties of bridging and the low Khadar, liable to floods, the railways avoid crossing the main arteries of drainage and usually run parallel to them, except at favourable and unavoidable points.

The distribution of towns is governed by the relief and drainage of the settlements. The regions which discourage growth of urban settlements are the Shiwaliks, the Ganga Khadar and the Yamuna Khadar. The Shiwaliks are not favourable for human inhabitant and no urban settlements is found in this tract. Similarly, the Khadar zone, generally liable to be submerged during the rains owing to the greater discharge of rivers are usually unsuitable for human habitation. The Tarai region of Saharanpur is devoid of urban settlements. Urban

settlements are numerous in number and also densely located and larger in size in the Plain. The plain of Muzaffarnagar, Deoband, Shamli, Hindan, Meerut, Hapur, Bijnor and Amroha have major concentrations of urban settlements. Bijnor, Tarai, Bhur tract of Muzaffarnagar and Yamuna Khadar of Meerut have high urban density owing to high population pressure although they are physiographically not very suitable for large urban settlements.

It may be suggested that the growth of new towns and development of existing towns needs incentives to bring more even distribution of towns.

The districts, Meerut and Ghaziabad had highest level of urbanisation both during 1971 and 1991.

However, the rate of urbanisation has declined in 1981-91 as compared to 1971-81. The decadal growth rate of the urban population of the study area for 1971-81 was 69.31% while it declined to 44.85% in 1981-91.

The number of towns in the region increased from 58 in 1971 to 116 in 1981 and further to 126 in 1991. It was observed that the concentration of population has been continuously increasing in the class I towns while it has decreased in class II and III towns. Similarly, the population share in class IV and class VI towns was very less in 1971 and even this has declined since then.

There were only seventeen towns which had experienced an increase from 1971-81 to 1981-91, while the remaining thirty five towns had shown a decline in their growth rate during this period. Two of the three towns namely Ghaziabad and Modinagar had more than 100% increase in their population (1971-81). These towns are in close proximity to the National Capital and were on the Grand Trunk road. This shows how Delhi had positive affect on the growth of towns. Instead of casting shadow, it has helped in the growth of towns.

Region-wise, the Tarai and Yamuna Khadar had experienced highest growth rate during 1971-81. While the Yamuna Khadar and Ganga Khadar had highest increase during 1981-91. High growth in Yamuna Khadar can be attributed to its nearness to the National Capital while population pressure has resulted in high growth in Tarai and Ganga Khadar which otherwise, are not favourable regions for high population growth.

The density of population of towns decreases from class II towns to the lower classes. It is also observed that the towns which have shown a drastic fall in their population density are the ones which have experienced an increase in their area. For example, Sardhana town of Meerut district had an area of 0.34 sq. km and population 22083 in 1971. Thus, its population density was 64950 persons/km² but in 1991 its population density declined to 2145 persons/km², when its area increased to 14.05 sq. km. There were also instances where the area decreased resulting in an increase in population density. Observing the density of population regionwise, the towns in the Plain show the highest density of all sub-regions, in all the three decades while the lowest density was observed in the Ganga Khadar region.

The nearest neighbour technique used to analyse the spatial distribution pattern of all towns in 1991, gives the R value of 0.8047, indicating a distribution more towards random.

The rank size distribution of towns for all the three decades show no conformity with the rank-size rule, that the second largest town will have almost half the population of the largest city i.e. the nth rank city will be one-nth the size of the largest city. All the urban centres (except three towns in 1971 and two towns each, in 1981 and 1991) were larger in size as they all lie above the exponential line and so the actual population of towns is larger than the expected population.

In 1971, the eastern part of the study area, i.e. Plain of Bijnor, Amroha, Sambhal and Hapur (in the western part) had high concentration of Artisan towns, while the manufacturing towns were mainly concentrated in Plain of Shamli, Hapur, Bijnor, upper Ramganga, Sambhal and Amroha.

The trade and transport towns predominate in the western part i.e. Saharanpur, Shamli, Meerut and Hindan plain and also in Sambhal plain in the eastern part.

However, there is no concentration of service towns and they were dispersed over the space. In 1991, the manufacturing towns had become more diversified while the trade and transport towns had maximum concentration in the western part of the study area. Almost all of these were situated along (transport lines, railways and roadways) state and national highways,

which contribute to their growth and development. There are twelve service towns in the Plain, six of them are in Hapur Plain itself while others were dispersed.

In 1971, 45% of towns had their functions diversified and it rose to 54% in 1991. There was predominance of industrial towns and the service towns. This pattern was observed in both the decades. But the percent share of industrial towns declined from 59% in 1971 to only 47% in 1991.

About 81 % of towns have undergone change in their functional character, 66% of these towns had undergone intra-functional change and only 34 percent had undergone inter-functional change, 60% of towns have changed their functions from manufacturing to trade and transport.

Analysing the levels of intra-structural facilities, we observe that although the number of services have increased in absolute numbers, they have shown a decline when seen in proportion to population. However, there were certain exceptions where there has been proportionate increase e.g. road length/sq. km of area, number of electricity connections/lakh population and banking facilities per lakh population .

There was not much change in the level of availability of the infra-structural facilities per lakh population in the common towns, while the new towns which have come up during 1971-91 (i.e. new towns) have higher level of facilities. The hierarchical level of various towns which were common during 1971 and 1991 show that towns which had high rank in 1971 did not necessarily have higher ranks in 1991. The town, Baraut had highest score during 1971 slipped to thirteenth position in 1991 and Nakur which was at second place in 1971 dropped to fifth position in 1991. On the other hand, Pilkhua which had 25th rank with centrality score 11.9 jumped to first position in 1991.

No relationship is observed between the size of the population of any town and its hierarchical level. There were many small towns having higher centrality score than class I and II towns, for example, in 1971 Baraut, a class III town and Nakur a class V town had first and second rank, respectively. Similarly Barahpur a class V town having first rank in terms of levels of infra-structural facilities if we consider all the towns in 1991.

In 1971, there were twenty-six (i.e. 45%) towns whose functional rank was higher than their population rank. On the contrary, 55% of towns had their functional ranks lower than their population rank. In 1991, in the towns, common both in 1971 and 1991, 47% of towns had their functional rank higher than their population rank.

In all the towns of upper Ganga plain in 1991, 42% of towns had their functional rank higher than their population rank.

The analysis of relationship of functional character of towns with the level of infrastructural facilities indicates that of the total 28 towns having low levels of infrastructural facilities 71% were manufacturing, 25% were trade and transport and only 1% were service towns, while in 1991 74% of the towns were manufacturing and 26% were trade and transport towns.

In the towns having medium level of infrastructural facilities (i.e. in category II) in 1971, 60.8% of towns were manufacturing, 30.4% were trade and transport and only 8.7% were service towns while in 1991 the share of manufacturing towns decreased to only 27.3% and that of trade and transport increased to 64% of the total. There were 9% of service towns.

Thus, it was observed that in both the decades, most of manufacturing towns had low levels of infrastructural facilities as compared to trade and transport and service towns.

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Series 22, Part X-A
Town Directory

Regional Divisions of India-
A Cartographic Analysis
Series I Vol. 22
Uttar Pradesh

Census of India 1991.
Circular No. 6
Subject: Census of India,
District Census of India Compilation

APPENDICES 2.1
AREA, POPULATION AND DENSITY OF TOWNS (1971)

TOWN/CITY/U.A.	POPULATION	AREA	DENSITY
Moradabad U.A.	272652	36.00	7574
Rampur M.B.	161417	20.20	7991
Saharanpur M.B.	225396	25.25	8927
Muzaffamagar U.A.	114783	12.04	9533
Meerut U.A.	367754	55.90	6579
Ghaziabad U.A.	127700	35.76	3571
Chandasi M.B.	53393	8.81	6060
Sambhal M.B.	86323	6.22	13878
Amroha M.B.	82702	6.32	13086
Hardwar U.A.	79277	15.07	5261
Hapur M.B.	71266	5.83	12224
Roorkee U.A.	62456	17.04	3665
Najibabad. M.B	42586	4.30	9904
Nagina M.B.	37066	7.77	4770
Chandpur M.B	28179	1.53	18418
Kiratpur M.B.	25147	4.45	5651
Seohara M.B.	22821	27.20	839
Dhampur M.B.	22639	1.94	11670
Nehtaur M.B.	20286	5.83	3480
Bijnor U.A.	43290	3.65	11860
Hasanpur M.B.	22063	9.71	2272
Deoband M.B.	38194	7.90	4835
Gangoh M.B.	24300	7.12	3413
Shamli M.B.	36959	3.73	9909
Kairana M.B.	32354	3.11	10403
Khatauli M.B.	24495	3.76	6515
Kandhla M.B.	20061	5.96	3366
Baraut M.B.	31264	10.36	3018
Mawana M.B.	24858	2.59	9598
Sardhana M.B.	22083	0.34	64950
Pilkhua-M.B.	23941	4.53	5285
Modinagar U.A.	43470	10.36	4196
Afzalgarh M.B.	10765	0.62	17363
Thakurdwara M.B.	11137	8.03	1387
Bahjoi M.B.	11334	6.55	1730
Kanth T.A.	12232	0.80	15290
Bilari U.A.	11620	3.63	3201
Tanda M.B.	14628	9.07	1613
Rampur Maniharan T.A.	12997	1.45	8963
Manglaur M.B.	19723	1.32	14942
Miranpur T.A.	12962	0.49	26453
Baghpat M.B.	11666	2.88	4051
Malayana	11346	6.40	1773
Kankar Khera	15352	1.37	11206
Garh mukteshwar	10937	15.54	704
Muradnagar M.B.	13985	0.54	25898

Dhanaura M.B.	8410	4.69	1793
Nakur M.B.	8370	0.26	32192
Jansath T.A.	8202	0.36	22783
Hastinapur N.A.	8889	3.06	2905
Shahjahanpur C.T.	7340	5.98	1227
Aminagar Sarai T.A.	5637	1.89	2983
Kaila	9333	2.46	3794
Ordinance Fty. Muradnagar C.T.	9026	0.54	16715
Faridnagar	7541	0.44	17139
Mandawar T.A.	9648	1.45	6654
Tajpur C.T.	7275	6.35	1146
Rasulpur Dhulri	4944	6.97	709
Rustamnagar Sahaspur	5391	4.64	1162

**SOURCE : CENSUS OF INDIA , 1971.
SERIES 21, PART X-A**

APPENDICES 2.2

AREA, POPULATION AND DENSITY OF TOWNS (1981)

TOWN/CITY/U.A.	POPULN	AREA	DENSITY
Morabad U.A.	345350	37.81	9134
Sambhal M.B.	108232	10.65	10163
Amroha M.B.	112682	6.32	17829
Rampur M.B.	204610	20.20	10129
Saharanpur M.B.	295355	25.25	11697
Hardwar U.A.	145946	42.01	3474
Muzaffarnagar U.A.	171816	12.04	14270
Meerut U.A.	536615	80.82	6640
Ghaziabad U.A.	287170	65.77	4366
Hapur	102837	5.83	17639
Najibabad M.B.	55109	4.30	12816
Nagina M.B.	50405	8.35	6037
Bijnor U.A.	56713	3.65	15538
Chandausi M.B.	66970	8.81	7602
Deoband M.B.	51270	7.90	6490
Roorkee U.A.	79076	17.04	4641
Shamli M.B.	51850	3.73	13901
Modinagar U.A.	87665	14.36	6105
Hasanpur M.B.	29817	9.71	3071
Bilari U.A.	23262	6.44	3612
Tanda M.B.	20424	9.07	2252
Bilaspur M.B.	20032	11.50	1742
Gangoh M.B.	32713	7.12	4595
Manglaur M.B.	25724	1.32	19488
Kairana M.B.	44505	3.11	14310
Khatauli M.B.	31384	3.76	8347
Kandhla M.B.	25522	5.96	4282
Baraut M.B.	46292	10.36	4468
Maswana M.B.	37620	2.59	14525
Sardhana M.B.	30138	14.05	2145
Khekda T.A.	24984	1.21	20648
Pilkhwa M.B.	37884	4.53	8363
Muradnagar M.B.	26047	1.60	16279
Chandpur M.B.	41552	1.53	27158
Sherkot M.B.	33191	5.35	6204
Kiratpur M.B.	32079	4.45	7209
Seohara M.B.	30198	2.72	11102
Dhampur M.B.	29070	2.25	12920
Nehtaur M.B.	27621	6.10	4528
Bachhron M.B.	17728	0.94	18860
Thakurdwara M.B.	16598	8.30	2000
Bahjoi M.B.	16073	6.55	2454
Kanth T.A.	15631	0.80	19539
Naugawan Sadat N.A.	13311	2.05	6493
Sirsi N.A.	13096	3.39	3863

Bhojpur Dharampur	12049	1.50	3950
Dhanaura M.B.	11816	4.69	2519
Narauli T.A.	10414	1.84	5660
Ujhari T.A.	10198	1.15	8868
Kundarki	12713	0.13	97792
Shahabad T.A.	18313	7.00	2616
Suar M.B.	14935	0.54	27657
Milak M.B.	14470	11.02	1313
Kemri T.A.	13537	2.40	5640
Rampur Maniharan T.A.	16420	1.45	11324
Nakur M.B.	11629	0.26	44727
Behat T.A.	11076	1.00	11076
Thana Bhawan T.A.	18711	1.19	15724
Budhana T.A.	17532	5.87	2987
Miranpur T.A.	17019	1.30	13092
Charthawal T.A.	15420	8.75	1762
Jalalabad T.A.	14929	1.21	12338
Purqazi T.A.	13412	1.85	7250
Bhokarhedi T.A.	12148	1.00	12148
Un T.A.	11302	1.43	7903
Sisauli T.A.	11057	2.01	5501
Jansath T.A.	10460	0.61	17148
Jhirjhana T.A.	10123	1.21	8366
Baghpat M.B.	17157	2.88	5957
Chhaprauli T.A.	13805	1.10	12550
Kithaur T.A.	13791	3.05	4522
Hastinapur N.A.	11637	3.00	3879
Lawar T.A.	11535	3.63	3178
Parikshitgarh T.A.	11328	3.44	3293
Tikri T.A.	11315	1.10	10286
Phalauda T.A.	10357	2.29	4523
Sewal Khas T.A.	10278	0.82	12534
Doghat T.A.	10019	0.92	10890
Dadri M.B.	19723	6.25	3156
Garhmukteshwar	17914	32.00	560
Ordance Factory-Muradnagar	13147	36.63	359
Loni	149	1.29	3901
Haldaur M.B.	15041	2.76	5450
Afzalgarh M.B.	14892	0.62	24019
Sahaspur T.A.	14296	8.05	1776
Barhapur T.A.	13825	1.30	10635
Noorpur M.B.	12465	1.55	8042
Jhalu T.A.	12461	3.25	3834
Mandawar T.A.	11587	1.45	7991
Sahanpur T.A.	11023	1.95	5653
Tajpur C.T.	9721	6.35	1531
Jalalabad T.A.	9561	3.55	2693
Umri Kalan T.A.	9190	0.60	15317
Maswasi T.A.	8786	1.30	6758
Chilkana Sultanpur T.A.	9936	0.37	26854
Nanauta T.A.	9288	0.42	22114

Ambekhta T.A.	7814	0.80	9768
Sarsawan T.A.	7696	1.02	7545
Titron N.A.	6646	0.98	6782
Landhaura T.A.	8077	0.82	9850
Jhabrera T.A.	5453	0.09	60589
Shahpur T.A.	9516	2.62	3632
Garhi Pukhta T.A.	7279	1.62	4493
Karnawal T.A.	9895	1.19	8315
Agarwal Mandi T.A.	9353	0.92	10166
Daurala T.A.	9146	1.05	8710
Shahjahanpur C.T.	8867	5.98	1483
Kharkhoda T.A.	8708	1.75	4976
Bahsuma T.A.	7906	3.00	2635
Aminagar Sarai T.A.	6837	1.89	3617
Abdullpur	6383	1.62	3940
Faridnagar T.A.	9116	0.44	20718
Patala T.A.	7847	1.20	6539
Niwadi T.A.	7078	1.60	4424
Joya T.A.	3536	5.03	703
Babugarh	2389	5.37	445

APPENDICES 2.3

AREA, POPULATION AND DENSITY OF TOWNS (1991)

SL. NO	TOWNS	AREA	POPULATION	DENSITY
1	Moradabad U.A.	35.99	443701	12328
2	Sambhal M.B.	15.65	150869	9640
3	Amroha M.B.	6.78	137061	20215
4	Rampur M.B.	20.20	243742	12066
5	Saharanpur M.B.	25.36	374945	14785
6	Hardwar U.A.	28.59	187392	6554
7	Muzaffarnagar U.A.	12.04	247624	20567
8	Meerut U.A.	177.58	849799	4785
9	Ghaziabad U.A.	74.64	511759	6856
10	Hapur M.B.	14.20	146262	10300
11	Modinagar U.A.	20.95	123279	5884
12	Noida C.T.	90.43	146514	1620
13	Najibabad M.B.	5.06	66860	13213
14	Nagina M.B.	10.36	58513	5648
15	Chandpur M.B.	10.81	55825	5164
16	Bijnor U.A.	3.65	73900	20247
17	Chandausi M.B.	8.80	82748	9403
18	Deoband M.B.	7.91	66208	8370
19	Roorkee U.A.	17.04	91139	5349
20	Shamli M.B.	4.76	70853	14885
21	Kairana M.B.	3.83	56079	14642
22	Baraut M.B.	10.36	67705	6535
23	Mawana M.B.	4.00	51701	12925
24	Pilkhua M.B.	5.38	50162	9324
25	Sherkot M.B.	5.35	42230	7893
26	Kiratpur M.B.	4.45	43757	9833
27	Seohara M.B.	2.72	37560	13809
28	Dhampur M.B.	2.21	39179	17728
29	Nehtaur M.B.	8.03	34753	4328
30	Hasanpur M.B.	4.18	43383	10379
31	Bachhraon M.B.	9.48	24097	2542
32	Bachhraon M.B.	9.48	24097	2542
33	Thakurdwara M.B.	8.30	25279	3046
34	Bahjoi M.B.	6.62	21723	3281
35	Kanth T.A.	8.00	20297	2537
36	Naugawan-Sadat N.A.	5.00	20613	4123
37	Gajraula T.A.	14.20	21096	1486
38	Bilari U.A.	6.44	31662	4916
39	Tanda M.B.	9.07	29328	3234
40	Bilaspur M.B.	11.50	26463	2301
41	Shahabad T.A.	7.00	25128	3590
42	Gangoh M.B.	4.50	41198	9155
43	Rampur Maniharan T.A.	1.69	21184	12535
44	Manglaur M.B.	1.33	34161	25685
45	Khatauli M.B.	3.76	44319	11787
46	Kandhla M.B.	5.96	32513	5455
47	Thana Bhawan T.A.	1.10	25577	23252
48	Budhana T.A.	5.87	26931	4588
49	Miranpur T.A.	1.03	22796	22132
50	Sardhana M.B.	14.06	42980	3057
51	Khekda T.A.	1.21	35191	29083
52	Baghpat M.B.	2.88	24939	8659

53	Muradnagar M.B.	10.00	44395	4440
54	Dadri M.B.	4.00	32883	8221
55	Garhmukteshwar M.B.	32.00	25241	789
56	Loni T.A.	9.43	36561	3877
57	Behta Hajipur C.T.	6.93	30360	4381
58	Haldaur M.B.	4.00	15830	3958
59	Afzalgarh M.B.	0.62	18650	30081
60	Sahaspur T.A.	8.05	18198	2261
61	Barhapur T.A.	1.30	17981	13832
62	Jhalu T.A.	2.25	14808	6581
63	Mandawar T.A.	1.45	15408	10626
64	Sahanpur T.A.	2.00	14299	7150
65	Tajpur C.T.	6.35	12898	2031
66	Jalalabad T.A.	1.22	12468	10220
67	Sirsi N.A.	2.51	18310	7295
68	Kundarki T.A.	3.71	18516	4991
69	Bhojpur Dharampur T.A.	4.49	17996	4008
70	Dhanaura M.B.	4.70	16484	3507
71	Narauli T.A.	1.84	13630	7408
72	Ujhari T.A.	1.12	14125	12612
73	Umri Kalan T.A.	3.69	11365	3080
74	Suar M.B.	0.54	19782	36633
75	Milak M.B.	11.02	18962	1721
76	Kemri T.A.	2.40	17481	7284
77	Maswasi T.A.	1.30	11830	9100
78	Nakur M.B.	0.26	15182	58392
79	Behat T.A.	1.00	14569	14569
80	Chilkana Sultanpur T.A.	7.85	12647	1611
81	Nanauta T.A.	4.84	12993	2685
82	Ambेhta T.A.	0.80	10297	12871
83	Sarsawan T.A.	6.00	12384	2064
84	Laksar T.A.	3.30	15622	4734
85	Landhaura T.A.	2.29	12195	5325
86	Charthawal T.A.	6.10	18593	3048
87	Jalalabad T.A.	4.75	19360	4076
88	Purqazi T.A.	8.00	17752	2219
89	Bhokarhedi T.A.	0.97	14006	14439
90	Un T.A.	1.43	13303	9303
91	Sisauli T.A.	2.01	13437	6685
92	Banat T.A.	3.37	13634	4046
93	Jansath T.A.	2.51	13865	5524
94	Thinjhana T.A.	1.21	13062	10795
95	Ailum T.A.	4.50	13044	2899
96	Shahpur T.A.	2.63	13287	5052
97	Chhaprauli T.A.	1.10	16008	14553
98	Kithaur T.A.	4.00	19270	4818
99	Hastinapur N.A.	3.50	15081	4309
100	Lawar T.A.	7.50	14471	1929
101	Parikshitgarh T.A.	3.93	13677	3480
102	Tikri T.A.	1.10	12784	11622
103	Phalanda T.A.	9.00	13970	1552
104	Sewal Khas T.A.	0.82	14402	17563
105	Doghat T.A.	0.90	12309	13677
106	Karnawal T.A.	3.00	11047	3682
107	Agarwal Mandi T.A.	0.92	10871	11816
108	Daurala T.A.	1.05	10025	9548
109	Shahjahanpur C.T.	5.98	12443	2081
110	Kharkhoda T.A.	1.75	10550	6029

111	Ord. Fty. Muradnagar C.T.	2.59	12792	4939
112	Dasna T.A.	3.25	16963	5219
113	Faridnagar T.A.	0.44	10940	24864
114	Pasaunda C.T.	1.96	12387	6320
115	Kalchhina C.T.	9.60	10373	1081
116	Joya T.A.	5.03	6514	1295
117	Titron N.A.	0.98	8045	8209
118	Jhabrera T.A.	0.09	7633	84811
119	Garhi Pukhta T.A.	1.62	9195	5676
120	Bahsuma T.A.	9.50	9060	954
121	Aminagar Sarai T.A.	1.89	8274	4378
122	Patala T.A.	1.20	9181	7651
123	Niwadi T.A.	3.29	8841	2687
124	Rori C.T.	6.53	8473	1298
125	Dujana C.T.	1.14	7313	6415
126	Babugarh T.A.	2.00	3581	1791

Source : Census of India, 1991
Series I, Part II-A

APPENDICE 2.4
S

PERCENT GROWTH RATE OF URBAN CENTRES
FROM 1971-91

S No.	Name of The Town	SGR (1971-81)	SGR (1981-91)
1	Afzalgarh M.B.	38.34	25.24
2	Aminagar Sarai T.A.	21.29	21.02
3	Amroha M.B.	36.25	21.64
4	Baghpat M.B.	47.07	45.36
5	Bahjoi M.B.	41.81	35.15
6	Baraut M.B.	48.07	46.26
7	Bijnor U.A.	31.01	30.31
8	Chandasi M.B.	25.43	23.56
9	Chandpur M.B.	47.46	34.35
10	Deoband M.B.	34.24	29.14
11	Dhampur M.B.	28.41	34.77
12	Dhanaura M.B.	40.50	39.51
13	Gangoh M.B.	34.62	25.94
14	Ghaziabad M.B.	132.10	64.66
15	Ghaziabad Rly. Colony C.T.	28.10	-6.10
16	Ghaziabad U.A.	124.88	78.21
17	Hapur M.B.	44.30	42.23
18	Hardwar U.A.	84.10	28.40
19	Hasanpur M.B.	35.14	45.50
20	Jansath T.A.	27.53	32.47
21	Kairana M.B.	37.56	26.01
22	Kandhla M.B.	27.22	27.39
23	Kanth T.A.	27.79	29.85
24	Khatauli M.B.	28.12	41.22
25	Kiratpur M.B.	27.55	36.42
26	Mandawar T.A.	20.10	32.98
27	Mawana M.B.	51.34	37.43
28	Meerut U.A.	45.92	58.36
29	Miranpur T.A.	31.30	33.94
30	Modinagar U.A.	101.67	40.63
31	Moradabad M.B.	27.63	30.04
32	Moradabad Rly. Settlement N.A.	8.80	-5.31
33	Moradabad U.A.	26.66	28.48
34	Muradnagar M.B.	86.25	70.44
35	Muzaffarnagar U.A.	49.69	44.12
36	Nagina M.B.	35.99	16.09
37	Najibabad M.B.	29.41	21.32
38	Nakur M.B.	38.94	30.55
39	Nehtaur M.B.	36.16	25.82
40	Ordinance Fty. Muradnagar C.T.	45.66	-2.70
41	Pilkhwa M.B.	58.24	32.41
42	Rampur M.B.	26.76	19.13
43	Rampur Maniharan T.A.	26.34	29.01
45	Roorkee U.A.	26.61	15.25
46	Rustamnagar Sahaspur C.T.	37.27	37.20
47	Sambhal M.B.	25.38	39.39
48	Sardhana M.B.	36.43	42.66
54	Seohara M.B.	32.33	24.38
55	Shahjahanpur C.T.	20.80	40.33
56	Shamli M.B.	40.29	36.65
57	Tajpur C.T.	33.62	32.68
58	Tanda M.B.	39.62	43.60
59	Thakurdwara M.B.	49.03	52.30

SGR = Simple Growth Rate:

APPENDICE 2.5
5

NEAREST NEIGHBOUR DISTANCE OF URBAN SETTLEMENTS (1991)

TOWNS	CODE	Distance in cm	Distance in km
BEHAT	1-2	1.00	9.09
CHILKANA SULTANPUR	2-3	0.70	6.36
SARSAWAN	3-2	0.70	6.36
SAHARANPUR	4-2	1.10	10.00
NAKUR	5-6	0.60	5.45
AMBEHTA	6-5	0.60	5.45
GANGOH	7-6	0.80	7.27
RAMPUR MANIHARAN	0-6	1.00	9.09
NANAULA	9-10	0.80	7.27
TITRON	10-9	0.80	7.27
JALALABAD	11-12	0.30	2.73
THANA BHAWAN	12-11	0.30	2.73
UN	13-14	0.25	2.27
GARHI PUKHTA	14-13	0.25	2.27
JHINJHINA	15-14	0.40	3.64
SHAMLI	16-17	0.50	4.55
BARAUT	17-16	0.50	4.55
CHARTHAWAL	18-67	1.00	9.09
SISAULI	19-20	0.80	7.27
SHAHPUR	20-21	0.75	6.82
BUDHANA	21-20	0.75	6.82
AILUM	22-23	0.50	4.55
KANDHLA	23-22	0.50	4.55
KAIRANA	24-23	0.65	5.91
CHHAPRAULI	25-28	1.10	10.00
TIKRI	26-27	0.40	3.64
DOGHAT	27-26	0.40	3.64
BARAUT	28-25	1.10	10.00
AMINAGAR SARAI	29-54	0.75	6.82
BAGHPAT	30-31	0.80	7.27
KHEKRA	31-30	0.80	7.27
LONI	32-33	0.90	8.18
PASAUNDA	33-34	0.80	7.27
GAZIABAD	34-38	0.65	5.91
NOIDA	35-33	1.40	12.73
DADRI	36-37	1.00	9.09
DUJANA	37-38	0.60	5.45
DASNA	38-34	0.60	5.45
MURADNAGAR	39-40	0.35	3.18
KALCHHINA	40-39	0.35	3.18
PATALA	41-42	0.20	1.82
NIWADI	42-41	0.20	1.82
RORI	43-44	0.20	1.82
BISHOKAR	44-43	0.20	1.82
MODINAGAR	45-43	0.20	1.82
FARIDNAGAR	46-40	0.55	5.00
PILKHUA	47-46	0.40	3.64
BABUGARH	48-51	1.20	10.91
GARHAMUKTESHWAR	49-50	1.45	13.18
SAHAJAHANPUR	50-52	0.90	8.18
KHARKHODA	51-46	1.00	9.09

PARIKSHITGARH	52-50	0.90	8.18
SEWAL KHAS	53-54	0.50	4.55
RASULPUR DHULRI	54-51	0.40	3.64
MEERUT	55-56	0.30	2.73
KANKERKHERA	56-55	0.30	2.73
KARANWAL	57-58	0.80	7.27
SARDHANA	58-59	0.60	5.45
DAURALA	59-60	0.50	4.55
LAWAR	60-59	0.50	4.55
MAWANA	61-62	0.70	6.36
HASTINAPUR	62-61	0.90	8.18
PHALAUNDA	63-60	0.65	5.91
KHATAULI	64-66	0.90	8.18
MIRANPUR	65-66	0.65	5.91
JANSATH	66-65	0.65	5.91
MUZAFFARNAGAR	67-18	1.00	9.09
BHOKERKHERI	68-80	1.40	12.73
PURQAZI	69-70	1.15	10.45
DEOBAND	70-72	1.10	10.00
MANGLAUR	71-73	0.30	2.73
JHABRERA	72-71	0.60	5.45
ROORKEE	73-71	0.30	2.73
LANDHAURA	74-71	0.40	3.64
LAKSAR	75-74	0.80	7.27
HARDWAR	76-75	1.20	10.91
NAZIBABAD	77-78	0.35	3.18
JALALABAD	78-77	0.35	3.18
KIRATPUR	79-80	0.50	4.55
MANDAWAR	80-79	0.50	4.55
BIJNOR	81-82	0.70	6.36
JHALU	82-83	0.50	4.55
HALDAUR	83-82	0.50	4.55
NEHTAUR	84-85	0.30	2.73
SAHANPUR NIWADA	85-84	0.30	2.73
NAGINA	86-87	1.00	9.09
BARHAPUR	87-86	1.00	9.09
AFZALGARH	88-89	0.85	7.73
SHERKOT	89-90	0.70	6.36
DHAMPUR	90-89	0.70	6.36
SEOHARA	91-92	0.60	5.45
SAHASPUR	92-101	0.45	4.09
TAJPUR	93-94	0.65	5.91
NOORPUR	94-93	0.65	5.91
CHANDPUR	95-94	1.00	9.09
DHANAURA	96-97	0.50	4.55
BACHHARAON	97-96	0.50	4.55
GAJRAULA	98-97	1.00	9.09
NAUGAWAN SADAT	99-102	0.80	7.27
UMRI KALAN	100-101	0.40	3.64
KANTH	101-100	0.40	3.64
AMROHA	102-103	0.60	5.45
JOYA	103-102	0.60	5.45
HASANPUR	104-105	0.80	7.27
UJHARI	105-104	0.80	7.27
SAMBHAL	106-107	0.65	5.91
SIRSI	107-106	0.65	5.91
BAHJOI	108-109	1.00	9.09
NARauli	109-110	0.50	4.55

CHANDAUSI	110-109	0.50	4.55
RUSTAMNAGAR SAHASPUR	111-112	0.25	2.27
BILARI	112-111	0.25	2.27
MURADABAD	113-114	1.00	9.09
BHOJPUR DHARAMPUR	114-118	0.90	8.18
TAKURDWARA	115-116	1.40	12.73
MASWASI	116-117	0.80	7.27
SUAR	117-116	0.80	7.27
TANDA	118-114	0.90	8.18
RAMPUR	119-122	1.30	11.82
SAHABAD	120-121	1.10	10.00
MILAK	121-120	1.10	10.00
KEMRI	122-123	0.80	7.27
BILASPUR	123-122	0.80	7.27
TOTAL		84.25	765.8325

SOURCE : CENSUS OF INDIA, 1991.

APPENDICES: 2.6
LOGARITHMS OF POPULATION WITH THE RANKS OF TOWNS (1971)

Name of the Town/U.A	RANK(R)	POPLN(Pr)	(X) LOG(R)	X2	(Y) LOG(Pr)	
Meerut U.A.	1	367754	0	0	5.565557	30.975
Moradabad U.A.	2	272652	0.30103	0.090619	5.435609	29.545
Saharanpur M.B.	3	225396	0.477121	0.227645	5.352946	28.654
Rampur M.B.	4	161417	0.60206	0.362476	5.207949	27.122
Ghaziabad U.A.	5	127700	0.69897	0.488559	5.106191	26.073
Muzaffarnagar U.A.	6	114783	0.778151	0.605519	5.059878	25.6
Sambhal M.B.	7	86323	0.845098	0.714191	4.936127	24.365
Amroha M.B.	8	82702	0.90309	0.815572	4.917516	24.181
Hardwar U.A.	9	79277	0.954243	0.910579	4.899147	24.001
Hapur M.B.	10	71266	1	1	4.852882	23.550
Roorkee U.A.	11	62456	1.041393	1.084499	4.795574	22.997
Chandausi M.B.	12	53393	1.079181	1.164632	4.727484	22.3
Modinagar U.A.	13	43470	1.113943	1.24087	4.63819	21.512
Bijnor U.A.	14	43290	1.146128	1.313609	4.636388	21.496
Najibabad M.B.	15	42586	1.176091	1.383191	4.629267	21.430
Deoband M.B.	16	38194	1.20412	1.449905	4.581995	20.994
Nagina M.B.	17	37066	1.230449	1.514005	4.568976	20.875
Shamli M.B.	18	36959	1.255273	1.575709	4.56772	20.864
Kairana M.B.	19	32354	1.278754	1.635211	4.509928	20.339
Baraut M.B.	20	31264	1.30103	1.692679	4.495045	20.205
Chandpur M.B.	21	28179	1.322219	1.748264	4.449926	19.801
Kiratpur M.B.	22	25147	1.342423	1.802099	4.400486	19.364
Mawan	23	24858	1.361728	1.854303	4.395466	19.3
a M.B.						
Khatauli M.B.	24	24495	1.380211	1.904983	4.389077	19.264
Gangoh M.B.	25	24300	1.39794	1.954236	4.385606	19.233
Pilkhua M.B.	26	23941	1.414973	2.00215	4.379142	19.176
Seohara M.B.	27	22821	1.431364	2.048802	4.358335	18.995
Dhampur M.B.	28	22639	1.447158	2.094266	4.354857	18.964
Sardhana M.B.	29	22083	1.462398	2.138608	4.344058	18.870
Hasanpur M.B.	30	22063	1.477121	2.181887	4.343665	18.867
Nehtaur M.B.	31	20286	1.491362	2.22416	4.307196	18.5
Kandhla M.B.	32	20061	1.50515	2.265476	4.302353	18.510
Manglaur M.B.	33	19723	1.518514	2.305885	4.294973	18.446
Kankar Khera	34	15352	1.531479	2.345428	4.186165	17.523
Tanda M.B.	35	14628	1.544068	2.384146	4.165185	17.348
Muradnagar M.B.	36	13985	1.556303	2.422077	4.145662	17.186
Rampur Maniharan T.A.	37	12997	1.568202	2.459257	4.113843	16.923
Miranpur T.A.	38	12962	1.579784	2.495716	4.112672	16.914
Kanth T.A.	39	12232	1.591065	2.531487	4.087497	16.707
Baghpat M.B.	40	11666	1.60206	2.566596	4.066922	16.539
Bilari U.A.	41	11620	1.612784	2.601072	4.065206	16.525
Malayana	42	11346	1.623249	2.634938	4.054843	16.
Bahjoi M.B.	43	11334	1.633468	2.668219	4.054383	16.438
Thakurdwara M.B.	44	11137	1.643453	2.700937	4.046768	16.3
Garh mukteshwar	45	10937	1.653213	2.733112	4.038898	16.312
Afzalgarh M.B.	46	10765	1.662758	2.764764	4.032014	16.257

Mandawar T.A.	47	9648	1.672098	2.795911	3.984437	15.875
Kaila	48	9333	1.681241	2.826572	3.970021	15.761
Ordnance Fty. Muradnagar C.T.	49	9026	1.690196	2.856763	3.955495	15.645
Hastinapur N.A.	50	8889	1.69897	2.886499	3.948853	15.593
Dhanaura M.B.	51	8410	1.70757	2.915796	3.924796	15.404
Nakur M.B.	52	8370	1.716003	2.944667	3.922725	15.3
Jansath T.A.	53	8202	1.724276	2.973127	3.91392	15.318
Faridnagar	54	7541	1.732394	3.001188	3.877429	15.034
Shahjahanpur C.T.	55	7340	1.740363	3.028862	3.865696	14.9
Tajpur C.T.	56	7275	1.748188	3.056161	3.861833	14.913
Aminagar Sarai T.A.	57	5637	1.755875	3.083097	3.751048	14.070
Rustamnagar Sahaspur	58	5391	1.763428	3.109678	3.731669	13.9
Rasulpur Dhulri	59	4944	1.770852	3.135917	3.694078	13.646

LOGARITHMS OF POPULATION WITH THE RANKS OF TOWNS (1981)

Name of the town/U.A.	RANK(R)	POPLN(Pr)	(X) LOG(R)	X ²	(Y) LOG(Pr)	Y ²
Meerut U.A.	1	536615	0	0	5.729663	32.829035
Moradabad U.A.	2	345350	0.30103	0.090619	5.538259	30.672317
Saharanpur M.B.	3	295355	0.477121	0.227645	5.470344	29.924667
Ghaziabad U.A.	4	287170	0.60206	0.362476	5.458139	29.791282
Rampur M.B.	5	204610	0.69897	0.488559	5.310927	28.205944
Muzaffarnagar U.A.	6	177816	0.778151	0.605519	5.235064	27.405890
Hardwar U.A.	7	145946	0.845098	0.714191	5.164192	26.668881
Amroha M.B.	8	112682	0.90309	0.815572	5.051855	25.521234
Sambhal M.B.	9	108232	0.954243	0.910579	5.034356	25.344737
Hapur	10	102837	1	1	5.012149	25.121641
Modinagar U.A.	11	87665	1.041393	1.084499	4.942826	24.431531
Roorkee U.A.	12	79076	1.079181	1.164632	4.898045	23.990841
Chandausi M.B.	13	66970	1.113943	1.24087	4.82588	23.289120
Bijnor U.A.	14	56713	1.146128	1.313609	4.753683	22.597498
Najibabad M.B.	15	55109	1.176091	1.383191	4.741223	22.479191
Shamli M.B.	16	51850	1.20412	1.449905	4.714749	22.228855
Deoband M.B.	17	51270	1.230449	1.514005	4.709863	22.182812
Nagina T.A.	18	50405	1.255273	1.575709	4.702474	22.113258
Baraut M.B.	19	46292	1.278754	1.635211	4.665506	21.766945
Kairana M.B.	20	44505	1.30103	1.692679	4.648409	21.607704
Chandpur M.B.	21	41552	1.322219	1.748264	4.618592	21.331391
Pilkhua M.B.	22	37884	1.342423	1.802099	4.578456	20.962257
Mawana M.B.	23	37620	1.361728	1.854303	4.575419	20.934457
Sherkot M.B.	24	33191	1.380211	1.904983	4.52102	20.439624
Gangoh M.B.	25	32713	1.39794	1.954236	4.51472	20.382700
Kiratpur M.B.	26	32079	1.414973	2.00215	4.506221	20.306026
Khatauli M.B.	27	31384	1.431364	2.048802	4.496708	20.220385
Seohara M.B.	28	30198	1.447158	2.094266	4.479978	20.070204
Sardhana M.B.	29	30138	1.462398	2.138608	4.479114	20.062466
Hasanpur M.B.	30	29817	1.477121	2.181887	4.474464	20.020827
Dhampur M.B.	31	29070	1.491362	2.22416	4.463445	19.922341
Nehtaur M.B.	32	27621	1.50515	2.265476	4.441239	19.724607
Muradnagar M.B.	33	26047	1.518514	2.305885	4.415758	19.498916
Manglaur M.B.	34	25724	1.531479	2.345428	4.410339	19.451085
Kandhla M.B.	35	25522	1.544068	2.384146	4.406915	19.420897
Khekda T.A.	36	24984	1.556303	2.422077	4.397662	19.339430
Bilari U.A.	37	23262	1.568202	2.459257	4.366647	19.067606
Tanda M.B.	38	20424	1.579784	2.495716	4.310141	18.577313
Bilaspur M.B.	39	20032	1.591065	2.531487	4.301724	18.504832
Dadri M.B.	40	19723	1.60206	2.566596	4.294973	18.446792
Thana Bhawan T.A.	41	18711	1.612784	2.601072	4.272097	18.250812
Shahabad T.A.	42	18313	1.623249	2.634938	4.262759	18.171118
Garhmukteshwar	43	17914	1.633468	2.668219	4.253193	18.089647
Bachhraon M.B.	44	17728	1.643453	2.700937	4.24866	18.051109
Budhana T.A.	45	17532	1.653213	2.733112	4.243831	18.010105
Baghpat M.B.	46	17157	1.662758	2.764764	4.234441	17.930493
Miranpur T.A.	47	17019	1.672098	2.795911	4.230934	17.900802
Thakurdwara M.B.	48	16598	1.681241	2.826572	4.220056	17.808870
Rampur Maniharan T.A.	49	16420	1.690196	2.856763	4.215373	17.769370

Bahjoi M.B.	50	16073	1.69897	2.886499	4.206097	17.691251
Kanth T.A.	51	15631	1.70757	2.915796	4.193987	17.589525
Charthawal T.A.	52	15420	1.716003	2.944667	4.188084	17.540050
Haldaur M.B.	53	15041	1.724276	2.973127	4.177277	17.449640
Suar M.B.	54	14935	1.732394	3.001188	4.174205	17.423989
Jalalabad T.A.	55	14929	1.740363	3.028862	4.174031	17.422532
Afzalgarh M.B.	56	14892	1.748188	3.056161	4.172953	17.413537
Milak M.B.	57	14470	1.755875	3.083097	4.160469	17.309498
Sahaspur T.A.	58	14296	1.763428	3.109678	4.155215	17.265807
Barhapur T.A.	59	13825	1.770852	3.135917	4.140665	17.145107
Chhaprauli T.A.	60	13805	1.778151	3.161822	4.140036	17.139901
Kithaur T.A.	61	13791	1.785533	3.187403	4.139596	17.136253
Kemri T.A.	62	13537	1.792392	3.212668	4.131522	17.069477
Purqazi T.A.	63	13412	1.799341	3.237626	4.127494	17.036203
Naugawan Sadat N.A.	64	13311	1.80618	3.262286	4.124211	17.009113
Ordance Factory Muradnagar	65	13147	1.812913	3.286655	4.118827	16.964733
Sirsi N.A.	66	13096	1.819544	3.31074	4.117139	16.950830
Kundarki	67	12713	1.826075	3.334549	4.104248	16.844852
Noorpur M.B.	68	12465	1.832509	3.358089	4.095692	16.774695
Jhalu T.A.	69	12461	1.838849	3.381366	4.095553	16.773553
Bhokarhedi T.A.	70	12148	1.845098	3.404387	4.084505	16.683179
Bhojpur Dharampur T.A.	71	12049	1.851258	3.427157	4.080951	16.654161
Dhanaura M.B.	72	11816	1.857332	3.449684	4.07247	16.585015
Hastinapur N.A.	73	11637	1.863323	3.471972	4.065841	16.531063
Nakur M.B.	74	11629	1.869232	3.494027	4.065542	16.528634
Mandawar T.A.	75	11587	1.875061	3.515855	4.063971	16.515860
Lawar T.A.	76	11535	1.880814	3.53746	4.062018	16.499987
Parikshitgarh T.A.	77	11328	1.886491	3.558847	4.054153	16.436158
Tikri T.A.	78	11315	1.892095	3.580022	4.053655	16.432115
Un T.A.	79	11302	1.897627	3.600989	4.053155	16.428067
Behat T.A.	80	11076	1.90309	3.621751	4.044383	16.357033
Sisauli T.A.	81	11057	1.908485	3.642315	4.043637	16.351002
Sahanpur T.A.	82	11023	1.913814	3.662683	4.0423	16.340187
Jansath T.A.	83	10460	1.919078	3.682861	4.019532	16.156635
Narauli T.A.	84	10414	1.924279	3.702851	4.017618	16.141251
Phalauda T.A.	85	10357	1.929419	3.722657	4.015234	16.122103
Sewal Khas T.A.	86	10278	1.934498	3.742284	4.011909	16.095410
Loni	87	10259	1.939519	3.761735	4.011105	16.088963
Ujhari T.A.	88	10198	1.944483	3.781013	4.008515	16.068192
Jhinjhana T.A.	89	10123	1.94939	3.800121	4.005309	16.042502
Doghat T.A.	90	10019	1.954243	3.819064	4.000824	16.006595
Chilkana Sultanpur T.A.	91	9936	1.959041	3.837843	3.997212	15.977700
Karnawal T.A.	92	9895	1.963788	3.856463	3.995416	15.963347
Tajpur C.T.	93	9721	1.968483	3.874925	3.987711	15.901838
Jalalabad T.A.	94	9561	1.973128	3.893234	3.980503	15.844406
Shahpur T.A.	95	9516	1.977724	3.911391	3.978454	15.828099
Agarwal Mandi T.A.	96	9353	1.982271	3.929399	3.970951	15.768451
Nanauta T.A.	97	9288	1.986772	3.947262	3.967922	15.744406
Umri Kalan T.A.	98	9190	1.991226	3.964981	3.963316	15.707869
Daurala T.A.	99	9146	1.995635	3.98256	3.961231	15.691352

Faridnagar T.A.	100	9116	2	4	3.959804	15.680050
Shahjahanpur C.T.	101	8867	2.004321	4.017304	3.947777	15.584940
Maswasi T.A.	102	8786	2.0086	4.034475	3.943791	15.553489
Kharkhoda T.A.	103	8708	2.012837	4.051514	3.939918	15.522957
Landhaura T.A.	104	8077	2.017033	4.068423	3.90725	15.266603
Bahsuma T.A.	105	7906	2.021189	4.085206	3.897957	15.194067
Patala T.A.	106	7847	2.025306	4.101864	3.894704	15.168716
Ambehta T.A.	107	7814	2.029384	4.118399	3.892873	15.154463
Sarsawan T.A.	108	7696	2.033424	4.134812	3.886265	15.103056
Garhi Pukhta T.A.	109	7279	2.037426	4.151107	3.862072	14.915598
Niwadi T.A.	110	7078	2.041393	4.167284	3.849911	14.821811
Aminagar Sarai T.A.	111	6837	2.045323	4.183346	3.834866	14.706194
Titron N.A.	112	6646	2.049218	4.199295	3.82256	14.611967
Abdullpur	113	6383	2.053078	4.215131	3.805025	14.478214
Jhabrera T.A.	114	5453	2.056905	4.230858	3.736635	13.962444
Joya T.A.	115	3536	2.060698	4.246476	3.548512	12.591939
Babugarh	116	2389	2.064458	4.261987	3.378216	11.412344

APPENDICE 2.8

5

LOGARITHMS OF POPULATION WITH THE RANKS OF TOWNS (1991)

Name of the Town/city/U.A	R) RANK	(Pr) POPLN	X LOG(R)	(X ²)	(Y)	(Y ²) LOG(Pr)	(C)
Meerut U.A.	1	849799	0	0.000000	5.929316	35.156791	
Ghaziabad U.A.	2	511759	0.30103	0.090619	5.709065	32.593429	1.7
Moradabad U.A.	3	443701	0.477121	0.227645	5.64709	31.889630	2.694
Saharanpur M.B.	4	374945	0.60206	0.362476	5.573968	31.069114	3.355
Muzaffarnagar U.A.	5	247624	0.69897	0.488559	5.393793	29.093000	3.770
Rampur M.B.	6	243742	0.778151	0.605519	5.38693	29.019019	4.191
Hardwar U.A.	7	187392	0.845098	0.714191	5.272751	27.801904	4.455
Sambhal M.B.	8	150869	0.90309	0.815572	5.1786	26.817898	4.676
Noida C.T.	9	146514	0.954243	0.910579	5.165879	26.686307	4.929
Hapur M.B.	10	146262	1	1.000000	5.165132	26.678583	5.165
Amroha M.B.	11	137061	1.041393	1.084499	5.136914	26.387884	5.359
Modinagar U.A.	12	123279	1.079181	1.164632	5.090889	25.917152	5.493
Roorkee U.A.	13	91139	1.113943	1.240870	4.959704	24.598666	5.5
Chandausi M.B.	14	82748	1.146128	1.313609	4.917758	24.184339	5.6
Bijnor U.A.	15	73900	1.176091	1.383191	4.868644	23.703699	5.7
Shamli M.B.	16	70853	1.20412	1.449905	4.850358	23.525975	5.840
Baraut M.B.	17	67705	1.230449	1.514005	4.830621	23.334897	5.943
Najibabad M.B.	18	66860	1.255273	1.575709	4.825166	23.282231	6.056
Deoband M.B.	19	66208	1.278754	1.635211	4.82091	23.241178	6.164
Nagina M.B.	20	58513	1.30103	1.692679	4.767252	22.726695	6.202
Kairana M.B.	21	56079	1.322219	1.748264	4.7488	22.551104	6.278
Chandpur M.B.	22	55825	1.342423	1.802099	4.746829	22.532383	6.372
Mawana M.B.	23	51701	1.361728	1.854303	4.713499	22.217072	6.418
Pilkhua M.B.	24	50162	1.380211	1.904983	4.700375	22.093524	6.4
Muradnagar M.B.	25	44395	1.39794	1.954236	4.647334	21.597714	6.496
Khatauli M.B.	26	44319	1.414973	2.002150	4.64659	21.590798	6.574
Kiratpur M.B.	27	43757	1.431364	2.048802	4.641048	21.539322	6.643
Hasanpur M.B.	28	43383	1.447158	2.094266	4.63732	21.504733	6.710
Sardhana M.B.	29	42980	1.462398	2.138608	4.633266	21.467158	6.7
Sherkot M.B.	30	42230	1.477121	2.181887	4.625621	21.396370	6.832
Gangoh M.B.	31	41198	1.491362	2.224160	4.614876	21.297082	6.882
Dhampur M.B.	32	39179	1.50515	2.265476	4.593053	21.096139	6.913
Seohara M.B.	33	37560	1.518514	2.305885	4.574726	20.928114	6.946
Loni T.A.	34	36561	1.531479	2.345428	4.563018	20.821134	6.988
Khekda T.A.	35	35191	1.544068	2.384146	4.546432	20.670040	
Nehtaur M.B.	36	34753	1.556303	2.422077	4.540992	20.620611	7.067
Manglaur M.B.	37	34161	1.568202	2.459257	4.533531	20.552899	7.1
Dadri M.B.	38	32883	1.579784	2.495716	4.516971	20.403031	7.135
Kandhla M.B.	39	32513	1.591065	2.531487	4.512057	20.358659	7.178
Bilari U.A.	40	31662	1.60206	2.566596	4.500538	20.254845	7.210
Behata Hajipur C.T.	41	30360	1.612784	2.601072	4.482302	20.091029	7.228
Tanda M.B.	42	29328	1.623249	2.634938	4.467282	19.956612	7.251
Budhana T.A.	43	26931	1.633468	2.668219	4.430252	19.627137	7.236
Bilaspur M.B.	44	26463	1.643453	2.700937	4.422639	19.559736	7.268
Thana Bhawan T.A.	45	25577	1.653213	2.733112	4.40785	19.429138	7.287
Thakurdwara M.B.	46	25279	1.662758	2.764764	4.40276	19.384295	7.320
Garhmukteshwar M.B.	47	25241	1.672098	2.795911	4.402107	19.378542	7.360
Shahabad T.A.	48	25128	1.681241	2.826572	4.400158	19.361390	7.397
Baghpat M.B.	49	24939	1.690196	2.856763	4.396879	19.332545	7.431

Bachhraon M.B.	50	24097	1.69897	2.886499	4.381963	19.201600	7.444
Bachhraon M.B.	51	24097	1.70757	2.915796	4.381963	19.201600	7.482
Miranpur T.A.	52	22796	1.716003	2.944667	4.357859	18.990932	7.4
Bahjoi M.B.	53	21723	1.724276	2.973127	4.33692	18.808873	7.478
Rampur Maniharan T.A.	54	21184	1.732394	3.001188	4.326008	18.714345	7.494
Gajraula T.A.	55	21096	1.740363	3.028862	4.3242	18.698707	7.525
Naugawan Sadat N.A.	56	20613	1.748188	3.056161	4.314141	18.611814	7.5
Kanth T.A.	57	20297	1.755875	3.083097	4.307432	18.553969	7.563
Suar M.B.	58	19782	1.763428	3.109678	4.29627	18.457938	7.576
Jalalabad T.A.	59	19360	1.770852	3.135917	4.286905	18.377558	7.591
Kithaur T.A.	60	19270	1.778151	3.161822	4.284882	18.360211	7.619
Milak M.B.	61	18962	1.78533	3.187403	4.277884	18.300293	7.637
Afzalgarh M.B.	62	18650	1.792392	3.212668	4.270679	18.238698	7.654
Charthawal T.A.	63	18593	1.799341	3.237626	4.269349	18.227345	7.682
Kundarki T.A.	64	18516	1.80618	3.262286	4.267547	18.211959	7.707
Sirsi N.A.	65	18310	1.812913	3.286655	4.262688	18.170512	7.727
Sahaspur T.A.	66	18198	1.819544	3.310740	4.260024	18.147802	7.7
Bhojpur Dharampur T.A.	67	17996	1.826075	3.334549	4.255176	18.106523	7.7
Barhapur T.A.	68	17981	1.832509	3.358089	4.254814	18.103441	7.796
Purqazi T.A.	69	17752	1.838849	3.381366	4.249247	18.056103	7.813
Kemri T.A.	70	17481	1.845098	3.404387	4.242566	17.999369	7.827
Dasna T.A.	71	16963	1.851258	3.427157	4.229503	17.888693	7.829
Dhanaura M.B.	72	16484	1.857332	3.449684	4.217063	17.783617	7.832
Chhaprauli T.A.	73	16008	1.863323	3.471972	4.204337	17.676450	7.834
Haldaur M.B.	74	15830	1.869232	3.494027	4.199481	17.635640	7.849
Laksar T.A.	75	15622	1.875061	3.515855	4.193737	17.587427	7.863
Mandawar T.A.	76	15408	1.880814	3.537460	4.187746	17.537219	7.8
Nakur M.B.	77	15182	1.886491	3.558847	4.181329	17.483512	7.888
Hastinapur N.A.	78	15081	1.892095	3.580022	4.17843	17.459278	7.905
Jhala T.A.	79	14808	1.897627	3.600989	4.170496	17.393040	7.914
Behat T.A.	80	14569	1.90309	3.621751	4.16343	17.334147	7.923
Lawar T.A.	81	14471	1.908485	3.642315	4.160499	17.309748	7.940
Sewal Khas T.A.	82	14402	1.913814	3.662683	4.158423	17.292480	7.958
Sahanpur T.A.	83	14299	1.919078	3.682861	4.155306	17.266565	7.974
Ujhari T.A.	84	14125	1.924279	3.702851	4.149988	17.222404	7.985
Bhokarhedi T.A.	85	14006	1.929419	3.722657	4.146314	17.191921	7.999
Phalanda T.A.	86	13970	1.934498	3.742284	4.145196	17.182653	8.018
Jansath T.A.	87	13865	1.939519	3.761735	4.14192	17.155500	8.033
Parikshitgarh T.A.	88	13677	1.944483	3.781013	4.135991	17.106420	8.042
Banat T.A.	89	13634	1.94939	3.800121	4.134623	17.095110	8.059
Narauli T.A.	90	13630	1.954243	3.819064	4.134496	17.094056	8.079
Sisauti T.A.	91	13437	1.959041	3.837843	4.128302	17.042880	8.087
Un T.A.	92	13303	1.963788	3.856463	4.12395	17.006960	8.098
Shahpur T.A.	93	13287	1.968483	3.874925	4.123427	17.002650	8.116
Jhijnhana T.A.	94	13062	1.973128	3.893234	4.11601	16.941536	8.121
Ailum T.A.	95	13044	1.977724	3.911391	4.115411	16.936606	8.139
Nanauta T.A.	96	12993	1.982271	3.929399	4.113709	16.922605	8.154
Tajpur C.T.	97	12898	1.986772	3.947262	4.110522	16.896394	8.1
Ord.Fac.Muradnagar C.T.	98	12792	1.991226	3.964981	4.106938	16.866943	8.177

Tikri T.A.	99	12784	1.995635	3.982560	4.106667	16.864712	8.1925
Chilkana Sultanpur T.A.	100	12647	2	4.000000	4.101988	16.826302	8.2025
Jalalabad T.A.	101	12468	2.004321	4.017304	4.095797	16.775551	8.2009
Shahjahanpur C.T.	102	12443	2.0086	4.034475	4.094925	16.768412	8.2225
Pasaunda C.T.	103	12387	2.012837	4.051514	4.092966	16.752372	8.2335
Sarsawan T.A.	104	12384	2.017033	4.068423	4.092861	16.751511	8.2355
Doghat T.A.	105	12309	2.021189	4.085206	4.090223	16.729922	8.2677
Landhaura T.A.	106	12195	2.025306	4.101864	4.086182	16.696882	8.2725
Maswasi T.A.	107	11830	2.029384	4.118399	4.072985	16.589205	8.2655
Umri Kalan T.A.	108	11365	2.033424	4.134812	4.055569	16.447643	8.2466
Kamawal T.A.	109	11047	2.037426	4.151107	4.043244	16.347825	8.2377
Faridnagar T.A.	110	10940	2.041393	4.167284	4.039017	16.313661	8.2
Agarwal Mandi T.A.	111	10871	2.045323	4.183346	4.036269	16.291471	8.2555
Kharkhoda T.A.	112	10550	2.049218	4.199295	4.023252	16.186560	8.2444
Kalchhina C.T.	113	10373	2.053078	4.215131	4.015904	16.127488	8.2444
Ambehta T.A.	114	10297	2.056905	4.230858	4.012711	16.101847	8.2533
Daurala T.A.	115	10025	2.060698	4.246476	4.001084	16.008676	8.2455
Garhi Pukhta T.A.	116	9195	2.064458	4.261987	3.963552	15.709742	8.1822
Patala T.A.	117	9181	2.068186	4.277393	3.96289	15.704497	8.1925
Bahsuma T.A.	118	9060	2.071882	4.292695	3.957128	15.658864	8.1888
Niwadi T.A.	119	8841	2.075547	4.307895	3.946501	15.574873	8.1901
Rori C.T.	120	8473	2.079181	4.322995	3.928037	15.429476	8.1677
Aminagar Sarai T.A.	121	8274	2.082785	4.337995	3.917716	15.348495	8.1599
Titron N.A.	122	8045	2.08636	4.352897	3.905526	15.253134	8.1488
Jhabrera T.A.	123	7633	2.089905	4.367703	3.882695	15.075323	8.1144
Dujana C.T.	124	7313	2.093422	4.382414	3.864096	14.931235	8.0889
Joya T.A.	125	6514	2.09691	4.397032	3.813848	14.545435	7.9977
Babugarh T.A.	126	3581	2.100371	4.411556	3.554004	12.630947	7.464

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APPENDIX 3.1

PERCENT OF WORKERS IN EACH OF THE NON-AGRICULTURAL
CATEGORIES (1971)

Town/City/UA	A	B	C
Afzalgarh M.B.	51.94	32.73	15.33
Aminagar Sarai T.A.	36.81	42.83	20.35
Amroha M.B.	45.27	32.34	22.39
Baghpat M.B.	29.43	35.56	35.01
Bahjoi M.B.	36.18	38.07	25.75
Baraut M.B.	30.85	41.31	27.84
Bijnor U.A.	27.05	34.72	38.23
Bilari U.A.	32.89	41.39	25.72
(B)Rustamnagar Sahaspur C.T.	58.66	19.26	22.08
Chandausi M.B.	28.54	44.77	26.70
Chandpur M.B.	45.95	31.45	22.60
Deoband M.B.	38.24	36.36	25.40
Dhampur M.B.	32.85	42.40	24.75
Dhanaura M.B.	36.49	33.78	29.73
Faridnagar	43.43	34.89	21.68
Gangoh M.B.	34.52	46.70	18.77
Garh mukteshwar	39.66	35.63	24.71
Ghaziabad U.A.	41.60	33.56	24.84
(A) Ghaziabad M.B.	52.15	41.17	6.67
(B) Razapur C.T.	-	-	-
(C) Ghaziabad Rly. Colony C.T.	45.21	45.44	9.35
Hapur M.B.	45.03	35.55	19.41
Hardwar U.A.	30.89	53.69	15.42
(A) Hardwar	-	-	-
(B) B.H.E.L. Ltd. Ranipur N.A.	94.96	1.37	3.67
(i) Hardwar M.B.	34.70	60.76	4.54
(ii) Gurukul Kangri O.G.	15.79	3.95	80.26
(iii) Jwalapur Mahavidyalay O.G	0.00	22.92	77.08
Hasanpur M.B.	40.60	29.09	30.30
Hastinapur N.A.	43.28	19.15	37.57
Jansath T.A.	32.68	33.48	33.84
Kaila	34.64	42.02	23.34
Kairana M.B.	25.56	43.85	30.59
Kandhla M.B.	26.82	48.00	25.19
Kankar Khera	16.96	25.45	57.59
Kanth T.A.	53.44	23.92	22.64
Khatauli M.B.	31.74	45.01	23.25
Kiratpur M.B.	42.93	31.58	25.48
Malayana	53.23	28.59	18.18
Mandawar T.A.	39.32	35.91	24.77
Manglaur M.B.	44.33	41.88	13.79
Mawana M.B.	29.30	45.57	25.14
Meerut U.A.	29.53	28.58	41.89
(A)Meerut M.C.	36.73	33.80	29.47

(B)Meerut Cantt.	11.02	16.71	72.27
Miranpur T.A.	42.08	36.74	21.18
Modinagar U.A.	72.71	14.44	12.85
Moradabad U.A.	36.08	37.43	26.49
(A)Moradabad M.B.	38.27	34.68	27.05
(B)Moradabad Rly.SettlementN.A	3.43	86.42	10.16
Muradnagar M.B.	42.55	36.30	21.15
Muzaffarnagar U.A.	25.56	43.85	30.59
Nagina M.B.	37.16	33.03	29.82
Najibabad. M.B	39.64	36.89	23.47
Nakur M.B.	21.81	46.51	31.68
Nehtaur M.B.	41.19	32.03	26.78
Ordnance Fty. Muradnagar C.T.	7.45	2.68	89.87
Pilkhua M.B.	49.73	32.91	17.36
Rampur M.B.	41.64	32.92	25.44
Rampur Maniharan T.A.	29.63	41.79	28.58
Rasulpur Dhulri	42.31	42.31	15.38
Roorkee M.B	19.69	34.64	45.67
Roorkee U.A.	10.09	17.02	72.89
(B)Roorkee Cantt	0.99	1.52	97.50
Saharanpur M.B.	35.98	40.96	23.06
Sambhal M.B.	45.35	33.78	20.87
Sardhana M.B.	45.80	34.70	19.51
Seohara M.B.	45.20	33.09	21.71
Shahjahanpur C.T.	50.91	38.56	10.53
Shamli M.B.	40.27	37.64	22.09
Tajpur C.T.	60.47	24.59	14.94
Tanda M.B.	23.99	63.68	12.33
Thakurdwara M.B.	36.10	28.98	•34.92

A = Per cent of main workers in Manufacturing

B = Per cent of main workers in Trade and transport

C = Per cent of main workers in Services

APPENDIX 3.2
PERCENT OF WORKERS IN EACH OF THE NON-AGRICULTURAL
CATEGORIES (1991)

TOWN NAME	(A)	(B)	(C)
Ambhta T.A.	36.37	41.36	22.27
Aminagar Sarai T.A.	29.26	49.45	21.29
Amroha M.B.	43.96	35.04	21.01
Babugarh T.A.	18.70	23.46	57.84
Bachraon M.B.	44.90	32.43	22.67
Baghpat M.B.	27.03	44.57	28.39
Bahjoi M.B.	26.55	52.64	20.80
Bahsuma T.A.	48.30	28.14	23.56
Banat T.A.	39.28	36.40	24.32
Baraut M.B.	29.75	45.40	24.85
Barhapur T.A.	42.60	28.18	29.22
Behat T.A.	31.61	43.92	24.47
Behta Hajipur C.T.	33.11	27.82	39.07
Bhojpur Dharampur T.A.	56.44	32.81	10.75
Bhokarhedi T.A.	47.92	24.32	27.76
Bijnor U.A.	26.86	31.38	41.76
(A) Bijnor M.B.	25.16	32.11	42.73
(B)Mukarampur Khema C.T.	43.64	24.19	32.17
Bilari U.A.	42.84	37.46	19.70
(A)Bilari M.B.	36.85	44.02	19.13
Bilaspur M.B.	32.06	43.12	24.83
Budhana T.A.	32.32	42.75	24.94
Chandausi M.B.	27.47	47.79	24.74
Chandpur M.B.	39.65	37.61	22.74
Charhawal T.A.	42.89	32.22	24.89
Chhaprauli T.A.	26.04	40.98	32.98
Chilkana Suitanpur T.A.	28.16	48.80	23.04
Dadri M.B.	29.03	35.19	35.78
Dasna T.A.	58.97	21.48	19.56
Daurala T.A.	56.03	21.39	22.58
Deoband M.B.	36.36	36.14	27.49
Dhampur M.B.	28.53	43.58	27.89
Dhanaura M.B.	32.31	42.93	24.76
Doghat T.A.	42.25	31.50	26.25
Dujana C.T.	15.19	14.85	69.95
Faridnagar T.A.	41.36	29.16	29.48
Gajraula T.A.	38.30	38.76	22.95
Gangoh M.B.	26.28	43.16	30.56
Garhi Pukhta T.A.	31.06	46.36	22.58
Garhmukteshwar M.B.	33.19	36.80	30.02
Ghaziabad U.A.	39.04	30.20	30.76
(A)Ghaziabad M.B.	39.14	30.62	30.24
(B)Razpur C.T.	41.19	21.20	37.62
(C)Ghaziabad Rly. Colony C.T.	25.79	50.02	24.19
Haldaur M.B.	34.43	38.52	27.05
Hapur M.B.	26.42	40.89	32.69

Hardwar U.A.	42.68	30.28	27.04
(A)Hardwar	33.92	36.51	29.57
(B)B.H.E.L. Ltd. Ranipur N.A.	78.62	4.70	16.68
(i)Hardwar M.B.	34.22	36.81	28.96
(ii)Gurukul Kangri O.G.	6.82	9.60	83.59
(iii)Jwalapur Mahavidyalay O.G	0.00	0.00	100.00
Hasanpur M.B.	37.13	38.82	24.06
Hastinapur N.A.	46.94	23.56	29.50
Jalalabad T.A.	34.84	43.54	21.63
Jalalabad T.A.	37.40	40.27	22.33
Jansath T.A.	26.91	41.21	31.87
Jhabrera T.A.	29.60	39.03	31.37
Jhalu T.A.	40.00	27.32	32.68
Jhinjhana T.A.	30.14	43.31	26.55
Joya T.A.	28.73	41.65	29.62
Kairana M.B.	38.66	39.64	21.70
Kalchhina C.T.	33.83	11.79	54.38
Kandhla M.B.	31.90	43.06	25.04
Kanth T.A.	51.53	29.97	18.49
Karnawal T.A.	46.34	24.29	29.37
Kemri T.A.	23.21	59.66	17.13
Kharkhoda T.A.	38.84	29.31	31.85
Khatauli M.B.	33.91	42.71	23.38
Khekda T.A.	39.53	30.21	30.26
Kiratpur M.B.	48.40	29.60	22.00
Kithaur T.A.	32.77	40.10	27.13
Kundarki T.A.	35.02	42.90	22.08
Laksar T.A.	32.15	44.36	23.49
Lardhaura T.A.	65.44	17.39	17.17
Lawar T.A.	55.08	28.89	16.04
Loni T.A.	42.16	30.73	27.11
Mandawar T.A.	34.96	34.31	30.73
Manglaur M.B.	40.37	37.36	22.27
Maswasi T.A.	30.16	38.30	31.54
Mawana M.B.	35.05	41.98	22.96
Meerut U.A.	35.88	30.77	33.35
(A)Meerut M.C.	39.19	31.41	29.39
(B)Meerut Cantt.	16.76	27.08	56.16
Milak M.B.	23.70	44.91	31.39
Miranpur T.A.	39.89	37.13	22.98
Modinagar U.A.	56.21	22.81	20.99
(A)Modinagar M.B.	57.23	22.61	20.15
(B)Begumabad Budhana C.T.	47.79	27.23	24.98
(C)Bisokhar C.T.	55.73	18.33	25.94
Moradabad U.A.	42.67	31.40	25.94
(A)Moradabad M.B.	43.74	30.05	26.21
(B)Moradabad Rly.Settlement N.A	5.92	77.66	16.42
Muradnagar M.B.	43.33	34.49	22.18
Muzaffarnagar U.A.	27.07	42.03	30.90
(i)Muzaffarnagar M.B.	27.14	42.04	30.82
(ii)Adarsh Cly. & Devpuram O.G.	26.80	38.61	34.59

(iii)Subhash Ngr.V.P.& L.B. OG	22.68	44.67	32.65
Nagina M.B.	42.81	34.22	22.97
Najibabad M.B.	36.42	37.97	25.61
Nakur M.B.	26.12	47.04	26.84
Nanauta T.A.	29.98	44.43	25.58
Narauli T.A.	32.18	35.99	31.83
Naugawan Sadat N.A.	75.38	12.22	12.40
Nehtaur M.B.	43.04	36.66	20.30
Niwadi T.A.	27.03	27.59	45.38
Noida C.T.	44.22	21.01	34.76
Noorpur M.B.	35.97	44.51	19.52
Ordinance Fty. Muradnagar C.T.	79.19	3.73	17.07
Parikshitgarh T.A.	28.66	41.69	29.65
Pasaunda C.T.	42.61	27.28	30.11
Patala T.A.	32.84	19.67	47.48
Phalauda T.A.	42.75	35.91	21.34
Pilkhua M.B.	38.82	34.44	26.73
Purqazi T.A.	30.30	42.96	26.74
Rampur M.B.	42.06	30.61	27.33
Rampur Maniharan T.A.	35.26	41.18	23.56
Roorkee U.A.	22.51	27.22	50.27
(A)Roorkee M.B.	27.19	32.46	40.35
(B)Roorkee Cantt	1.41	3.61	94.98
Rori C.T.	31.63	12.99	55.38
Sahanpur T.A.	36.03	31.71	32.26
Saharanpur M.B.	38.64	37.46	23.90
Sahaspur T.A.	57.50	25.91	16.58
Sambhal M.B.	39.48	40.54	19.98
Sardhana M.B.	47.43	33.82	18.75
Sarsawan T.A.	21.38	27.09	51.53
Seohara M.B.	41.78	37.71	20.51
Sewal Khas T.A.	35.69	39.67	24.64
Shahabad T.A.	34.99	33.22	31.79
Shahjahanpur C.T.	47.11	29.85	23.04
Shahpur T.A.	35.78	44.59	19.63
Shamli M.B.	34.88	43.52	21.60
Sherkot M.B.	56.89	25.06	18.04
Sirsi N.A.	33.67	38.76	27.57
Sisauli T.A.	44.58	28.44	26.98
Suar M.B.	28.94	46.00	25.07
Tajpur C.T.	48.00	28.63	23.37
Tanda M.B.	30.75	49.23	20.02
Thakurdwara M.B.	43.36	36.54	20.10
Thana Bhawan T.A.	35.35	40.67	23.98
Tikri T.A.	59.47	19.89	20.64
Titron N.A.	28.06	33.22	38.73
Ujhari T.A.	36.26	32.11	31.64
Umri Kalan T.A.	60.14	24.47	15.39
Un T.A.	40.02	32.12	27.86

A=Per cent of main workers in Manufacturing

B=Per cent of main workers in Trade and transport

C=Per cent of main workers in Services

SOURCE: CENSUS OF INDIA, 1991, SERIES 22, PART X-A

TABLE : 4.1

HIERARCHY OF URBAN SETTLEMENT IN NORTHERN UPPER GANGA PLAINS (1971-91)

S.No	Town/City	Cen.Score	S.No	Town/City	Cen.Score
1	Pilkhua	21.76	1	Baraut M.B.	23.26
2	Afzalgarh	17.13	2	Nakur M.B.	22.74
3	Roorkee	15.37	3	Hardwar U.A.	18.40
4	Saharanpur	14.64	4	Saharanpur M.B.	17.93
5	Nakur	14.34	5	Baghpat M.B.	16.62
6	Hapur	13.62	6	Roorkee U.A.	16.60
7	Bijnor	13.20	7	Jansath T.A.	16.44
8	Rampur Maniharan	13.11	8	Hastinapur N.A.	15.01
9	Shamli	12.92	9	Dhampur M.B.	14.59
10	Hardwar	12.81	10	Meerut U.A.	14.54
11	Muzaffarnagar	12.73	11	Modinagar U.A.	14.29
12	Baghpat	12.46	12	Khatauli M.B.	13.29
13	Baraut	12.37	13	Hapur M.B.	13.27
14	Meerut Cantt.	11.98	14	Moradabad U.A.	13.06
15	Hastinapur	11.97	15	Bijnor U.A.	12.93
16	Moradabad	11.86	16	Muzaffarnagar U.A.	12.86
17	Jansath	11.50	17	Manglaur M.B.	12.80
18	Manglaur	11.47	18	Chandpur M.B.	12.69
19	Sambhal	10.63	19	Chandausi M.B.	12.65
20	Najibabad	10.59	20	Aminagar Sarai T.A.	12.61
21	Chandausi	10.42	21	Rampur M.B.	12.60
22	Mawana	10.35	22	Sardhana M.B.	12.44
23	Garhmukteshwar	10.29	23	Ghaziabad U.A.	12.01
24	Nagina	10.28	24	Nagina M.B.	11.84
25	Ghaziabad	10.05	25	Pilkhua M.B.	11.69
26	Hasanpur	9.91	26	Deoband M.B.	11.68
27	Kandhla	9.73	27	Muradnagar M.B.	11.40
28	Dhampur	9.72	28	Mawana M.B.	11.40
29	Rampur	9.58	29	Shamli M.B.	11.25
30	Meerut	9.47	30	Bahjoi M.B.	10.81
31	Thakurdwara	9.32	31	Garhmukteshwar	10.72
32	Amroha	9.17	32	Najibabad M.B.	10.31
33	Bahjoi	9.11	33	Faridnagar	9.72
34	Gangoh	8.77	34	Miranpur T.A.	9.52
35	Khatauli	8.76	35	Dhanaura M.B.	9.46
36	Modinagar	8.60	36	Seohara M.B.	9.24
37	Chandpur	8.46	37	Amroha M.B.	9.22
37	Dhanaura	8.39	38	Thakurdwara M.B.	8.79
42	Tajpur	7.98	39	Bilari U.A.	8.30
40	Rustamnagar	7.93	40	Afzalgarh M.B.	8.20
	Sahaspur				
41	Kairana	7.38	41	Rampur Maniharan T.A.	8.19
43	Miranpur	7.37	42	Tanda M.B.	8.03
44	Deoband	7.25	43	Kairana M.B.	7.95
45	Kanth	7.20	44	Kandhla M.B.	7.94
46	Muradnagar	6.82	45	Kanth T.A.	7.80
47	Aminagar Sarai	6.82	46	Shahjahanpur C.T.	7.70
48	Kiratpur	6.79	47	Sambhal M.B.	7.65

49	Sardhana	6.70	48	Hasanpur M.B.	6.97
50	Seohara	6.50	49	Mandawar T.A.	6.78
51	Faridnagar	6.49	50	Kiratpur M.B.	6.72
52	Bilari	6.22	51	Nehtaur M.B.	6.67
53	Shahjahanpur	5.58	52	Malayana	6.61
54	Mandawar	5.50	53	Gangoh M.B.	6.37
55	Nehtaur	5.50	54	Kankar Khera	6.34
56	Tanda	4.88	55	Rasulpur Dhulri	6.15
			56	Rustamnagar Sahaspur	4.29
			57	Kaila	4.24
			58	Tajpur C.T	4.13

TABLE:4.2
HIERARCHY OF NORTHERN GANGA PLAINS (All Towns -1991)

S.No	TOWN	CEN.SCORE	S.No	TOWNS	CEN.SCORE
1	Barhapur	31.32	64	Shahabad	9.81
2	Noida	28.87	65	Kalchhina	9.80
3	Pilkhua	24.33	66	Gangoh	9.77
4	B.H.E.L. Ltd. Ranipur	22.61	67	Khatauli	9.76
5	Babugarh	21.71	68	Chilkana Sultanpur	9.76
6	Moradabad Rly.Settlement	20.36	69	Niwadi	9.47
7	Ordinance Fty. Muradnagar	20.20	70	Budhana	9.29
8	Roorkee	19.83	71	Dhanaura	9.22
9	Saharanpur	19.27	72	Tikri	9.19
10	Gajraula	18.66	73	Chandpur	9.12
11	Roorkee Cantt. Cantt.	18.42	74	Thana Bhawan	8.81
12	Mukarampur Khema	17.93	75	Bilaspur	8.76
13	Hapur	17.90	76	Tajpur	8.75
14	Bijnor	17.45	77	Un	8.73
15	Hardwar	17.14	78	Ghaziabad Rly. Colony	8.52
16	Muzaffarnagar	17.12	79	Rustamnagar Sahaspur	8.50
17	Shamli	16.91	80	Chhaprauli	8.47
18	Afzalgarh	16.67	81	Sahaspur	8.44
19	Nakur	16.35	82	Miranpur	8.40
20	Meerut Cantt.	16.31	83	Kairana	8.40
21	Baraut	16.18	84	Dasna	8.39
22	Moradabad	16.16	85	Agarwal Mandi	8.33
23	Jhabrera	15.93	86	Kundarki	8.27
24	Jalalabad	14.85	87	Deoband	8.19
25	Dujana SS	14.71	88	Charthawal	8.17
26	Suar	14.67	89	Kanth	8.14
27	Rampur Maniharan	14.39	90	Aminagar Sarai	7.70
28	Najibabad	14.28	91	Noorpur	7.68
29	Sambhal	14.18	92	Muradnagar	7.66
30	Ghaziabad	14.15	93	Sardhana	7.58
31	Jhinjhana	14.11	94	Haldaur	7.56
32	Chandausi	14.09	95	Sewal-Khas	7.51
33	Baghpat	13.67	96	Faridnagar	7.38
34	Nagma	13.59	97	Kiratpur	7.31
35	Sarsawan	13.39	98	Narauli	7.25
36	Meerut	13.38	99	Seohara	7.20
37	Khekra	13.37	100	Landhaura	7.16
37	Rampur	13.37	101	Karnawal	7.13
42	Hastinapur	13.26	102	Maswasi	7.10
40	Amroha	12.92	103	Kithaur	6.97
41	Titron	12.82	104	Lawar	6.95
43	Jansath	12.76	105	Loni	6.88
44	Ambehta	12.73	106	Bhojpur-Dharampur	6.82
45	Manglaur	12.67	107	Bilari	6.82
46	Laksar	12.66	108	Bachhraon	6.77
47	Parikshitgarh	12.63	109	Sirsi	6.75
48	Kharkhoda	12.54	110	Pasaunda	6.70
49	Ujhari	12.42	111	Sherkot	6.66
51	Behat	12.31	112	Sahanpur	6.64
52	Modinagar	12.29	113	Naugawan Sadat	6.44
53	Shahpur	11.93	114	Jhalu	6.40
54	Dadri	11.49	115	Jalalabad	6.29

55	Nanauta	11.49	116	Purqazi	6.27
56	Mawana	11.27	117	Phalauda	6.24
50	Garhmukteshwar	11.07	118	Mandawar	6.23
51	Bahsuma	10.97	119	Garhi Pukhta	6.22
52	Dhampur	10.93	120	Nehtaur	6.00
53	Hasanpur	10.79	121	Bisokhar	5.96
54	Daurala	10.77	122	Shahjahanpur	5.93
55	Kandhla	10.57	123	Tanda	5.45
56	Bhokarhedi	10.30	124	Kemri	5.44
57	Thakurdwara	10.07	125	Ailum	4.99
58	Patala	10.02	126	Umri Kalan	4.98
59	Joya	10.00	127	Banat	4.40
60	Milak	9.97	128	Rori	3.44
61	Sisauli	9.96	129	Razapur	3.39
62	Bahjoi	9.88	130	Behtha Hajipur	3.20
63	Doghat	9.87	131	Begumabad Budhana	2.26

**Source : Census of India,
Series 22, Part-XA Town Directory**