

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

It is certified that the dissertation entitled
'A Profile of Rural Settlements in the Flood - Plains of the
National Capital Region', submitted by Miss Kamla Seshan in fulfillment
of ^{twelve} ~~six~~ credits out of the total requirements of twenty four
credits for the degree of Master of Philosophy (M.Phil) of the
University, is her original work, and may be placed before the
examiners for evaluation.

Shangia
SUPERVISOR

G.S. Bhalla.
CHAIRMAN

Chairman,
Centre for the Study of
Regional Development,
School of Social Sciences,
Jawaharlal Nehru University
New Delhi

**A PROFILE OF RURAL SETTLEMENTS
IN THE FLOODPLAIN OF THE NATIONAL CAPITAL REGION**

**A DISSERTATION SUBMITTED TO THE
CENTRE FOR THE STUDY OF REGIONAL DEVELOPMENT**

IN PARTIAL FULFILMENT FOR THE DEGREE

OF

M. PHIL

BY

KAMALA SESHAN

JUNE 1976

ACKNOWLEDGEMENTS.

To the completion of this work I owe much to the efforts of Dr. (Mrs.) S. Nangia and Professor M. Raza to spur me on.

I can only dedicate this to my father who was very keen to see its completion but did not remain to do so.

I also own sincere thanks to all my friends for having ably assisted me.

C O N T E N T S

INTRODUCTION:

Chapter I	Review of research studies in the analysis of rural settlement profiles.	1-12
Chapter II	1. Need to study the flood plain. 2. Identification of the Region (Ganga & Yamuna Flood Plain) 3. Major Physical and Regional Characteristics of Flood Plain. 4. Research Design.	13-49
Chapter III	Demographic profile of the flood plain.	50-64
Chapter IV	Functional profile. Identification of Nodes & Regions	65-98
Chapter V	District Dist. of Social Facilities Identification of a hierarchy of settlements.	99-111
Chapter VI	Conclusions and problems to be identified for further research.	112-118

...

List of maps	Page No	Figures	Page No
2.1. Flood Plain Region of the NCR - 1/126720	23	1. Total settlements in size class in the Ganga flood plain.	
2.2. Distribution of major towns and villages.	20	2. Size and Distance, GR	
2.3 Map of study area 1/16	23	3. GR and Distance scattergram.	
2.4. Urban spheres of influence	Enclosed	4. Agr. and distance Ganga	
3.5. Population size of settlements	53	5. Manf. and distance Ganga	
3.5.1. Growth rate	61	6. Ter. and distance Ganga	
4.9.1 Nodes and Regions 1951		7. Functional categories of settlements.	
4.9.2 of workers emp- 1961 loyed in primary, secondary and tertiary sectors.	99		
5.11 Functional heirarchy of settlements.	104	8. Graph showing relationship between location quotient of industrial categories and population size.	

CHAPTER I

" (....) the scientific analysis of air into its component elements, left the atmosphere, as an experienced physical object unchanged (....) " Marx (1867).

The specific approaches to the study of the transformation of rural settlements in geography have lingered long at defining sociological processes and theories. The area studies of communities which constantly occur in researches of rural sociology and settlement studies have three main groups. The studies of entire areas of varying magnitudes, studies made within certain areas, and studies dealing with particular problems than areas themselves.

The first type of studies do not directly bear with the needs of this study but the other two groups are typified by certain approaches which are unique to them. The studies made within certain areas have always attempted to evolve a multi pronged attack on all aspects of the area as defined by R. L. Singh.

(...) " designed to bring out the regional personality of the representative regions by focussing attention on the aspects of the physico - cultural environment from rural agrarian level to the urban industrial complexity and from primary to tertiary level function (...) (R.L. Singh (C 6)".

These studies have a descriptive approach and deductions from observed phenomena. The studies are exclusively oriented to details of soil, climate, occupations, population and settlements. In an attempt to survey literature of this variety in Indian rural settlement geography instances are found as early as 1948 in the Gazetteers of British India.

The boost which this approach received with the gaining popularity of regional studies is well established by the literature dealing mainly with geographical phenomena and their spatial distribution in India. A Regional Geography of India by R.L. Singh (C 6). Rural agrarian phenomena are considered alongside the

descriptions of soil and climatic regions and the impact of one on the other is stressed.

Pattern of rural settlements, their distribution and response to natural advantages, their spread and growth are the problems which are dealt with in these studies. These studies are made of certain areas and almost always stress the descriptive aspects of the area as is seen in the studies of distribution of population in Bihar (C 3) or the rural settlements, in the Himalayan Beas Basin (C 3).

The approaches to such studies are derived from the strong dependence on the rural settlement studies evolved by F.S. Hudson, R.E. Dickinson, Eurye Jones, A.E. Smailes and A.V. Perpillou. These founders of settlement studies clearly indicated the need to thoroughly analyse the patterns and responses of human habitations to economic and natural advantages.

The second approach that is found in the study of rural communities has a common platform with rural sociology. A marked shift from the

descriptive studies of rural settlements to the social science research plan of problem studies. These studies as seen in the works of Berry (C 5) in market centres and retail distribution, Duncan and Reiss (C 2) in characteristics of urban and rural communities and Wientraub (C 0) in the interaction of societal centres and process of agrarian development, emphasise the role of rigid research methodology applied to specific problems of rural to urban transformation in specific rural communities.

In suggesting a basis for such studies of rural settlements, problems have been identified as the study of rural areas with regard to population differences between rural and urban settlements, occupational and employment pattern and effect of urbanisation with an endeavour to approximate the possible changes which would improve rural life.

These studies are based fundamentally on developing approximations of different basic characteristics of rural communities. These are mostly -

- a) the construction of the variables which indicate the problem and the identification of the constructs of the explanatory variables
- b) the construction of the premises where by the transformations of rural communities can be approximated.
- c) the construction of the chief determinant which assumes a convergent behaviour of change in every situation.

These studies can be broadly surprised as being organised on the basis of the general theme of Economic development and social change in rural communities. These are manifested in the identification of certain areas like folk communities, urban fringe villages, traditional societies, in their regional setting as in the river valleys, urban hinterlands, planning regions, metropolitan areas etc.

In these regions certain problem clusters have been identified which deal with the distribution of settlements, their internal structure, and influence on the socio cultural dimensions of caste groups, communities, occupations, land holdings, area cultivated and economic phenomena. The problems that are tackled at this level are those related to the existing structures and

socio-economic trends which influence the process of development of rural communities.

Again these problem clusters are further split up into the special ^o ~~foi~~ of interest in sub areas. The main stress in these studies is the study of rural settlements as functioning in ecological regions of flood plains, arid regions, coastal areas, or economic regions of industrial, metropolitan and urban importance under varying systems of land ownership and class structure.

It is evident that the work of Gilb/^{ert}white, (A 10,11) Kates, (A 6) Mukherjee (B 1) and Thakur (A 8) are particularly related to these specific solutions to major problems facing a region like a flood plain. The main stress in these works are the responses of human activities to overcoming the problem of flood hazard. The initial works on this problems come from the Chicago school of Geography. The proposal made by Kates (A 6) was that flood plain damages could be summarised by a series of land use maps indicating the location of various developments agricultural

and residential for a given date. A second series of maps each indicating the severity of flooding would be superimposed for the specific date and flood damage as a function of frequency of flood may be determined.

Gilbert White has proposed a series of changes that would occur in flood plains as a response to flood adjustment as

1. The growth of the urban places in the flood plain in the direction in which agriculture is not so lucrative.
2. Growth of population and diversification of activities in rural areas in the areas less as affected by flooding.
3. The control of location is largely controlled by accessibility which results in accelerated growth adjacent to major transportation entries of urban industrial areas.

The studies which are of the cost-benefit project evaluation type are indicative of the economic

problems related to maintaining and developing flood plain regions within a larger planning area. As James and Lee have reiterated that (...) flood plain fertility encourages agriculture and flatness encourage urban development and railway and highway construction. However, nature does not provide these advantages without exacting a price from those who benefit (....) (A 5). Thus the phenomena requires a status study of adaptation to the benefits of the flood plain.

O. Eckstein (A 4) has identified these needs as ^{benefits} ~~fits~~ and costs of flood protection as

being tangibly measured as agriculture
registering :-

- 1.1 shift of farming from lower to higher value crop.
- 1.2 agriculture being replaced by urban development.
- 1.3 irrigation changing the cropping pattern.
- 2.0 employment characteristics would change with assurance of flood protection by :-
 - 2.1 activities tending to move to secondary sector from primary activities.
 - 2.2 quicker transport results in speeding up the influence of the urban place on the surrounding villages diversifying activities.

In the context of such studies these methods of analysing rural settlements as an ecological problem region the study in India of Ramchandran and Thakur (A S) do indeed break new ground. The adjustment to hazard that they analysed as "(...) adjustments to flood in Easturanarang,

are of the folk or preindustrial type. They are therefore corrective not preventive " (...).

The work is in depth study of flood adjustment and perception villagers in the village which is frequently flooded by the Ganga.

The methodology of this study uses sociological techniques and tools of interview schedule and attitude inventory of flood adjustment. The outcomes of this study clearly indicate that villagers continue to settle on the flood affected areas in spite of the hazard availing the benefits supplied by the Government. Their response is more corrective than preventive of floods.

The research^e on the nature of settlement in economic and metropolitan regions and within ecological areas differ in that the former studies deal with identifying trends within the region but the latter deals with the trends with regard to the specific problem and responses of the villages in the eco-region.

Studies of similar responses to flood plain settlement is constructed by A.B. Mukherjee who

has carried out in depth studies of the Upper Ganga Yamuna Doab (B 1) and worked out the relationship between size, caste groups, occupations and spacing of villages in the region.

...

CHAPTER II

2.1 Importance of the study of population and functional profiles of rural settlements in the Yamuna & Ganga flood plain regions.

2.2 Major physical and settlement characteristics of the Yamuna & Ganga flood plain.

CHAPTER - II

(...) " for while a region may have both cultural uniformity and structural unity, methods of study may differ considerably according to emphasis on one or the other concept (...) " (Steward 1950)

2.1 Importance of the study of settlements demographic and economic profile in the Yamuna and Ganga Flood Plain regions.

This study deals mainly with the region delimited as the flood prone area of the Yamuna and Ganga which lies in the cap National Capital Region.

As has been pointed out in Chapter I any special problem region within a major planning region has to be delimited not as being a problem of a tehsil or district but of the entire region. The Town and Country Planning Plan for the development of the National Capital Region also emphasise this problem and

call of the need to constitute a separate body to investigate into the flood affected areas' development.* The flood affected area of the Yamuna and Ganga have been delimited by the Central Water and Power Department (A 1) as "the area most intensily affected, and the area affected when severe floods occur." Since the estimate of the flood damage is done mostly at the state level and in monetary terms the physical area is not definitely delimited.

The purpose of this study has been mainly to determine whether the availability of better economic and locational advantages allow for the expansion of economic activities in the region in spite of the hazard of flood.

Studies of responses to flood as a hazard and human perception to this problem had been probed into by taking one village in a flood prone area and the Ganga Yamuna Doab (A 3).

* TCPO Plan Document for the National Capital Region. 1974 (B 2).

The thesis forwarded in this study indicates how the exploitation of the natural advantage of plenty of water and fertile land has led to the substantial development, by human endeavour.

In ^{the present} this study it is proposed to analyse the profiles of population characteristics and employment of villages in the entire flood plain region of the Yamuna and Ganga within the NCR. Such an attempt is an aid to identifying the process occurring cross sectionally in this area, by which human adaptation fairly surmounts the natural hazard.

The flood plain region as such differs from the regions of the NCR in that they have been for a longtime a zone of intensive agriculture and the earliest areas to be settled in. This preference of the early settlers is fairly evident from a study of the documents relating to the history of villages in this region. *

* The settlement records for Delhi villages were consulted to reveal this information.

The spread of settlements in the areas farther away from the river had followed consequent to this early settlement with the need to find more land for agriculture. Even the suffixes to village names like "Bhangar" and "Khadar" and "Naya" and "Buzurg" old and new allurium and new and old village sites with locations close to and farther away from the river, substantiate this claim.

In more recent years with the successful control of extensive damage by flood new activities have emerged and few large villages developed. Urban places along major trunk routes like the Grand Trunk Road and routes converging at Delhi have come up and ^{diverted} ~~modified~~ the earlier river oriented location of "growing villages". These changes are particularly noticeable when investigating the population and economic profile of settlements in the Yamuna flood plain.

The Ganga flood plain too provides a similar back drop to the patterning of settlements. It was only a century ago that the flood plain

of the Ganga begun to be used by "Gujars" as pasture lands with most settlements on the higher khola ground, with the need to rehabilitate refugees, the flood prone areas were settled, on the then less densely populated flood plain areas. With the improvement in the economic condition of a few farmers a steady movement began to location which was safer, but still close to the river. This has been the explanation offered for the maintenance of high employment in agriculture close to the river and more diversified farming and shift to tertiary and household industries farther away.

The Ganga flood plain is a region served by few roads and being isolated from urban marketing influences, is an area where this phenomena is readily observable. Whereas the Yamuna flood plain settlements with their orientation to urban Delhi and major agricultural markets and industrial centres has developed a mosaic of activities. This district difference between the two regions in terms of their demographic and employment status is why the profiles of

functions and population characteristics of size and growth was suggested to be studied.

This effort is mainly to identify the variations in the two flood plains of the population distribution and growth and employment in the different industrial categories*. The differences in their spatial distribution and the profile of each village in the area enable the identification of what has been defined for the purpose of this study as the nodes and regions of a typical combination of demographic and economic traits.

The amenities available in these villages and their presence being instrumental in aiding the development of a hierarchy in settlements is a variable that is proposed in settlement studies. This view point is considerably debated due to the distortions of accepted hierarchies that result with the availability of better transport facilities and the advantages of human activities as being linked to the close

* This term is used to denote the employment as in the IX industrial categories that working population is divided into by the Census of India.

association of movement minimisation, accessibility, and prevalence of industrial and tertiary activities is seen.

Studies of the Yamuna flood plain reveal that it has developed into an area with definite functional and distribution properties of human occupation. The Ganga flood plain with a similar character however reveals a very different response in terms of functional and distributional properties of human occupation. A study of the extent of these variations and identification of the role of transport and growth of urban - industrial activities causing such variations need to be studied.

The study is essentially a preliminary work to identify the distinct variations of economic activity in a flood plain. Such an effort is necessary before further analysing whether the economic development of a flood plain is brought about more by the growth of urban areas and urban industrial activity or the efforts to develop an area in terms of agricultural

regions and industrial regions with transport connections between them.

The National Capital Region plan has adopted the corridor development plan as being suited to the future development of this region.* It has been made imperative that an orderly growth is to be achieved by planning for a larger area, which in turn would be economically interdependent. Decentralised economic activity and population distribution ensuring coordinated growth*.

To implement this scheme efforts are proposed to be directed to developing certain tehsils as agricultural zones and others as industrial urban areas so that economic interdependence is sustained. It is vital to point out that every tehsil in a predominately agricultural area is acquiring a greater diversification and requires both agricultural and industrial activities to flourish. In the absence of such facilities the areas with industrial activities act as nodes to which the surrounding hinterland caters and the inaccessible areas develop as sub-areas.

* Summary of Recommendations : TCPO on the NCR Plan.

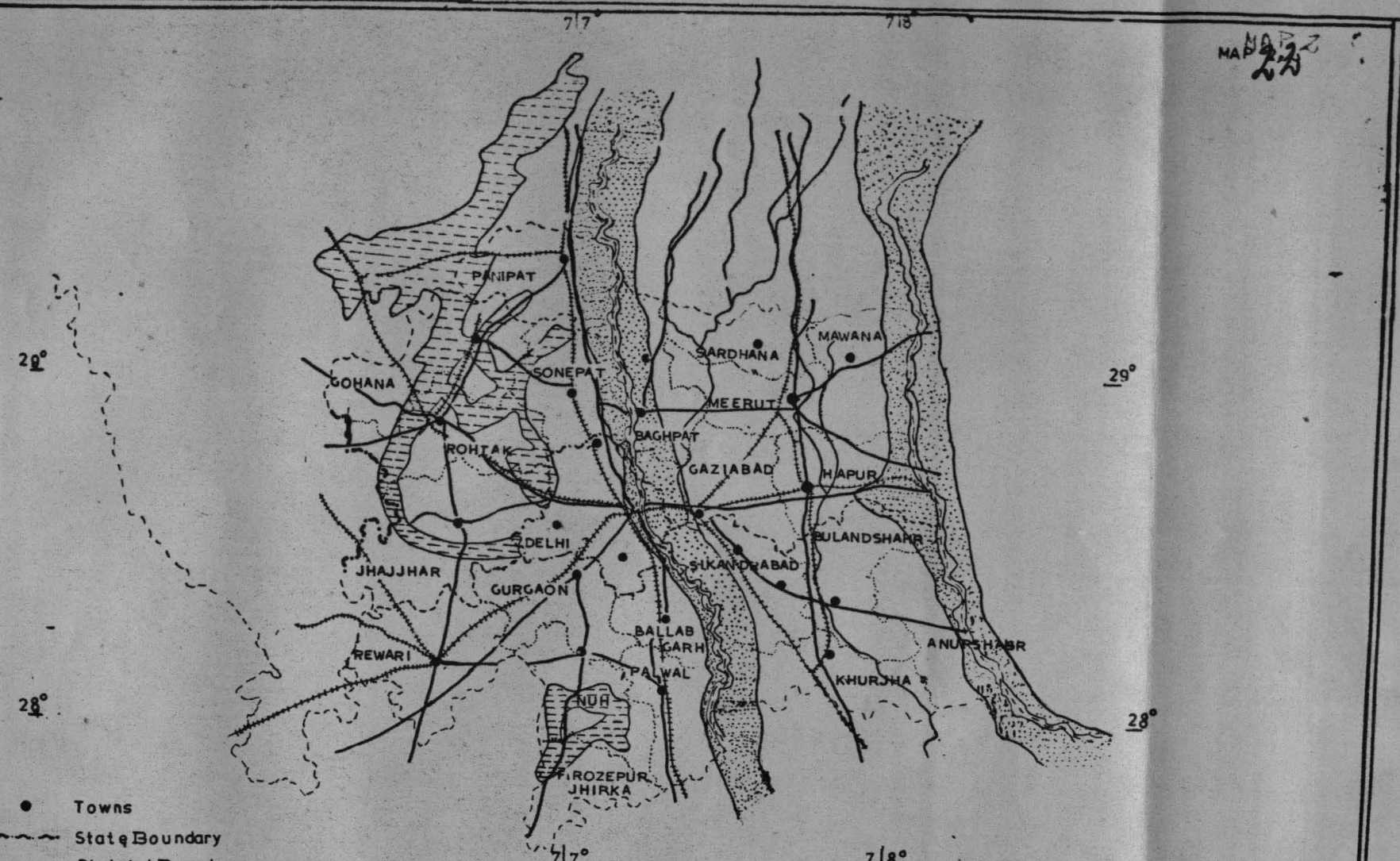
2.2 Identification of the Yamuna and Ganga Flood Plain - Major Physical and settlement distribution characteristics.

2.2.1 Major Physical characteristic of the Yamuna and Ganga flood plain

The delimitation of the flood plain area of the Ganga and Yamuna within the National Capital Region is particularly necessary to bring out the underlying uniformity of this regions vis-a-vis the National Capital Region's subregions. The town and Country Planning study has for the purposes of planning divided the National Capital Region into the Haryana subregion, the Meerut Bulandshahr subregion and the Alwar subregion. However cross cutting the Haryana Subregion and Meerut Bulandshahr are the Ganga and the Yamuna rivers flood plains.

The observation made by the High Level Committee on floods which met in 1957 is of interest. They stated that "The significance of the flood control problem in the Yamuna arises out of the

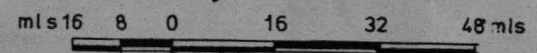
MAP 2/2



- Towns
- State Boundary
- - - District Boundary
- Tehsil Boundary
- ~ River
- ▨ Flooded Area
- ▧ Inundated Area
- Roads
- Railways

NATIONAL CAPITAL REGION

Area Affected by Flood is the Study Area



fact that the Yamuna in this reach is a boundary between two important states Punjab and Uttar Pradesh and there is the fact that the agricultural areas affected by the floods are very highly developed and hence valuable. (....) (B 5) "The danger posed to the interference due to the flood of the communication lines like the grand trunk road and the Northern Railway Bridge is identified as the major problem. The Ganga east of the Yamuna in the same area with a north south flow does not pose any serious flood problem (...)" (B 5).

Considering this assessment of the flood plains of the Yamuna and Ganga rivers in the reach within the National Capital Region it was necessary to develop criteria to delimit the same.

Flood plain of a river has been defined by Schaumn as the actual area over which at one time or another the channel has shifted. The delimitation of the flood plain in this study was undertaken by scrutinising the topographical maps of this region on the 1/63360 scale to identify old channels and delimit the

Khadar, Khola and Bangas* lands. This map reduced to the 1/126720 scale as is given in (Map 1). A similar scrutiny of the Ganga flood however revealed that no such channels were identifiable. In the north specially the Mawana tehsil an area where the Burganga joins the Ganga makes the demarcation of the flood plain as such, not possible.

Between these two major rivers, flowing into the Yamuna near Gaziabad is the Hindan which does not really form its own flood plain for flooding does not occur here. But inundation does. (Map 2). The CPWD map also identified areas around the Najafgarh drain and Nuh where due to drain overflow ~~is-cause~~ waterlogging is caused (Map 2). This region forms a separate area which has a problem related more to the proximity to Delhi and disposal of waste rather than flooding. The development of industrial activities in the Najafgarh area of Delhi further adds to the problem of disposal of waste in region.

* The Khadar lands are the areas where recent deposition of alluminium have occurred due to river flooding. The Bhangar is the highland area with older alluminium. The Khola is the highland tract between the Khadar and the Bhangar lands.

The criteria used in this study to delimit the physical extent of the flood plain is by taking into account the existence of old channels and swamps along the river and flood affected area. The area affected by flood which are delimited by the Central water and power Commission, as the flood zone of 5 miles on an average distance from the river on the either bank is included. Along the Ganga the extent considered is only the west bank for the National Capital Region is bounded on the west by this river. The presence of the embankment from Anupshahr to Debai town and the less flooding in this reach of the Ganga requires the delimitation of the Ganga flood plain mainly on the basis of area affected by flood. The Yamuna and Ganga flood plains' rural settlements and urban places are identified by taking all the settlements that are located in this belt along the Ganga west bank and either bank of the Yamuna. 445 settlements along the Yamuna and 112 settlements along the Ganga with 13 urban centres along the Yamuna and 5 urban centres along the Ganga from the settlements of the this region.

The villages form almost 20% of the total villages of the tehsils along the Yamuna and 10% of the villages of the tehsils along the Ganga. (Table - 1).

The major towns of these tehsils are located along the river at 2-4 mile distances from the Yamuna and at 1 mile distance from the Ganga (Table - 1) (Map 2). (photostat map of flood plain).

**Population and Flood Plain settlements
along the Ganga**

Table 2.1.

1961	Total population	Rural population	Urban population	Total vill- ages	Total villages in F.P.	Total population in F.P.
1) Mavana	319608	292717	26891	250	31	34354
Mavana TA			20677			
Shahjahanpur TA			6214			
2) Hapur	427975	364010	63965	295	25	49359
Hapur TA			55248			
Garhmuktesar TA			8717			
3) Bulandshahr	534571	445915	88656	386	9	18193
Bulandshahr			44163			
Bugraei			4925			
Siyana			12729			
4) Anupshahr			41380	388	42	75279
Anupshahr			10226			
Jahangirabad			17149			
Debai			14003			
5) Khurjha East	385738	338870	46868	354	<u>5</u>	22138
					112	

Contd....

**Population and Flood plain settlements
along the Yamuna**

Table 2.1.

1961	Total population	Rural population	Urban population	Total vill- ages	Total villages in F. P.	Total population in F.P.
1) Panipat					25	36426
2) Sonapat	324326	278444	45882	228	28	58889
3) Gaziabad	529705	404438	125267	310	51	179518
Gaziabad Town			63190			
4) Ballabgarh	171894	120795	59089	171	68	66129
Ballabgarh TA			8330			
Faridabad TA			50709			
5) Palwal	216139	177718	38421	187	76	105266
Palwal			27863			
6) Delhi					46	33889
7) Baghpat	489512	458251	31255	220	26	148379
Baghpat TA			8437			
Baraut TA			22818			
8) Sikandrabad	376668	333690	42978	411	67	71654
Sikandrabad TA			26290			
Dankaur TA			7995			
Dadri TA			8693			

1961	Total population	Rural population	Urban population	Total Vill- ages	Total villages in F.P.	Total population in F. P.
9) Khurjha West	385738	338870	46868	354	15	44582
Khurjha TA			41491			
Pahasu TA			5377			
10) Meerut	585097	290244	294853	211	19	43265
Meerut TA			283997			
Kankarkhera			10856			
11) Sardhana	361063	344500	16563	194	24	28654
Sardhana TA			16563			
			Total	2286	445	

The criteria used for selecting these villages was that they are located in the flood plain of the rivers, ^{and} are habitated. Another set of villages at greater than 6 miles distance was selected to see the variations in population and employment profiles of villages close to the river and in the area farther interior.

Since the villages selected for study were identified from the topographical sheets about 80 villages could not be identified in the District Census Handbook 1961. These were however not taken into account for the analysis.

The transport lines of road and rail have also been taken as another criteria for delimiting the region. On the west of the Yamuna are the Grand Trunk Road which is at 8 miles distance from the river and the Delhi Amritsar Railway line at 10-12 miles distance from the river. Between the Ganga and the Yamuna are the road and railway lines connecting Meerut, Hapur, Bulandshahr and Khurjha towns of the National Capital Region. Both these transport lines

run north to south.

Cutting across this region from west to east is a road link between Gohana to Mawana towns and a road and railway line between Rohtak across Delhi to Hapur (Map 2.3).

2.2.2 Major characteristics of settlement locations in the Flood Plain Region.

The Yamuna and Ganga Flood Plain as has been delimited and taken up for a status study of settlement profiles has distinct variations in its settlements characteristics.

This region falls into the major regions identified as the Ganga Yamuna Doab and the other streams like the Hindan and Burganga being of lesser importance. The soil-type of this region has been interpreted to sandy loam along the Ganga and clayey loam along the Yamuna. The Khadar separated from the highland Bangar by the Khola is another noticeable feature. The extent of area affected by flood is 31.5% in the Yamuna flood plain and 31% in the Ganga flood plain.

The distribution of settlements in this region though not quantified by near neighbour analysis can be broadly summarised as being affected by the existence of swamps along the river. Still the settlements concentrate along the river avoiding the marshy and low lying land. Between the Yamuna and the Burganga this feature is again obvious (Map 1). Farther away the settlements are more evenly location.

Along the Ganga flood plain the settlements are located more evenly and do not show a tendency to concentrate along the river. In Mawana tehsil around Hastinapur the presence of the swampy land drained by the Burganga does not deter the establishment of settlements which avoid the swampy areas (Map 2.1).

The delimitation of the urban spheres of influence was ascertained to identify the extent to which settlements in the two flood plains vary with distance from towns (Map 2.4). The towns in this regions have marked variations in the extent of the influence zones. (include Map of urban spheres of influence.).

- 1) Delhi Metropolitan area has an influence over all the towns in the region.
- 2) The agriculture mandi towns have a limited area of influence over the surrounding agriculture based on villages in the Yamuna flood plain.
- 3) Urban industrial based towns have a larger sphere of influence. They extend more towards other industries based towns and little towards agriculture towns. This is true only for the Yamuna flood plain.
- 4) In the Ganga flood plain the sphere of influence of towns is restricted to the short distances immediately around them. The relative isolation of this area from the remainder of National Capital Region, further accentuates this problem.

The variations in the extent of influence of the towns of the flood plains' as follows : - TABLE 2.2.

		Using the Reilly Index of Granitation.	
YAMUNA		DJK	
1.	Sonepat Baghpat	4.96	
2.	Baghpat Baraut	5.09	

3.	Baghat	Khokhra	3.19
4.	Barant	Khokhra	7.82
5.	Kankarkhera	Khokhra	14.28
6.	Meerut	Sardhana	2.33
7.	Sardhara	Baghat	15.11
8.	Sonepat	Barant	6.04
9.	Baraut	Sardhara	5.96
10.	Daurala	Sardhara	6.53
11.	Daurala	Hapur	8.34
12.	Sardhana	Hapur	9.99
13.	Kankarkhera	Daurala	6.52
14.	Meerut	Hapur	3.18
15.	Gaziabad	Meerut	14.94
16.	Fardng	Meerut	13.93
17.	Philkua	Meerut	16.93
18.	Fardnagar	Gaziabad	9.88
19.	Gaziabad	Philkua	1.73
20.	Fardnagar	Philkua	0.93
21.	Khokhra	Gaziabad	12.73
22.	Khokhra	Sardhana	21.13
23.	Gaziabad	Dadri	2.16
24.	Sikandrabad	Dadri	5.11
25.	Sikandrabad	Philkua	3.23
26.	Sikandrabad	Faridnagar	6.89
27.	Gaziabad	Ballahgarh	4.52
28.	Gaziabad	Faidabad	10.39
29.	Gaziabad	Dankaur	6.29
30.	Ballabgarh	Dankaur	7.42
31.	Ballbgarh	Sikandrabad	14.72
32.	Ballabgarh	Faridabad	3.56
33.	Dadri	Dankaur	7.83
34.	Sikandrabad	Dankaur	4.26
35.	Faridabad	Dankaur	3.69

36.	Jewar	Faridabad	13.86
37.	Palwal	Faridabad	7.47
38.	Jewar	Palwal	8.76
39.	Hodal	Palwal	13.27
40.	Hodal	Jewar	28.47
41.	Jewar	Dankaur	7.09
42.	Sikandrabad	Jewar	5.71
43.	Hodal	Gaziabad	41.22
44.			

GANGA

1.	Garmuktesar	Siyana	5.47
2.	Siyana	Anupshahr	5.19
3.	Anupshahr	Jahangirabad	5.64
4.	Siyana	Jahangerabad	8.05
5.	Anupshahr	Debai	4.85
6.	Jahangirabad	Debai	7.12

This identification of rural settlement distribution and influence zone of towns enables the study of profile of rural settlements in the flood plain as

- 1) The profile of settlements in an area where urban industrial activities and transport lines affecting the functional profile and
- 2) The profile of settlements in an area where urban places are few and the employment in

settlements is mainly in agriculture.

The areas which fall into these two areas are the urban industries as major activity - the region of Gaziabad, Ballabgarh, Sonapat and Delhi. The agriculture based regions and Palwal along the Yamuna Flood Plain. The entire area from Mawana to Khurjha east along the Ganga is identified as having agriculture and household industries as the main activities of the population.

- 2.3 **Research Design**
- 2.3.1 **Map Base**
- 2.3.2 **Data Base**
- 2.3.3 **Urban Spheres of influence**
- 2.3.4 **Location quotient of employment**
Percentage of employment
- 2.3.5 **Population growth 1951-61**
Population size of villages
- 2.3.6 **Amenity Index**
- 2.3.7 **Hypotheses of the study**
- 2.3.8 **Procedure adopted to identify the**
relationship between employment and
distance from the river, Nodes and
regions of dominant economic activity,
and the hierarchy of settlements based
on functions.

2.3 **The study of the demographic and employment profile of rural settlements in the Ganga and Yamuna Flood Plain of the National Capital Region required the adoption of the following scheme.**

2.3.1 **Map Base. - The area of study was delimited by the criteria defined in 2.2 and the 1/63360 Survey of India maps compiled to**

delimit the regions. The maps used to cover the regions are given in Appendix 1.

The 1/63360 scale maps were traced locating all the settlements which lie in the 6 mile band along the Yamuna. A similar exercise was undertaken taking only the west bank of the Ganga.

The towns in the region were also located as also the main rail and road linkages. The 1/63360 map was reduced to 1/126720 to make it easier to work on. (Map 1.1).

A map of the flood affected area was compiled from the Central Public Works Department map of Haryana & U.P. in the scale 1:16 mls. (Map 1.2).

2.3.2 Data Base. - The data for the settlements identified in the flood plain were compiled from the District Census Abstracts 1961 of Delhi, Haryana, U.P. of the 15 tehsils that constitute this region.

This data was for 547 villages on the Yamuna

flood plain and 9 towns and also 133 settlements on the Ganga flood plain with 4 towns.

The population size of these villages was collected for 1951 and 1961 and the amenities, area, total workers employed in IX industrial categories for ¹⁹⁵¹⁻1961 ~~years~~.

Data regarding the damage due to floods in Rupee value to persons, Cattle and Property at the state level were compiled from the Central Water and Power Department flood Wing at State level.

2.3.3 Urban spheres of influence - The statistical cartographic methods adopted to see the relationship between the profiles of the demographic structure and employment pattern were as follows. Urban spheres of influence were delimited using the Reilly formula of ~~regal~~ ^{regal} gravitation *.

This method was used to delimit the urban influence zone of the towns in this region.

*Everson J.A. & B.P. Fitzgerald
Settlement Patterns : Longman.

The influence zones of towns to the nearest town of higher or lower size class were drawn up by the formula

$$d_{jk} = \frac{d_{ij}}{1 + \frac{p_i}{p_j}}$$

where

i = Centre 1 J. Centre 2

p_i = Population of centre 1

p_j = population of centre 2.

This method has several limitations being based on a law from physics that the interaction between two bodies is proportional to the products of their mass. The assumption of this method is that the centre has a service function, however if industrial based, then other variables like employment in industries, or number of industrial establishments would have to be used.

Further variations in population density within the sphere of influence, lines of communication, and alternative centres in between, may distort the area of urban influence of one town. In spite of which the gravity model provides an ideal

measure for delimiting urban fields in small areas.

2.3.4 Location Quotient of Industrial workers in the region : - The variation in the employment in the different sectors was studied using both catographic and statistical methods. The workers employed in agriculture, household industries and manufacturing, tertiary and other services as a percentage to total workers was calculated for each village.

The employment location quotient of workers as cultivators and agricultural labourers, household industries, manufacturing, construction, trade and transport and other services was calculated as

$$LQX = \frac{\frac{\text{Total workers in X in the village}}{\text{Total workers in the village}}}{\frac{\text{Total workers in X in the region}}{\text{Total workers in the region}}}$$

These location quotients having an advantage over the simple percentage in that the employment characteristic in one industrial category is known vis-a-vis the entire region. This

facilitates the identification of regions which have a "surplus" employment in one industrial category than another.

2.3.5 Population growth - The variables taken to study the demographic profile of the region are population size of the villages 1961 and 1951*. The growth rate was calculated as percentage increase during 1951-61 to total population of 1951. This method did not give the necessary indication as to whether the absolute increase was of a lesser range than a greater increase. The absolute increase figures were used to clarify this position.

The population percentage increase and the percentage employed in different industrial categories were plotted for every village in the flood plain and isolines interpolated (Maps 5-8). This method was particularly suited, for the change was gradual in the variables taken, and not patchy or concentrated in small clusters in the study area. The distance from

* The size classes of villages has been taken to be as less than 200, 200-499, 500-999, 1000-1999, 2000-4999, 5000-9999, 10,000 + Class VI - I towns.

the river and decrease of agricultural employment being one such example.

The contour values were interpolated by plotting the value on a scalogram and by observing the breaks in the data. The 10% interval was identified as the best value for the variables.

2.3.6 The amenities available in the villages are listed by the Census of India in the District Census Handbook. The amenities listed were counted and the number of settlements in the region found as a ratio to them calculated as

$$\frac{\text{Total number of X amenity in the region}}{\text{Total settlements in the region.}}$$

this was taken to be the weightage to x amenity. For every village the weightage was added for all the amenities to find the amenity level of that village. The weightages are as follows :

Hospital	52	Rural Health Clinic	47
Maternity & child welfare clinic	43	Dispensary	26

High school	13	Middle school	10
Medical Practitioner	5	Post Office & P&T	4
Primary school	3		

2.3.9 The percentage employed in each industrial category of every village was plotted and the isolines interpolated using the derived 10% isoline interval.

In order to see the relationship between distance from the river and employment in the industrial categories the correlation coefficient by the Pearson Product moment correlation was calculated as

$$r = \frac{\frac{\sum xy}{n} - (\bar{x})(\bar{y})}{\sqrt{\left(\frac{\sum x^2}{n} - (\bar{x})^2\right)\left(\frac{\sum y^2}{n} - (\bar{y})^2\right)}}$$

and a simple linear regression for the same calculated as

$$y = mx + c$$

where

$$m = \frac{\sum xy - (\sum x)(\sum y)/N}{\sum x^2 - (\sum x)^2/n}$$

and $c = \bar{y} - m\bar{x}$.

* Toyne, P.S. Newby, P.T., Techniques in Human Geography Macmillan.

The coefficients and regression equations of the two variables of distance and employment in manufacturing and tertiary are given in Chapters II and III. These values tested for significance by the T test with $n-2$ degrees of freedom.

A similar exercise was done ^{for} to see the relationship between population increase and distance from the river. The Ganga flood plain was treated separately from the Yamuna Flood Plain Region.

The three maps of percentage employed in different industrial categories ^{1951/1961} were superimposed to identify the nodes and regions where a particular sector dominated. The location quotients were similarly plotted with the villages having a greater than 0.850 in a sector as being dominately a village with specialization in that sector.

It is an accepted fact that a flood plain presents a homogeneous region for population and settlement with similar problems of land utilization.

The process of concentration of population and orientation of activities avail the most optimal location with regard to protection from flood and easy accessibility. The consequences of such an influence manifest themselves in a specific hierarchical and interrelated manner along the flood plain.

Therefore there is an intimate relationship between location of rural settlements and their activities in a similar ecological environment.

The earlier two propositions are reflective of the decision taken in the initial settling of dwellers in the flood plain. Various theories of settlement location (Haggett, Bunge, Gunawardena) have proved that agglomeration, resource localization and transport links impose a new pattern of settlement location, interlinks and economic profile.

If such a process is operative then it is evident

that the present location and activities in rural settlements are represented by

- 1) cores and peripheries where the economic profile of settlements increases in non farm activities or declines away from the agglomeration and
- 2) the concentration and dispersal of population together with percentage increase of population in villages are reflective of the demographic profile.

The hazard of location of settlements in the flood plain and relative attraction of population to villages near agglomerations diversifying their activities are to be assumed.

In such a situation the areas closer to the river would foster more agricultural employment, smaller concentrations of population and greater dispersal in location.

Farther away from the river greater security, better road rail links and urban agglomerations, larger population concentrations occur. Non

agricultural employment within the village, or in the case of settlements near towns, commuter employment in towns increases. More settlements occur infilling the areas between larger settlements.

Such a proposition entails another assumption ^{un} that ~~less~~ settlements operate with the economic milieu of a region they decline or stagnate. Closer to the river would be the lesser transport facilities, small agriculture based villages faced with a problem of reducing flood damage, face serious disaster and have little diversification of activities.

It is the purpose of this study to identify the extent of transformation of rural settlements in a flood plain region which occurs close to and further away from the river.

The idea to be stressed is that until conscious efforts to provide transport facilities and links to other regions of the national capital region are made, the flood plain area would always pose a problem. Merely promoting measures

for flood protection do not allow rural
settlement dwellers to grow and diversify
their activities.

..

TABLE - 7

**YAMUNA SIZE-WISE TOTAL VILLAGES
AND POPULATION**

....

	23	200	500	1000	2000	5000		
		499	999	1999	4999	9999	10000	
Panipat	23	2	3	1	11	6	-	-
		305	920	991	14885	17457	-	-
Sonepat	28	-	2	4	10	11	1	-
			801	3096	14096	32833	6479	-
Delhi	46	6	17	16	3	4	-	-
		511	6402	12125	4000	10890	-	-
Ballabgarh	70	11	21	21	10	6	-	-
		1044	6403	14883	16796	14369	-	-
Palwal	75	5	14	22	18	18	-	-
		592	5153	15707	26648	561605	-	-
Baghpat	28	-	-	2	6	12	7	0 (2)
				676	8861	37765	49349	38481
Chasiabad	52	2	2	10	17	17	3	1
		162	981	8277	25453	847536	18900	63190
Sikandrabad	68	8	20	20	10	9	1	-
		4566	7006	14447	13215	24783	7995	-
Khuraja	20	-	6	6	2	5	1	-
		2189	4244	2298	13404	9909		
		-	2189	4244	2298	13404	9909	-
Meerut	25	-	-	4	7	12	2	-
				95357	11576	30790	11664	-
Sardhana	24	-	-	4	-	5	48	-
	24	-	1	-	5	12	6	-
			426	-	6312	33725	42318	-
		34	102	90	99	110	21	3

...

CHAPTER - III

- 3.0.0 Demographic Profile of the Yamuna Ganga Flood Plain.
- 3.1.1 Yamuna Flood Plain : Distribution of population
- 3.1.2 Ganga Flood Plain : Distribution of Population
- 3.2.1 Yamuna Flood Plain : Growth rate
- 3.2.2 Ganga Flood Plain : GrowthRate.
- 3.3 Summary of conclusion of pattern of population distribution and growth rates in the Yamuna Flood Plain and Ganga Flood Plains.

CHAPTER - III

(...) " Climate, fertility of soil and so on, all the natural conditions operate in human history as functions of social regime, not vice versa " (...) Coletti.

Demographic Profile of the Yamuna Ganga
Flood Plain.

The demographic profile of the flood plain region is analysed chiefly to distinguish the settlement size and growth rate for 1951-61. In this analysis the size of settlement is used as a variable which represents the extent to which the flood plain supports the rural population of the region. Such a distinction is necessary as it is supposed that the larger sized settlements are located at the distance from the river where settled agriculture can be carried on and small settlements dependent on both agriculture with household industries flourish near the river. The larger size village though located further inland are the villages where employment in tertiary services

are higher and act as centres on which the surrounding centres are dependent.

The population characteristic of the settlements in the two flood plains are studied in terms of population distribution and growth rate pattern.

The distribution of villages in the different size classes of each tehsil is as follows in 1961

Table 2.3

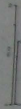
	10000	5000- 9999	2000 4999	1000 1999	500 999	499 200	200
Panipat	-	-	5	13	-	5	
Sonepat	-	1	11	11	4	1	
Delhi	-	-	5	3	8	30	
Ballabgarh	-	1	7	10	21	39	
Palwal	-	-	16	18	22	19	
Baghpat	3	7	11	6	1	-	
Gaziabad	1	6	18	15	13	1	
Sikandrabad	-	1	10	9	16	31	
Meerut	-	2	12	7	3	1	
Sardhana	1	7	11	4	-	1	

Total

The distribution by size of the settlements shows

NATIONAL CAPITAL REGION

FLOOD AFFECTED AREA IN THE
GANDAK AND YAMUNA DRAINAGE
BASINS



DISTRIBUTION OF VILLAGES ACCORDING
TO POPULATION SIZE IN 1961

- 10000+
- 5000-9999
- 2000-4999
- 1000-1999
- 500-999
- 200-499
- 100



the greater number of settlements in two size classes the 200 - 499 and the 2000 - 4999. The very small ^{number of} ^{in the} villages ~~are~~ 5000 - 9999. It is the towns that from the 10000 + settlements.

This distribution over the entire Yamuna flood plain can be studied from the map of population size (Map). As is obvious the settlements closer to the river with a higher probability of flooding support villages with smaller population than the villages on the Khola and Bangar* lands. The occurrence of large and medium settlements of the 2000 - 4999 and 1000 - 1999 coincide with the 4th mile zone from the Yamuna.

Another area where small settlements of the 200 - 499 size class are numerous is in the area flanked by the Hindan and Jumana rivers. The area as is obvious from the topographical sheets are swampy and frequently water logged. The lack of good agricultural land and remoteness from the major towns makes this area unattractive for settlement.

Farther south in the Gaziabad and Sikandrabad tehsils the settlements are mostly of the

* See earlier page

size between 1000 - 1999 and 2000 + persons, not only the security from flood, but also the proximity to urban industrial nodes like Gaziabad accounts for the feature.

In the Palwal and Khurja tehsils again the 500 - 999 size class is close to the river and the larger villages are closer to the urban places like Hodal and Jewar.

The urban settlements in this region are clearly oriented to the transport routes in the tehsils south of Delhi. In Baghpat, Sardhana, Sikandrabad and Khurja the towns are smaller in population size and are really semi-urban in character. A study of the percentage employed in tertiary services and distance from urban Delhi to identify the urban orientation of towns in this region done earlier revealed that the towns here have a low urban population to total population and lower employment in non agricultural activities.

Table - 3.4

Tehsils	UP/TP 1961	% non agr. 1961 emp.	R1	R2	R1-R2
Panipat	23.7	15.78	5	6	-1
Sonepat	14.14	12.41	6	8	-2
Delhi	-	-	-	-	-
Ballabgarh	28.19	11.08	4	9	-5
Palwal	12.89	14.19	7	7	0
Baghpat	43.47	28.23	2	1	1
Gaziabad	31.47	25.37	3	2	1
Sikandrabad	1.97	18.59	9	4	5
Khurja	10.75	17.75	8	5	3
Meerut	54.21	4.63	1	10	-9
Sardhana	4.58	25.19	10	3	7

The rank difference of higher non agricultural tehsils than urban population are only in Panipat, Sonepat, Ballabgarh and Meerut. The tehsils where urban population is high and non agriculture low, conversely agriculture employment is high in Sikandrabad, Khurja and Sardhana tehsils.

3.1.2 Population size of settlements in the Ganga Flood Plain : The population distribution of settlements in the Ganga Flood Plain is again

analysed using Map - 5. The size of settlements is small till the 2nd mile from the river and till the 5th mile are all alone 1200 persons on an average. These villages which have populations of 5000 + are all located along major road routes in the area.

This enables the recognition that the greatest number of settlements in the Ganga flood plain are in the size class 1000 - 1999. The urban places do not stand out as important population clusters for most of them are class IV & V towns.

The impact of distance on size of settlement is particularly illustrated by

Table - 2.6

<u>Distance in miles from Ganga</u>	<u>Average population size of villages.</u>
0-1	756
1-2	987
2	1756
3	1951
4	1317
5	1481

There is a tendency for larger sized settlements

to be located farther away from the river.

The 6th mile from the river is the distance upto which population size of settlements increases to 2000.

Close to the river, contrary to the overall pattern, large settlements are found. Their location being along the roads radiating from the towns to the rest of region. Other settlements are close to the embankment and with protection from flood they attract many settlers. The villages within the embankment are however not as large in size.

The tehsil wise distribution of settlements along the Ganga reveal that in the Mawana and northern Hapur tehsil size of settlements are small. The unfavourable terrain and preference of richer farmers to settle in the ^{khadar} ~~Bajar~~ & Khola areas, result in reduction of the size of settlements.

In the Anupshahr and Khurja tehsils it is the proximity to embanked portion of river, or large town that affects size. The larger villages in these areas are more oriented to urban places for they are mainly agricultural in economy. Tertiary

services too develop here and these villages become dormitory to the urban place.

The following Table - 5 gives the extent of urban orientation in this area.

Table - 5 ^{3.4b}

Tehsils	UP/TP	% in non agr.	R1	R2	R1-R2
Mawana	6.46	5.69	4	3	1
Hapur	6.81	22.85	3	1	2
Bulandshahr	13.04	0.66	1	4	-5
Annupshahr	9.39	7.71	2	2	0

Most of the towns have a higher proportion in agriculture and tertiary activities thus making the towns supported by the villages and not create an atmosphere where town and country ^{Gan} can develop together.

3.2.1 Population Growth rate in the Yamuna & Ganga

Flood Plain : The percentage increase or decrease in population size of rural settlements are an indicator of changing economic development in them. A lack of opportunities for the working population

effect a decline in population. A simple exercise of plotting the growth rates of villages in the study area reveals definite patterns which can be analysed when considering the following factors :

1. the distance from the river
2. the proximity to rail and road links
3. the proximity to urban industrial areas
4. the employment in non agricultural activities.

Table 6 gives the number of villages in 10% groups of percentage increase and decrease. The frequency of occurrence within each group reveals that in both the flood plains the largest number of settlements registered a 20% increase.

10% increase since 1951 are registered in 120 villages and these form a band along the river (Map 6 (Fig 1a)).

Very high growth rates of 40+ are more isolated in occurrence being oriented more to urban places like Gaziabad, Meerut, Modinagar, Ballabgarh and Hodal.

TABLE - 6

**NUMBER OF VILLAGE ACCORDING TO
PERCENTAGE INCREASE 1951-1961.**

.....

Name of Tehsils	TV	-50	0	+10	20	30	40	50	60	70 +
<u>YAMUNA FLOOD PLAIN</u>										
Panipat	23	1	4	5	4	2	2	0	1	5
Sonepat	28	0	3	6	6	5	2	1	2	1
Delhi	46	2	2	4	11	5	10	5	5	2
Ballabgarh	70	3	1	5	20	11	17	5	4	4
Palwal	75	1	0	5	26	16	11	7	2	5
Baghpat	28	2	8	13	4	0	0	0	0	1
Gaziabad	52	3	7	17	14	6	2	1	1	1
Sikandrabad	68	3	4	12	17	5	9	4	6	8
Khurjha W	20	1	1	1	5	6	2	4	0	0
Meerut	25	2	1	5	6	2	4	0	0	0
Sardhana	24	0	4	10	6	1	0	2	0	1
<u>GANGA FLOOD PLAIN</u>										
Mawana	31	8	4	5	5	1	8	-	-	-
Hapur	28	2	5	8	9	3	0	-	-	-
Annupshahr	60	6	9	27	16	2	1	-	-	-
Bulandshahr	9	3	0	1	4	0	0	-	-	-
Khurjha E	5	0	2	2	0	0	1	-	-	-
SE										
TV -		37	55	120	153	65	69	29	21	28
YEP -		18	35	77	119	59	59	29	21	28
GEP -		19	20	43	34	6	10	-	-	-

...

The tehsils of Ballabgarh and Palwal and Delhi Union territory are the areas where a larger number of villages register a sustained high growth rate of 20% to 70%. The villages in Baghat, Gaziabad and Sikandrabad register an increase of 10-20% with a few villages ^{along} on routes near towns increasing by 60-80%.

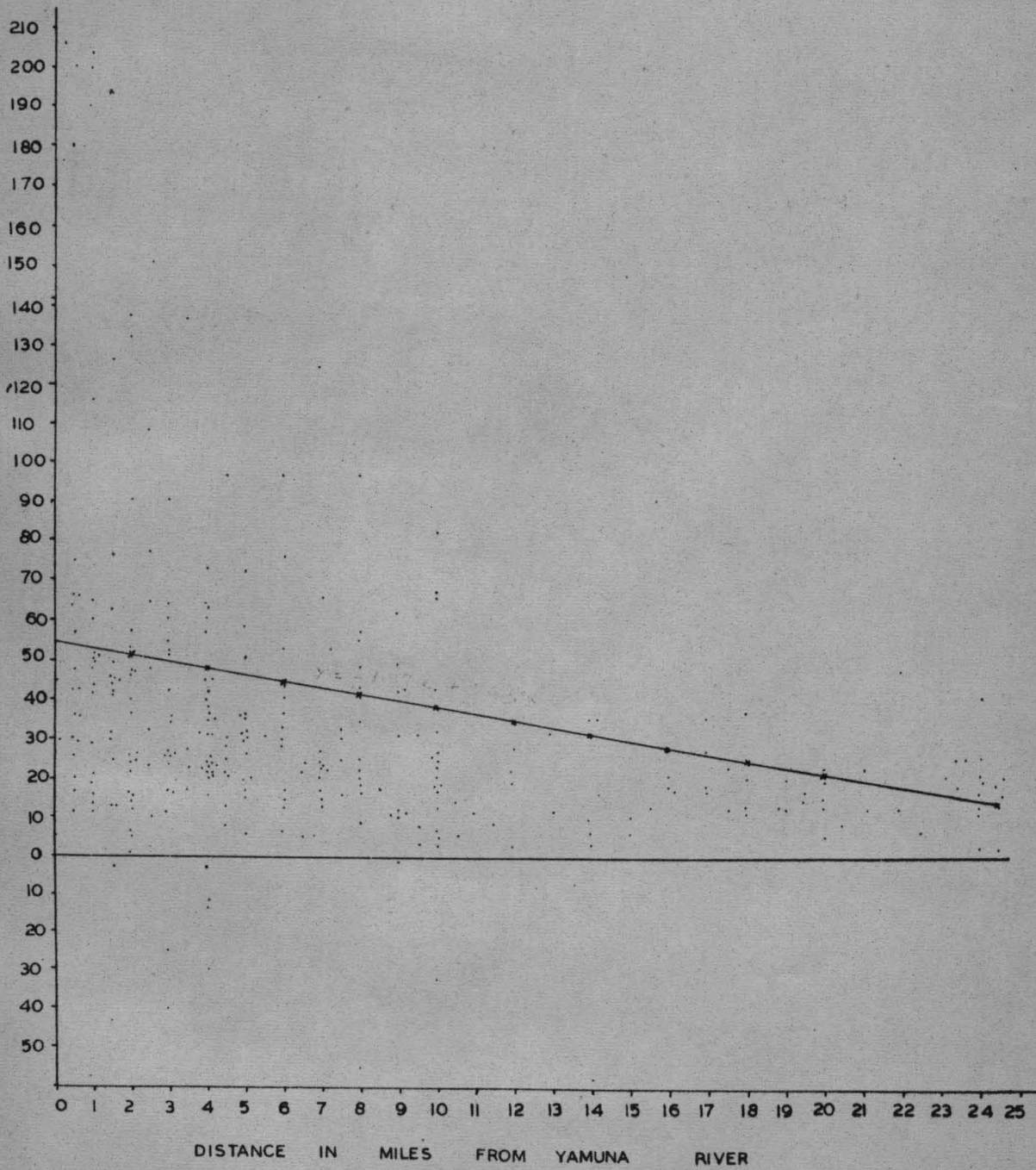
The Ganga flood plain reveals a higher growth rate near the river of 20% with an increase to 30% in Hapur and Anupshahr tehsils. (Table 4.5). The highest growth rates are found in only 16 settlements and almost 76 settlements register 20-40% increase and 19 settlements have declined.

Decline of population are particularly noticeable in the tehsils of Mawana and Anupshahr. Hapur tehsil shows a percentage increase of 20% and all the settlements are of the 2000 - 4999 size class.

In both the flood plains the size wise absolute increase reveals that larger population and availability of employment opportunities increases size of population. Though natural increase of every village cannot be calculated, the phenomena

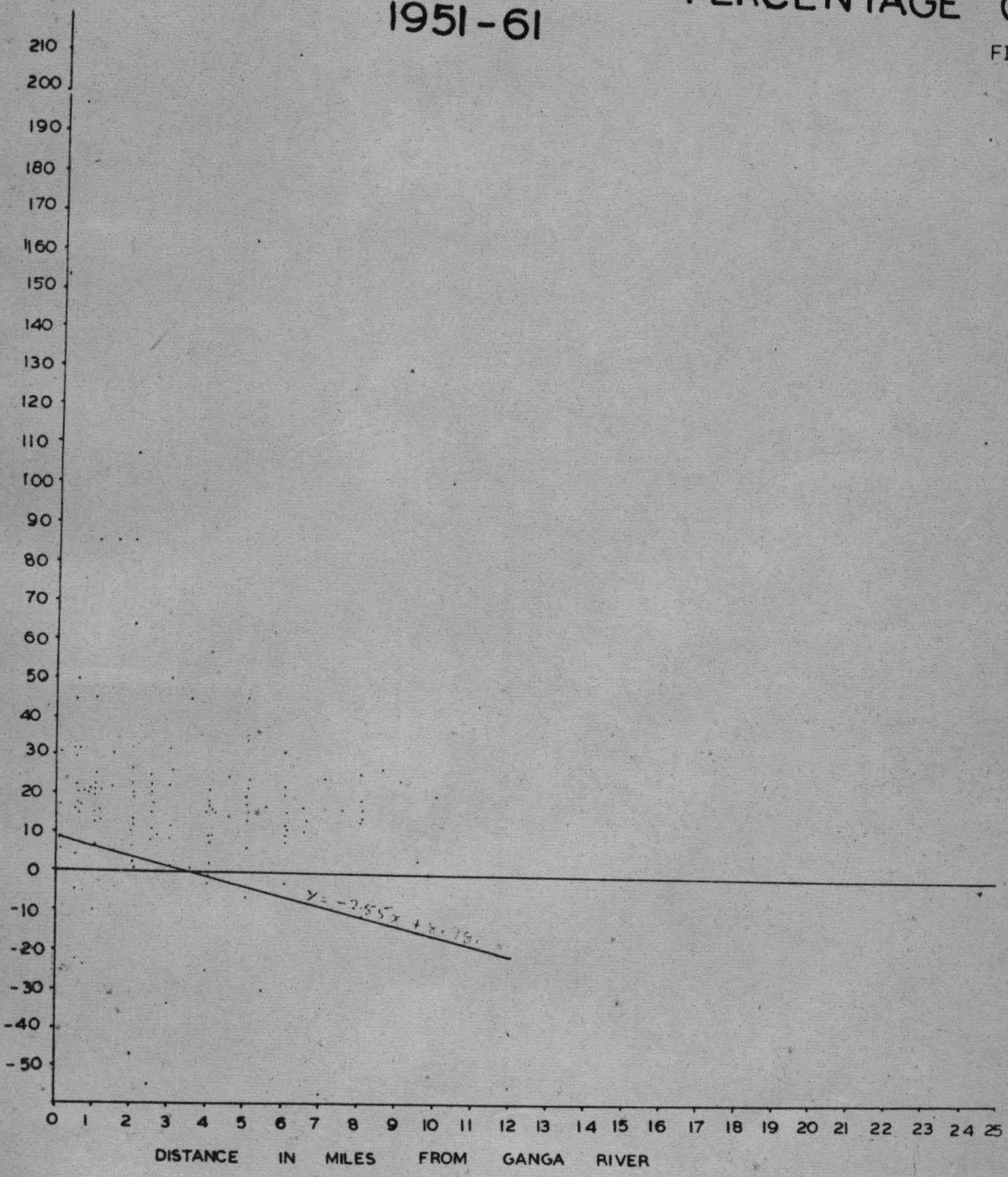
GROWTH RATE HIGHER NEAR THE RIVER

FIG MAP 3.



DISTANCE FROM RIVER & PERCENTAGE CHANGE 1951-61

FIG 3B



that large villages far away from large towns do not show a significant increase, can be used to test the hypotheses. Figure 2a, and b reveal this relation between size of settlement growth rate and distance from the river.

In the region as a whole of the Yamuna flood plain the settlements in the 2000 - 4999 size show the highest average absolute increase. The small settlements of less than 200 to 500 size class show a small increase on an average. Further the settlements with high absolute increase of the larger size class are in the tehsils of Sonapat, Delhi Union territory, Ballabgarh, Sardhana and Khurja. This position is clearly related to the availability of better employment facilities in these tehsils.

In the Ganga Flood Plain the higher absolute increase are close to the river and mostly in Hapur and Mawana tehsils. The increase of settlements in the 2000 - 4999 size class is higher than in the 1000 - 1999 size class.

The spatial pattern of growth rate is clearly higher close to the river than farther away

(Fig 3A, 3B). The ^{Pearson} ~~person~~ product moment correlation for the two Flood Plains of growth rate and distance from the river are -

	Co-efficient of correlation -----	Simple Linear Regression -----
Yamuna Flood Plain	- 0.233	$Y = -1.67x + 54.58$
Ganga Flood Plain	- 0.155	$Y = - 2.55x + 8.98$

both at 0.10 level of significance.

In both the regions the villages above the average are plotted and the fact that villages of 1000 - 1999 size class register the higher percentage increase close to the river is revealed.

The 4th and 6th mile from the river have most of the larger sized settlements that register a growth rate of 20% - 40%. The increase of size of settlement with distance does not register a parallel increase in growth rate. Here again the growth rates of settlements in the size class 1000 - 1999 near the river being higher is noticed.

This analysis of the growth rates and population distribution in the two flood plains reveals

the following trends.

- 1) In both the regions it is the settlements of the 1000- 4000 size class that registers a higher growth rate than the 5000+ villages.
- 2) The average growth rate does not exceed 20% in the region and has a tendency to increase close to the river as also near large towns.
- 3) In the Ganga flood plain the presence of an embankment offers a very good reason for settlements to increase in size. In the Yamuna flood plain however proximity to transport routes results in higher population increase.
- 4) On either side of the Yamuna the distribution of population and growth rate pattern differ. The Haryana region has larger settlements with a distinct hierarchy of medium and small sized settlements. However the eastern portion of Meerut, Bulandshahr districts have medium and larger sized settlements in certain areas.
- 5) The large size of settlements in the tehsils of the north have a higher employment in tertiary services. The 1000 -1999 sized but growing villages in the tehsils of Gaziabad and Ballabgarh show a higher employment in manufacturing.
- 6) Even the small settlements along the Ganga have

about 15-20% employment in household industries.
Employment in tertiary and other services
increase in large villages close to towns.

..

CHAPTER - IV

- 4.1 Comparison of employment in agriculture in the Yamuna and Ganga Flood Plains.
- 4.2 Industrial Employment structure in the Yamuna and Ganga Flood Plains.
- 4.3 Identification of areas of concentration in tertiary activities in the Yamuna and Ganga Flood Plains.
- 4.4 Changes in the pattern of employment in primary secondary and tertiary sector employment of total workers 1951 to 1961.

CHAPTER - IV

(...)" Primary causes of transformation which society undergoes are the changes in the economic sphere" (...)
Lazzer 1950.

..

The census industrial categories of workers as agricultural workers and cultivators have been taken together to represent the employment in the primary sector of this region. It is proposed that in rural areas predominant employment is in agriculture and a decline in employment in agriculture is supported by proximity to towns in location of villages.

In the study region the percentage employed in primary activities to total workers shows a distinct difference in pattern in the two flood plains.

4.1 The agricultural employment in the Yamuna Flood Plain.

In a detailed study of Map 7, isolines showing percentage to total workers employed in primary

sector three distinct trends are noticed.

In the north is a region comprised of the tehsils of Baghpat, Sardhana, Merrut and in the south the tehsils of Sikandrabad, Palwal and Khurja where the 60% isoline extends to a maximum of 10 miles in the north and 8 miles in the south, east of the Yamuna. On the west bank of the Yamuna the 3 mile distance from the river registers a rapid decline of percentages from 80% to 50%. The Alipur block of Delhi Union Territory shows a similar decline in less than 2 miles from the river.

In Palwal and Southern Ballabgarh tehsils the 80% isoline is continuous along the 2 mile band near the river declining to 60% at 8 miles. Between the 4th and 8th mile are pockets of 90% employment in agriculture.

The increase in non agricultural employment with distance from the river tehsils of Gaziabad and northern Sikandrabad is evident from the delimitation of the 60% isoline in the west at the 8th mile from the river and the 40% isoline at 13th mile from the river in eastern Baghpat and Meerut

tehsils. Farther south around Ghaziabad only 30% employment in agriculture is found.

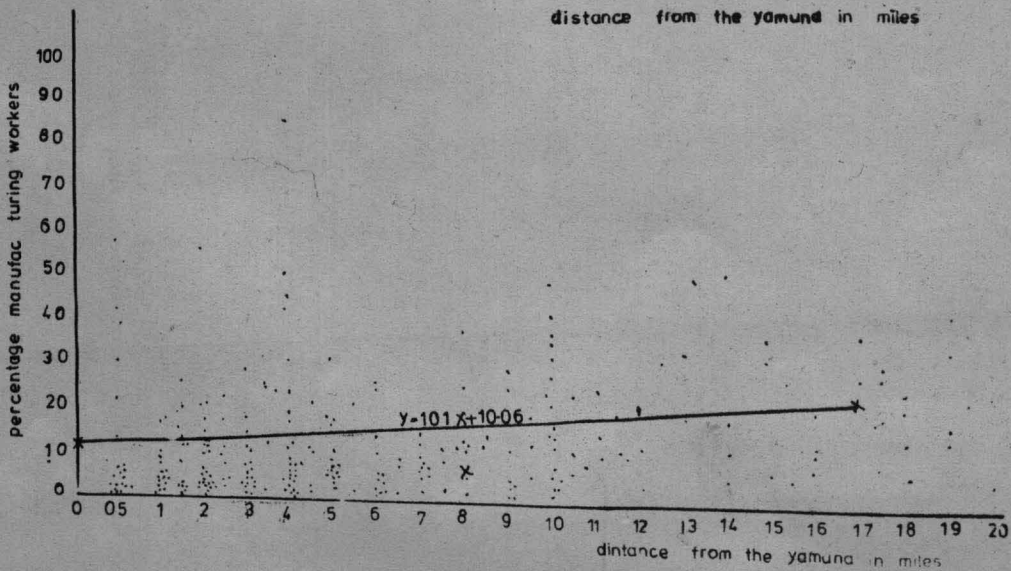
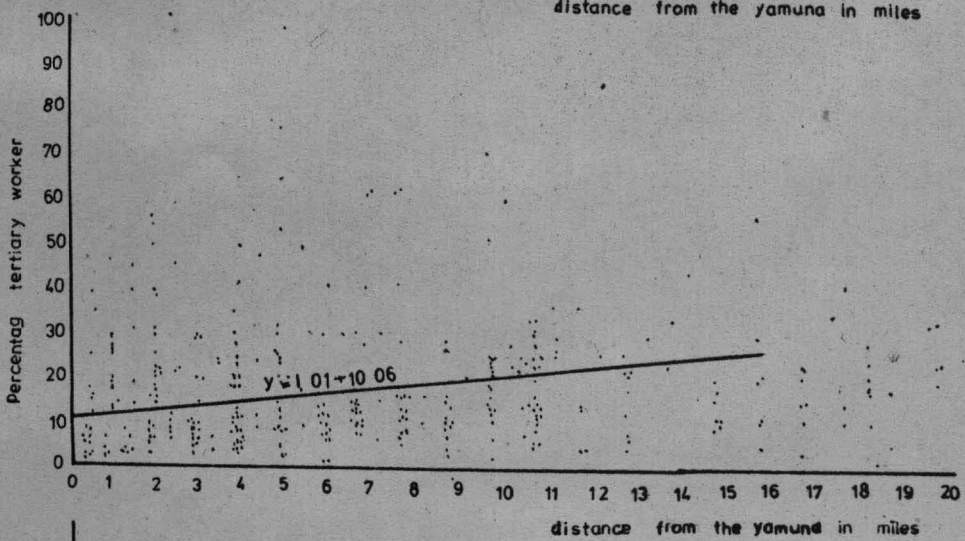
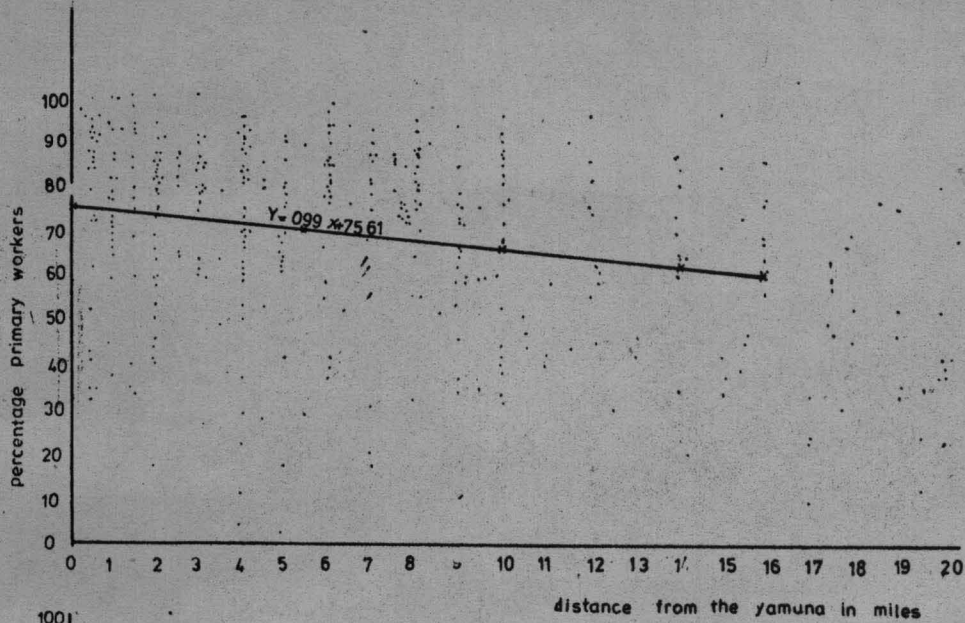
In Sikandrabad tehsil except for the area along the railway line from Dadri to Sikandrabad where 80% employment is registered at 2 - 3 miles from the river, there is a decline in agriculture employment from 80 - 60% in villages at 4 - 6 miles from the river.

The next stage of the analysis was to relate the employment in agriculture with the size class of villages. The hypothesis that is maintained is that the larger sized settlements would probably have lesser employment in agriculture for new activities to support the village economy would develop when proximity to a town or mandt village facilities exist.

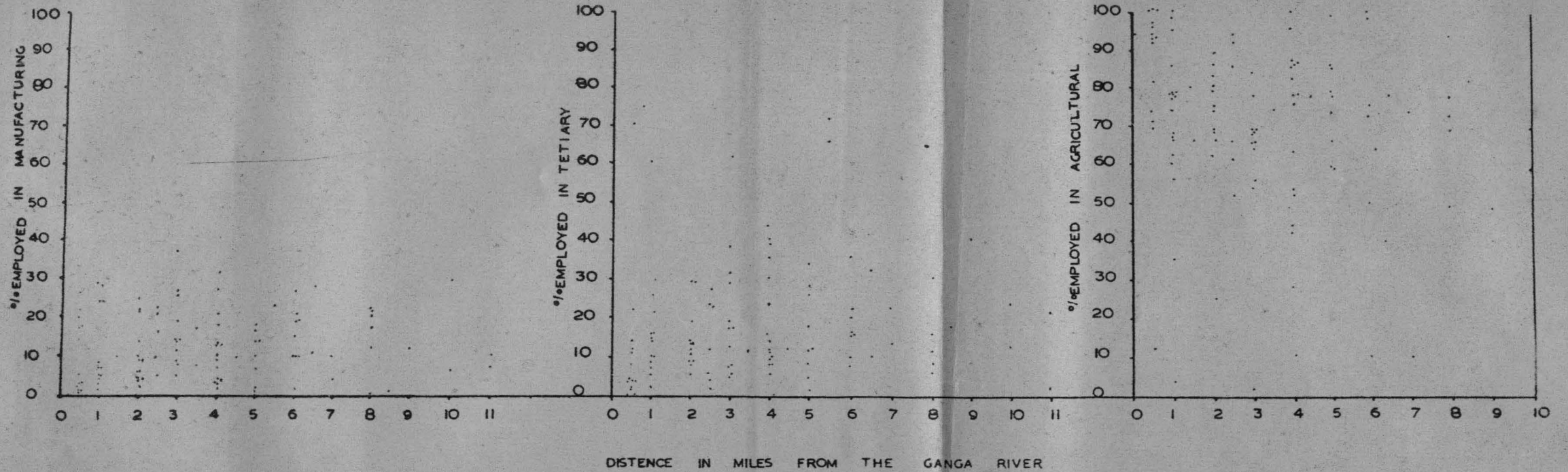
In the region as has been stated earlier the larger sized settlements are more numerous in the north specially around Baghpat and Baraut towns. In the tract between the Hindan and the Yamuna in tehsil Sardhana villages are of the size class 2000 - 4999. In these villages the employment

SCATTERGRAM SHOWING RELATIONSHIP BETWEEN OCCUPATIONS AND DISTANCE FROM THE YAMUNA

FIG. 161



SCATTERGRAM SHOWING EMPLOYMENT OCCUPATION & DISTANCE FROM THE GANGA



in agriculture is 50 - 80% near the river in Baghpat tehsil and 30 - 40% in the villages of Sardhana tehsil.

In the southern tehsils of Sikandrabad, Ballabgarh and Palwal the villages have an average size of 500 - 999 near the river and 1000 - 1999 at 1 - 2 mile distance. Here the villages of 500 - 999 size class have 80% in agriculture. The larger sized villages of 2000 - 4999 at 3 miles from the river have 40 - 60%.

The graph showing employment in agriculture and distance from the river has a correlation of - 0. 213 at 0.5% level of significance the simple linear regression is $Y = - 0.99 X + 75.61$ which shows the negative relationship of employment in agriculture and distance of 8 miles from the river.

The areas which are close to the river and yet show low percentage employment in agriculture are those located in Ghaziabad tehsil and Delhi Union territory.

The pockets with greater than 80% in agriculture

at 2 miles distance from the river in Ballabgarh and Palwal tehsils are adjoined by villages with 60 - 70% in agriculture in a tract extending from Paigalthu to Palwal and Dadhka near Hodal. On the east bank from Sikandrabad town south to Jahangirpur and Jewar the villages have 60 - 80% employed in agriculture at 10 miles distance from the river. Thus the general pattern is a continuous band of 80% of total workers in 1961 in agriculture in all villages at 0.5 - 2 miles from the river and in small sized villages of the flood plain. The large sized villages at 3 - 6 miles distance from the river have 10 - 50% employed in agriculture.

Such a sharp contrast between north and south of employment in agriculture is not noticeable in the Ganga Flood Plain.

The employment in agriculture within 1 mile distance from the river is 80-90% declining to 60% at 6 miles distance from the river. This trend is noticeable in the flood plain from Mawana to Khurja tehsil.

A phenomena which is peculiar to the Ganga flood

plain in the tract between the Burganga and Ganga in northern Mawana tehsil is a decline to 30 - 50% in primary sector at 0.5 - 2 miles distance occurs. Adjoining Hastinapur town, villages have 11% to 50% of their total workers in agriculture. The impact of low lying Khadar area with frequent water logging could explain this decline in employment in the primary sector as also the development of village level gur and khandsari production.

Since no noticeable concentration in the agricultural employment as greater than 90% is noticeable, a decline in agricultural employment around towns have been identified. In Anupshahr tehsil extending into Khurja, are areas which have 60% in agriculture, at 1 - 2 miles distance from the river from Narora to Debai. This tract is well known as the site of the Barrage across the Yamuna. An embanked tract of the river lies in this area - the settlements within the embankment have 60 - 90% in agriculture and outside the embankment to as low as 53%.

4.2 Comparison of the employment in agriculture of the Yamuna and Ganga Flood Plain.

From the foregoing description of the trends of the isolines showing employment in the primary sector it is possible to distinctly recognise areas in the Yamuna Flood Plain where the employment (1) in agriculture is as low as 50% at 5 - 8 miles from the river in villages of size class 1000 - 1999. In these same settlements, employment in manufacturing and household is 25% and tertiary is 25%. These villages are in the tehsils of Ghaziabad, Delhi, Southern Baghpat and Meerut tehsils. This characteristic is absent in the Ganga flood plain.

(2) The villages of 2000 - 4999 with 60% in agriculture and 30% in household and manufacturing with only 15% in tertiary at 2 - 6 miles from the river are the second category. Such settlements are found in both the flood plains specially Palwal, Sikandrabad, Khurja, Anupshahr and Hapur. In the Ganga flood such settlements are found near large towns of Garhmuktesar, Siana, Debai and Jahangirabad.

(3) The settlements of the less than 999 size class in both the flood plains at less than 1 mile distance from the river have 80 - 90% in agriculture.

In a region with diversified economic activities and better infrastructural facilities the towns grow at the cost of the countryside immediately around them, leaving the remote flood prone areas to ~~mainly~~ ^{carry on} agricultural activities.

The hypotheses that size of settlements of 2000 + would have a higher percentage employed in non farm activities is not acceptable. This the proximity villages to urban centres and accessibility by road or rail that affect the diversification of activities in a village. An increase in tertiary employment ensues with gradual increase of household sector activities.

Villages with high percentage increase of population since 1951-61 have a higher percentage employed in tertiary level activities.

4.2 The Industrial Employment structure of
villages in the Ganga & Yamuna Flood Plain.

The location quotient of employment in household and manufacturing categories are high in the villages where percentage employment to total workers of the village is high. Therefore the location quotients have been taken to identify the areas of concentration of employment in household and manufacturing delimited by isolines showing percentage employed.

The regions that emerge are listed at the end of this chapter. Along the Yamuna the areas where the highest concentration of workers in manufacturing and household to total workers in each village ^{are in} ~~the area of~~ :

Delhi (Alipur Block), Ghaziabad, Serana, Modinagar, Meerut area and Philkuwa - Faridnagar area, and the Debal - Morna area in Sikandrabad tehsil.

This region is a representation of the role that transport linkages and proximity to market play in transforming a region. The villages in the area between the Hindan and railway line in Ghaziabad

tehsil are mostly in 2000 - 4999 population size .

This tract has three types of patterns of employment at varying distances from Gaziabad along the railway line. Between Ghaziabad and Muradnagar till Sikrikalan on the Hindan the villages have a location quotient of greater than one of manufacturing workers.

At a distance of 20 miles from Muradnagar the Pattern changes till Modinagar where the employment in household industries increases between 1.58 to 2.70 location quotients. These areas have 33 - 50 percent in secondary employment. The percentage employed in household industries is between 20 - 30% and manufacturing 3-10%.

At 2 miles from Modinagar villages like Quaderabad with a location quotient of 8.32 in manufacturing, Bakhāba^r (0.92) are found.

Between the three towns of Gaziabad, Muradnagar and Modinagar, villages at 0.5 miles - 1.0 miles from the railway line have 10 - 30% of total workers in household industries. These villages have a location quotient 1.5 - 1.95 in household industries.

The villages of Rawlikalan (0.80 LQ 34.26% of TW// in household industries) Surena (1.41 LQ 16.68%) Kangara (1.26, 14.92%) Amirpur (1.08, 12.74%) Patta (2.18, 30.68%) Sara (1.48, 16.57%).

South and west of Ghaziabad - Sewana tract are three pockets of high employment in secondary sector activities.

1) The Philkuma - Faridnagar area, (2) The Debri Parthala area in northern Sikandrabad tehsil and the (3) Alipur - Shahadra area of Delhi U.P.

Though all the three areas have 20 - 40% in secondary sector activities the concentrations in household or manufacturing give their real status.

The Philkuwa Faridnagar area is such that Faridnagar has a LQ of manufacturing workers of 1.42 and H.H. of 4.30. The other villages in the area Philkuwa (LQ ~~1.42~~, 12.35%) Atrauli (LQ 1.91, 2.15 36.52% Nurpur (LQ ~~1.42~~, 25.62%) have a higher location 2.74 quotient of household industries workers.

In Sikandrabad the Debri Parthala area also have an higher percentage employed in household than

manufacturing industries. The area unlike the Faridnagar Philkuna region has no core of higher employment of manufacturing.

Debri, a agro industrial town, has developed with its location on the Ghaziabad, Aligarh railway and 10 mile distance from Ghaziabad and 2 miles from Delhi's border. The increase of employment in the household sector is 9-12% with a location quotient of 0.5 - 2.0 nearer Delhi. The villages of Parthala (1.22), Nithari (0.83), Morna (1.07), Khairpur (2.35) and Surajpur (0.8) all register this tendency.

The Delhi Union Territory with the industrial core of Shahadra shows an increase of workers in manufacturing from 1.9 - 4.23. The percentage being 60 - 80% in manufacturing, the region from Mustafabad to Mandauli in the trams Yamuna tract, depicts this tendency.

Apart from these area of high concentration in manufacturing and household smaller more localised areas are found in the Narela and Badarpur areas in Delhi and Baghpat Tatiri area of Baghpat tehsil.

In the south, Faridabad Ballabgarh tract Jewar-Chhatanga area and Hodal area are the other pockets of relatively higher employment with 10-20% in household and manufacturing.

These concentrations of higher employment in manufacturing in villages are clearly related with the proximity to towns where the industrial activities are higher. The villages with 20-30% workers in household industry i.e. a location quotient of 1.8 - 2.5 are more in areas close to the river at 1-3 miles distance and in areas remote from large towns.

These areas at 0.5 - 1 mile from the river and 10-20% employment in manufacturing and household with increasing percentage at 3-6 miles from the river is clearly indicated by the correlation coefficient of 0.369 with 0.5% level of significance and a regression coefficient of $Y = 0.64 X + 12.66$ as is seen in Fig 6 which indicates the decline of employment in manufacturing with decreasing distances to the river.

In the Ganga flood plain the variation in employment of manufacturing and household does not

increase with distance from the river. At 5 miles as at 2.5 miles the employment in manufacturing and household is 20%. Further the higher employment as indicated by the location quotient is in the household sector. The location quotients are 1.5 - 3.1 in the household sector and the manufacturing sector has a location quotient of 0.24 to 0.76.

The Ganga flood plain has 20% of total employment of a village in household industries in the area drained by the Burganga and the Ganga. The lack of adequate flat land which is not affected by flood results in almost 30% of the villages being 200-499 in size with 10-20% employed in household industries. In spite of being removed from the main road lines of the regions this is a case of the adaptability of a village economy to its natural disadvantages.

In the remaining area of Southern, Hapur, Bulandshahr and Anupshahr, save the villages at 0.3 to 0.5 miles from the towns of Siana and Garhmuktesar, the location quotient of employment in household industries is 0.40 - 2.48.

In southern Anupshahr with the increase of power facilities at Narora and Rajghat the changing employment pattern can be gauged to some extent by the increasing concentration in a few villages of Dogwan (1.24) Belona Rup (1.19) at 0.5 miles distance from the river of location quotients or employment in household and manufacturing industries.

In the Ganga flood plain the concentration of workers is mostly in the household sector in the areas around the towns of Mawana and Hapur tehsils. In Anupshahr and Khurja the localised areas of household sector concentration of 2.3 or 30% of total workers have only a few industries. The data on establishments in villages and towns as provided by the district census handbooks (1961) reveals this picture. The villages of Anupshahr tehsil with location quotient of greater than 2.3 in household industries have mainly cotton ginning, weaving and textile garment production. This situation is further substantiated by the increase upto 50 units producing textiles in the towns of Anupshahr, Jahangirabad and Debai.

However in the tehsils of Mawana and Hapur the

villages have units producing gur edible fat and wood craft with 6-7 units on an average for cane work. The towns of Hastnapur, Garhmuktesar and Siana again have more production units of edible fat and pottery as also pipes and hardware.

As no similar data on the member to establishments by Minor Groups are available for the Haryana sub region, this discussion is restricted to the Meerut, Bulandshahr, Ganga and Yamuna flood plain.

The villages with greater than 1 location quotient in household industries workers and 0.5 in manufacturing workers were selected. The list of establishments in these villages reveals that all the villages in the flood plain have certain common establishments of gur and khandasari production, rice and atta milling units, production of ghee and diary products which differs in the two flood plains in that the Yamuna flood plain villages have 8-9 units in each village whereas the Ganga flood plain have only 1 or 2 units, Silver Jewellery and Pottery.

Apart from these production units, villages with a location quotient in manufacturing employment of Baoli (1.04) Lohara (1.04) Khekhra (1.24) Baraut (1.45)

and Philkua (2.15), Faridnagar (3.08) Nurpur (1.40) Loni (1.06) of Ghaziabad tehsil have a higher location quotient than location quotients in household industries.

Establishments for the production of hardware, GI pipes and ceramic sanitary fittings, leather tanning and shoe making, bicycle and motor repair, Cotton ginning weaving, drying and printing, soap making and iron and steel furniture production are present. Villages along the road have bicycle and motor repair units.

The analysis of the employment structure in the flood plain region establishes the fact that in villages where the farm non farm employment is 60/40 located at 0.5-3 miles from the river have the 40% non farm employed in household industries and other services.

A villages at 3-6 miles away from the river and those near towns at either 2 miles or 5 miles distance have a 60/40 farm/non farm employment of a higher non employment in manufacturing and tertiary services.

In the study of comparison of the nature of employment

in the household and manufacturing categories of villages in the Ganga and Yamuna flood plain, three clear cut trends emerge.

- 1) that villages which have less than 500 population size close to the river have ~~both~~ large-and-small higher farm employment. Both large and small villages which are at 3 - 5 miles distance from the river have a higher employment in non farm activities in village based household industries.
- 2) that the villages with larger population size and higher employment in manufacturing are found only if they are close to larger urban industrial towns. Farther away from the town even the villages with larger population size have a higher employment in household industries.
- 3) that size of population does not affect the employment in household or manufacturing activities as does proximity to a transport route or urban place.
- 4) that the nature of production in and villages is dependent the demands of the town within the urban sphere of influence in which they are located.

The Pattern of employment in the household industries and manufacturing in the two regions can be identified in concentrations in settlements VERY CLOSE TO EACH OTHER.

1. The employment in the secondary sector is high close to the river in the Yamuna Region with a correlation coefficient of 0.369 at 0.1% level of significance. In the Ganga region, there is a decline towards the river of employment in the secondary sector.

2. Areas with 25% in manufacturing of villages with population size 2000-9000	Areas with 25% in household
1. Panipat Panipat	Bahail, Bamnauli
2. Delhi Delhi (Alipur Block)	
3. Ghaziabad Ghaziabad-Serena- Modinagar- Modinagar	Faridnagar- Philkuma
4. Meerut Daurala Dahar Moihudinpur Modinagar	
5. Baghpat	Ramli Kalan, Singharli, Bhangdvli.
6. Ballabgarh Faridabad/ Ballebgarh	Kherikalan - Sehi- Ajraunda.
7. Khurja	Jewar-Chhanta Khurd
8. Baghpat	Baraut-Dhanaura Silvang Hilwari Fatehpur Poothi
9. Bilaspur	Naurospur Gujar

10. Daurala - (Meerut TA)	Dankaur, Bilaspur
11. Meerut Rasulpur Rohta	Naglachitr, Jewar
12. Salehnagar-Siwalkhas	Dadupur
13. Jani Khurd Nek	Dankaur
14. Sikandrabad	Jewar Debrri

Areas with 15% in household and manufacturing
in the size class 500 - 2000.

1. Parthola Kanjarpur, Kulesar
2. Jatta Gulaoli, (Sikandrabad)
3. Morthuka - Mohamadpur (Palwal)

In the Ganga Flood Plain

	Areas with Household with popu. 2000-9000 persons	25% in villages	Areas with 25% in household in villages 1000- 2000 person
1. Anupshahr	Amargarhi - Basi Bangar Shafinagar		Mau-Kanehra Gushrangel
2. Hapur	Garhmuktesar - Jakhera Kalan Jalalpur		Khiwai
3. Mewana	Hastnapur - Poothi		Khor Rai - Jalalpur - Nagla Goswami

3. In the Ganga flood plain, there is noticed a decline in the employment in the manufacturing and household industries sector towards the river.

However, in the Mawana tehsil, the small size settlements of 500 ϕ - 1000 persons register a high percentage employed in non-farm activities suggesting that the unhospitable terrain frequently waterlogged unfit for agriculture does also contribute to an increase in non-farm activities in small villages close to the river.

4.3 Identification of areas of concentration
in tertiary activities in the Ganga and Yamuna
Flood Plains of the National Capital Region.

The flood plain region of the National Capital Region as a predominantly agricultural region is a fairly known fact. It is possible that the diversification of activities to tertiary services of the village are more likely to be outcome of proximity to towns and location on major trunk routes and the activities of villages to be the existence of household industries.

The centres which are identifiable as nodal centres in the region are probably the centres which belong to the former category of the higher tertiary sector employment and not really the centres of nodal activity of the surrounding villages. The distinction between the 'urban oriented village' and the 'focal village' are bound with the extent to which the tertiary services cater to the villages themselves or to the urban places.

It is to identify these trends that the following facts were collected by a study of the distribution

of location quotients of tertiary employment (LQT) and the Location quotient of other services employment (LQOT). The distinction between these two categories are necessary in order to distinguish the services which are more the Urban activities like trade and commerce, transport and construction and tertiary activities like village services as being the inherent activities of the village.

The spatial distribution of the percentage employed in the tertiary activities and the location quotients of LQT and LQOT are studies as are distributed along the river and at varying distances from larger towns in the region.

The main areas of concentration of the workers in tertiary services in the flood plain region can be delimited as being of two varieties - the areas where the workers in tertiary services are higher than the workers in the other services category and the villages where the other services category is as high as those of tertiary workers.

In the Yamuna Flood plain the areas where tertiary workers are high are mostly at 2 - 4 miles from the

river. The 20 percent isoline delimits this area as can be seen in Map . The correlation coefficient is 0.512 at 0.5 percent level of significance.

The pockets of greater than 30 percent concentration in (greater than 1.0 LQT) each village of tertiary level workers and other service workers are mostly in the areas of

1. Narela - Aterna along the G.T. Road on the Delhi Sonapat border
2. Alipur - Libaspur in Alipur block of Delhi U.T.
3. Khajoori Khas - Badarpur area of the south Alipur Block
4. The trans Ya una villages of Mandauli to Qarawal Nagar which surround the Shahdra industrial area of Delhi Union Territory extending to Afsalpur, Asalatpur, Sikri Kalan area of Ghaziabad Tehsil.
5. The Loni - Badshahpur area of Ghaziabad tehsil.
6. The trans Hindan tract from Meerut to Modinagar
7. The villages of northern Sikandrabad tehsil
8. The Ghaziabad - Ballabgarh area
9. The Sikandrabad - Jewar tract with the villages of Kakore Wair, Quaderpur all with Location Quotients of greater than 2.5 and 30 percent of total workers of the village in tertiary services.
10. The Palwal Hodal area with willages like Gudhrana Hasianapur and Lalwari.

These areas have been identified on the basis of three criteria.

- a) a greater than 20 percent to a maximum of 30 percent in tertiary and other workers categories of employment in each village.
- b) an increase of Location quotients between 1 to 3.0.
- c) Population sizes of greater than 3000 persons.
- d) Distances of not more than 6 miles to 1 mile from the Yamuna . These criteria are based on the trends that are noticeable from the scatter graphs showing the relation between location quotients and size of population, distance from river and employment in tertiary and other services categories.

Having identified these areas the next exercise was to see the nature of tertiary and other services activities in these areas considering their proximity to the river and distance from the nearest town.

In the villages which are situated in the Delhi Union territory and surrounding areas the employment in tertiary activities is between 20 - 40 percent at 2-3 miles from the river and employment in other services is only 10 - 20 percent.

In the areas which lie in Baghpat, and surrounding Meerut to Modinagar area the villages which are of the category 20 - 30 percent in manufacturing have 30 - 50 percent in tertiary activities. Whereas the

villages which have 15 - 30 percent in household industries have only 10 percent in tertiary activities and 30 - 40 percent employment in other services.

The villages in the mainly agricultural tract south of Faridabad have a higher percentage in other services than in tertiary activities if the villages are situated far away from the urban industrial towns. In the Faridabad Ballabgarh tract the villages have an average of 60 percent in agriculture, 10 percent in household and 10 percent in tertiary activities and 20 percent as other services. The villages which have a higher percentage in other services are those villages which are closer to the river. These villages have LQOT of greater than 2 and population size of 2000-1000 persons.

The villages of Fathepur, Mawai, Wazirpur, Kheri Kalan, Bahadarpur, Sahirpura Tikri Khadhar in Ballabgarh tehsil are villages. LQOT is greater than 2.5 and have population sizes between 200 to 800. In location these villages are found to be close to each other at an average distance of 2-2.5 miles from the river. At 4 and 6 miles from the river the percentage employed in tertiary services

declines to 0.63 to 0.46 LQOT. These villages have location quotient agriculture of greater than 2.5.

In the Sikandrabad Jewar tract the villages have location quotients of higher than 1.5 in other services but not higher than 0.35 in tertiary. The villages that are at 0.5 miles to 1 miles distance from Sikandrabad and Jewar have 1.14 - 1.28 LQOT which declines beyond these villages.

Further it 0.5 to 1 miles from the river villages which are small in size between 500 to 1000 persons have 2.35 - 4.0 LQOT which results in employment of persons in agriculture being 0.52 to 1.00.

	Population size.	% to TW Agriculture	% Tertiary employment	LQOT
Quaderpur	215	0.69	45%	2.77
Hasanpur	498	0.90	32%	1.95
Kasna	934	0.98	30%	1.01
Raipur, Banghar	567	1.41	24%	1.42

The increase in percentage of tertiary workers to total workers in the extreme South of the National capital region is found in the area delimited by the 20% ~~isoline~~ ^{isoline of} tertiary activities extending from Palwal to Hodal and increasing in small pocket at 0.5 miles distance from the river.

In this area LQOT and LQT are very low, no where increasing above an average of 0.65. Even the towns in this tract of Hodal and Palwal have 40 - 60% in agriculture and the villages surrounding them have a higher percentage in Household activities.

In the Ganga flood plain the workers in other services are higher in the village where workers in household industries and agriculture, are higher whereas workers in tertiary services are higher where the villages are close to the town or are villages where irrigation projects are under construction.

The area which emerges in the Ganga flood plain as having settlements with higher employment in tertiary ~~xxx~~ are

- i) The area surrounding Garhmuktesar, 0.5 miles from the river extending towards Hapur 6 miles from the Ganga.
- ii) The Manki Jalalpur Chitawa, Moihuddinpur tract with an increase at Chitanra to 40% and LQT of 4.71 and LQOT of 1.46.

- iii) The area of increase in tertiary sector employment around Delhi, Karnatras, Dogwan, Narora and Rajghat.

In the three areas identified the workers in tertiary sector of trade, transport, construction have location quotients of 1.47 to 2.5 with almost 20-30% employment on non farm workers. The three areas that are identified are all at 0.5 - 2 miles distance from the river which is embanked in short stretches of the course.

The population size of the villages in the region are all above 2000 till 4000 persons. The villages of 500 - 999 persons in this area have between 0.5 to 0.9 LQOT and 0.2 - 0.5 LQT i.e. they have agriculture as the main stay of employment.

A comparison of the trends of employment in tertiary and other services classification of the two flood plains reveals.

<u>Ganga Flood Plain</u>	<u>Yamuna Flood Plain</u>
1. Villages close to the river and close to each other have LQOT of 1.0-2.5 and LQT 0.2-0.5.	Villages close to the river but dispersed have LQOT of 0.5 - 1.0 and LQT of 1.0 - 2.0

2. Away from the river, the villages with LQT and LQOT of 1.0-2.0 are in villages which are close to each other. The villages away from the areas which are not so frequently affected by flood in the area have LQOT of 1.25 - 2.1 i.e. 60% in tertiary and other services sector.

The collection of facts to substantiate the hypotheses that tertiary sector employment probably responds to larger population size and proximity to towns and that the other services sector is higher in villages where employment in household industries and agriculture are higher, the relation of population size, and location quotient of other services and tertiary employment was studied. Further a comparison of areas with increase in tertiary sector with areas where increased employment in manufacturing and household industries is registered was analysed.

In the first analysis, as can be deduced from the Graphs of Fig 9, as the population size of settlements increases the location quotients of employment in other services does not increase as

FLOODPLAIN OF THE NATIONAL CAPITAL REGION

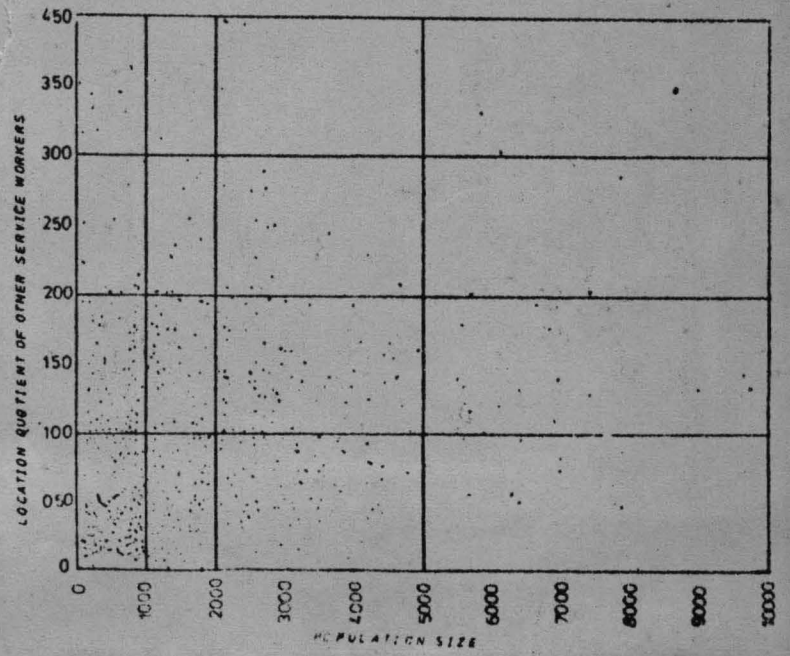
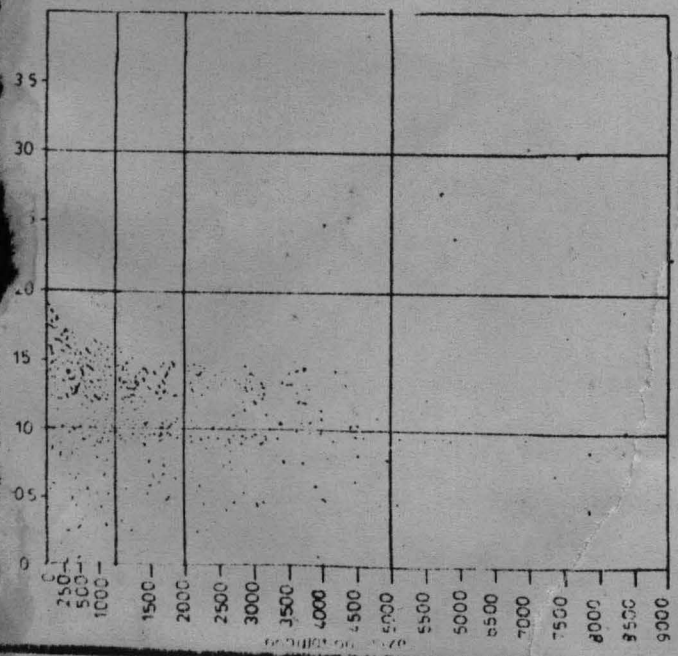
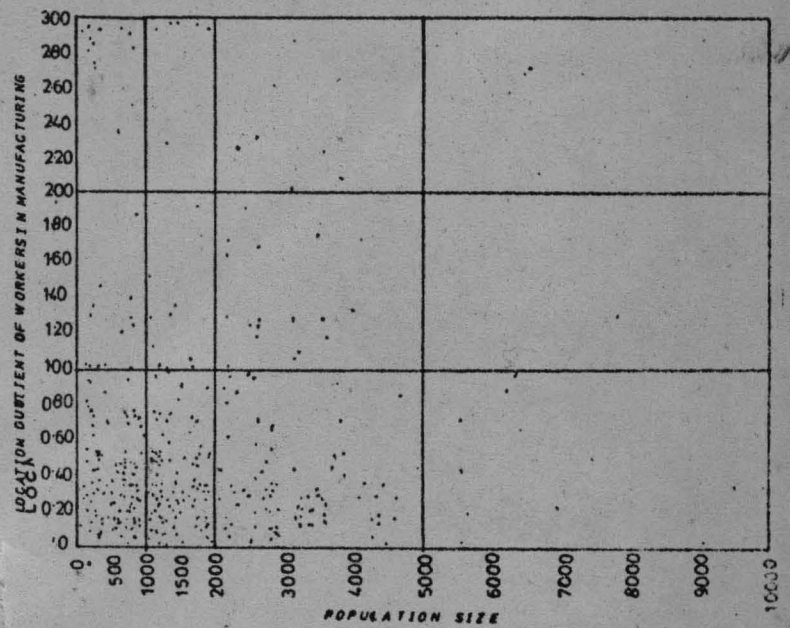
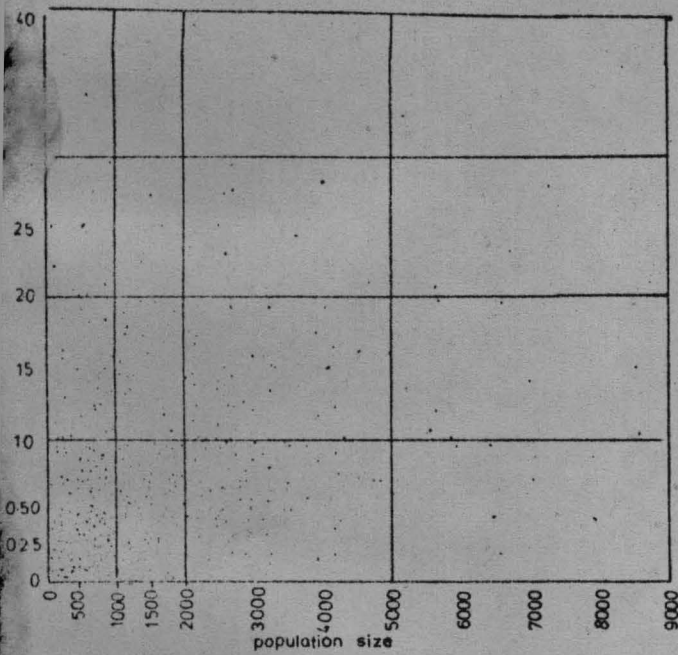


ISOLINES SHOWING AREAS OF CONCENTRATION OF HOUSEHOLD
MANUFACTURING TERTIARY/OTHER SERVICES WORKERS



U.S. GEOLOGICAL SURVEY
WASHINGTON, D.C.

LOCATION QUOTIENT OF WORKERS IN INDUSTRIAL CATEGORIES AND POPULATION SIZE



much as employment in tertiary services. The villages in the 200 to 999 size class register an increase in tertiary employment to almost 9.50 to 3.50 whereas villages of greater than 2000 register LQOT of only 2.5 at a minimum. In fact villages greater than 3000 in population size till 5000 population size have an increase to only 1.5 LQOT. The workers in tertiary services however show an increase with increase in population size in almost all the villages. The villages with higher tertiary sector employment than other services are the village of greater than 3000 in population size. Below this size-class, employment in tertiary services has location quotients less than 0.25 to 0.85.

The map showing isolines of greater than 20% employment in manufacturing and household and greater than 30% in tertiary when superimposed allow the identification of villages and areas where manufacturing, household industries and tertiary activities are the second most important activity after farming.

The areas where higher location quotient in tertiary and higher location quotient in manufacturing

i.e. LQ of greater than 1 are in the area in the Alipur Block of Delhi Union Territory. Villages of Bahalgarh and Asawarpur and Rai are examples of villages where 30-50% in tertiary activities with 20% in manufacturing.

A similar area of concentration in manufacturing and tertiary employment is in the villages between Ghaziabad, Modi Nagar and Meerut. However, the villages with a higher location quotient in tertiary services are found over a larger area of the trans Hindon tract villages with a higher location quotient in manufacturing are less than 1 mile from the railway line.

The villages in agricultural based settlements of Baghpat and Meerut and Mawana tehsil and the Tehsils of Palwal, Sikandrabad, Khurja and Anupshahr, the villages with greater than 25% in household industries are villages where tertiary services location quotient are low but the LQOT is 1.0 - 3.00 the villages of Dhanaura & Silvanagar with 47% in primary 25% in secondary and 28% in tertiary and Kamli Kalam and Serana with 35% primary 39% secondary and 22% tertiary are found.

The two situations do amply justify the fact that household industries with other services from the main employment sectors outside agriculture in the agricultural areas of the flood plain whereas tertiary activities and manufacturing increase where the urban town has urban industrial activities.

..

	% employed in agriculture								% employed in secondary							
	90+	80-90	70-80	60-70	50-60	40-50	30-40	20-30	35+	30-35	25-30	20-25	15-20	10-15	5-10	15
Sikandrabad																
1951	11	24	18	6	6	0	2	5	2	0	0	4	3	9	26	18
1961	11	29	17	4	7	2	2	2	0	0	1	3	5	14	16	22
Balialgarh																
1951	11	31	19	8	1	2	2	2	2	0	0	0	0	3	18	34
1961	30	28	21	7	3	2	2	1	2	0	3	1	2	6	23	33
Palwal																
1951	22	33	10	6	2	2	1	2	0	0	0	1	1	7	22	37
1961	12	23	29	10	1	1	1	0	0	0	1	1	2	10	24	33
Chasiabad																
1951	0	3	3	12	17	13	1	6	1	3	8	10	12	0	5	5
1961	0	3	8	8	12	0	10	4	10	4	9	5	13	7	3	4
Baghpat																
1951	0	1	3	7	6	6	3	3	0	0	1	5	5	12	4	4
1961	1	0	1	6	8	7	5	1	3	0	1	7	5	6	4	3
Panipat																
1951	1	7	2	7	6	2	0	0	0	0	1	2	3	6	10	2
1961	2	7	7	9	0	0	0	0	0	0	0	1	4	7	6	5
Sonepat																
1951	0	5	6	8	6	4	1	0	0	0	1	0	5	8	7	6
1961	4	6	12	3	2	1	1	1	0	1	1	2	3	5	9	8

	% employed in tertiary services								% employed in other services							
	35+	30-35	30-25	20-25	15-20	10-15	5-10	L5	35+	30-35	25-30	20-25	15-20	10-15	5-10	L5
Sikandrabad																
1951	1	0	1	1	1	1	6	35	1	0	2	5	5	21	21	12
%																
1961	6	1	2	1	1	4	9	35	2	1	2	3	7	17	28	9
%																
Ballabgarh																
1951	0	0	0	1	1	3	5	40	0	0	1	5	7	13	30	13
%																
1961	0	0	0	0	1	0	6	51	0	0	1	2	7	17	25	20
%																
Falwal																
1951	0	0	0	3	0	1	13	44	0	0	0	2	3	6	28	35
%																
1961	0	0	0	1	0	2	12	50	0	0	1	6	10	9	28	20
%																
Ghaziabad																
1951	1	1	0	2	1	6	19	23	0	0	2	9	12	5	1	0
%																
1961	1	0	0	1	3	2	23	24	0	0	4	2	11	10	2	1
%																
Baghpat																
1951	0	1	1	1	2	1	6	18	1	5	6	8	8	3	0	0
%																
1961	1	0	0	2	1	3	5	16	2	4	2	11	4	5	0	0
%																
Panipat																
1951	0	0	0	1	0	1	10	7	0	0	2	2	8	3	5	3
%																
1961	0	0	0	0	0	10	6	6	0	0	0	0	0	12	6	6
%																
Sonepat																
1951	0	0	0	1	5	4	5	14	0	0	1	3	7	9	7	1
%																
1961	0	0	1	1	0	1	5	18	0	0	0	3	1	5	5	15
%																

		% employed in agriculture							% employed in industry								
		90+	80-90	70-80	60-70	50-60	40-50	30-40	L20	35+	30-30	25-30	20-25	15-20	10-15	5-10	L5
Havana	1951	12	6	8	7	4	0	1	1	0	0	0	0	6	3	7	11
	1961	7	9	10	4	7	0	0	2	0	2	1	7	4	7	6	7
Hagur	1951	1	3	6	5	7	5	1	1	0	0	0	3	4	7	7	5
	1961	4	4	4	8	3	4	2	1	1	0	3	6	4	4	4	4
Bulandshahr	1951	1	1	2	1	2	0	1	1	0	0	1	2	1	0	4	0
	1961	0	1	4	1	2	0	1	0	0	0	2	0	0	1	5	1
Aunyahahr	1951	11	14	13	8	8	2	1	3	1	0	0	5	8	8	19	11
	1961	16	9	14	14	7	0	0	1	0	0	4	4	6	9	10	19
Khurjn	1951	3	3	8	10	4	3	1	0	0	0	1	1	1	3	10	13
	1961	6	11	8	5	2	0	1	0	0	0	1	1	0	6	7	14

		% employed in tertiary							% employed in other services								
		35+	30-35	25-30	20-25	15-20	10-15	5-10	L5	35+	30-35	25-30	20-25	15-20	10-15	5-10	L5
Mavana	1951	0	0	0	0	0	0	3	23	3	1	0	6	4	8	5	6
	1961	0	0	0	0	0	0	3	22	2	0	0	3	3	6	13	6
Hapur	1951	0	0	1	0	0	2	7	16	1	4	7	5	2	4	5	1
	1961	1	0	0	0	0	4	6	14	1	3	0	4	5	6	6	4
Bulandshahr	1951	0	0	1	3	0	0	4	0	0	0	3	0	3	1	0	1
	1961	0	0	2	0	1	1	4	0	0	2	0	1	1	3	0	2
Anupshahr	1951	0	1	0	1	2	2	6	39	2	3	2	4	4	11	14	16
	1961	0	0	1	0	2	8	6	34	3	0	2	2	3	8	13	18
Kherja	1951	0	0	1	1	0	1	3	24	0	0	0	0	0	1	10	22
	1961	0	0	0	4	0	0	4	22	0	2	0	2	2	7	12	8

FLOODPLAIN OF THE NATIONAL CAPITAL REGION



The analysis of the employment profile of the villages in the Yamuna and Ganga flood plain requires a comparison of the relative position of employment in primary secondary and tertiary activities in 1951 with the position in 1961.

Since the definitions of workers in 1951 and 1961 have changed the comparison of absolute figures is not possible. It is only worth while to compare the changes in the major sectors.

The table 4 of total villages with villages having 90 percent to 30 percent in agriculture 30 percent to 50 percent in secondary and tertiary activities gives an indication of the direction of change.

As has been assumed for this work that the dependents and workers to total population is comparable to workers in such sector to total workers the increase or decrease in number of villages in each category is indicative of the overall trends of change. The map 4 gives the actual isoclines in 1951 and a comparison with 1961 is possible.

Considering the number of villages in each percentage category of workers in agriculture 1951 and 1961 it is obvious that along the Yamuna there has been a reduction in villages having 80 percent to 100 percent in agriculture however in the Ganga flood plain the villages with 70 percent - 100 percent have remained almost the same.

The villages with greater than 30 percent in household industries and non agricultural activities have increased in the Yamuna flood plain but remained low about 10 villages only in both 1951 and 1961.

Villages with 15 percent to 5 percent in tertiary activities continue to be more in 1961 than 1951 whereas there are fewer villages with 20 percent - 35 percent in tertiary activities. The employment in villages in other services continues to be the dominant employment source in 1961 as in 1951 an average of 10 - 15 villages with 20 percent and more in other services.

The shifts in the villages falling into each of these categories is of three trends.

1. The increase in number of villages with 70-80 percent in agriculture and decrease in villages with 90-100 percent in agriculture. This is complemented by increase in number of villages with 20-30 percent in tertiary and other services in 1961 (Baghpat, Palwal Sikandrabad are examples of such shifts).

2. The increase in the number of villages with 70-80 percent in agriculture and decrease in villages having 90-100 percent in agriculture registering a corresponding increase in villages with 15-30 percent in household and manufacturing in 1961 compared to 1951. (Tehsils of Mawana, Hapur, Anupshahr, Ghaziabad, Sonapat and Ballabgarh register such a change).

3. The increase in number of villages with 80 percent in agriculture with no complementary decrease in villages with regard to employment in tertiary and other services.

The analysis of the similiar trends by comparing Map 4.9.1 and Map 4.9.2. reveals the following positions :

1. The isolines of percentage employed in primary

secondary and tertiary activity in 1951 are continuous and the villages within each mile band almost similar percentages employed in the 3 categories.

1.2. The isolines of percentage employed in the 3 categories in 1961 are concentrated around a few villages which are close to each other. The 90 percent isoline of workers in primary, and the 30 percent isoline of workers in secondary activity emerge in the 1961 map.

2.3. The percentage increase of workers in each village in non agricultural pursuits complementary to decrease in percentage of workers in agriculture pursuits is obvious from the increase of isoline value from 10 percent in secondary (1951) to 30 percent in secondary (1961) and 20 percent in tertiary (1951) to 40 percent in tertiary (1961).

3.4. The areas which emerge in 1961 as having villages with higher non farm employment like the Ghaziabad Meerut area are in 1951 mostly with having 10 percent - 20 percent in tertiary and 20 percent in manufacturing. These same villages in 1961 have 30 percent workers in manufacturing and 20 - 25 percent in tertiary sectors.

A similar concentration in few villages at 1-3

miles from Ballabgarh is noticed.

3.5. The Ganga flood plain has a different shift of employment in the three sectors. In 1951 almost 80 percent of the villages in the flood plain had employment of 60-80 percent in agriculture. The secondary sector employment was between 5-10 percent in 1951 and tertiary sector employment between 10-20 percent. In 1961 the employment of 80 percent in agriculture remains similar but the employment in secondary sector reduces and the employment in tertiary sector concentrates round the large towns.

..

CHAPTER - V

- 5.1 Construction of the composite index for social facilities in the flood plain region.
- 5.2 Identification of the hierarchy of settlements according to social facilities in the flood plain region.
- 5.3 Distribution and type of facility in the settlements with higher and lower social facility index.
- 5.4 Relationship between the level of social facility and population size, distance from the nearest town, extent of employment in the three sectors and chief production functions in the villages.
- 5.5 Conclusions.

5.1 Social "amenities", the facilities such as schools, medical care, communications as post and telegraph facilities, are to be to a large extent an indicator of the "attractiveness" for residing in a area. Every effort is made in planning to provide amenities to every town and almost all the rural communities.

As it is a difficult task to state categorically that the provision of amenities would ensure better living conditions in villages, yet it is assumed that their provision ^{is aimed to} ~~can~~ ensure better standard of living for the village community.

In the Yamuna Ganga flood plain region analysis of the distribution of amenities would provide an insight as to whether the villages which are dependent on agriculture with small size of population also avail of such amenities. It is very likely that large villages close to towns and having a diversification of activities attract better amenities which are availed of only by these same villages.

5.2 Distribution of social facilities in the Yamuna and Ganga Flood Plain.

The plotting on the map 10 of the A to H level

villages as depicted in the graphs showing functional tiers in rural settlements hierarchy (fig 10) helps in identifying the spatial distribution of villages, with high and low social facility level according to population size.

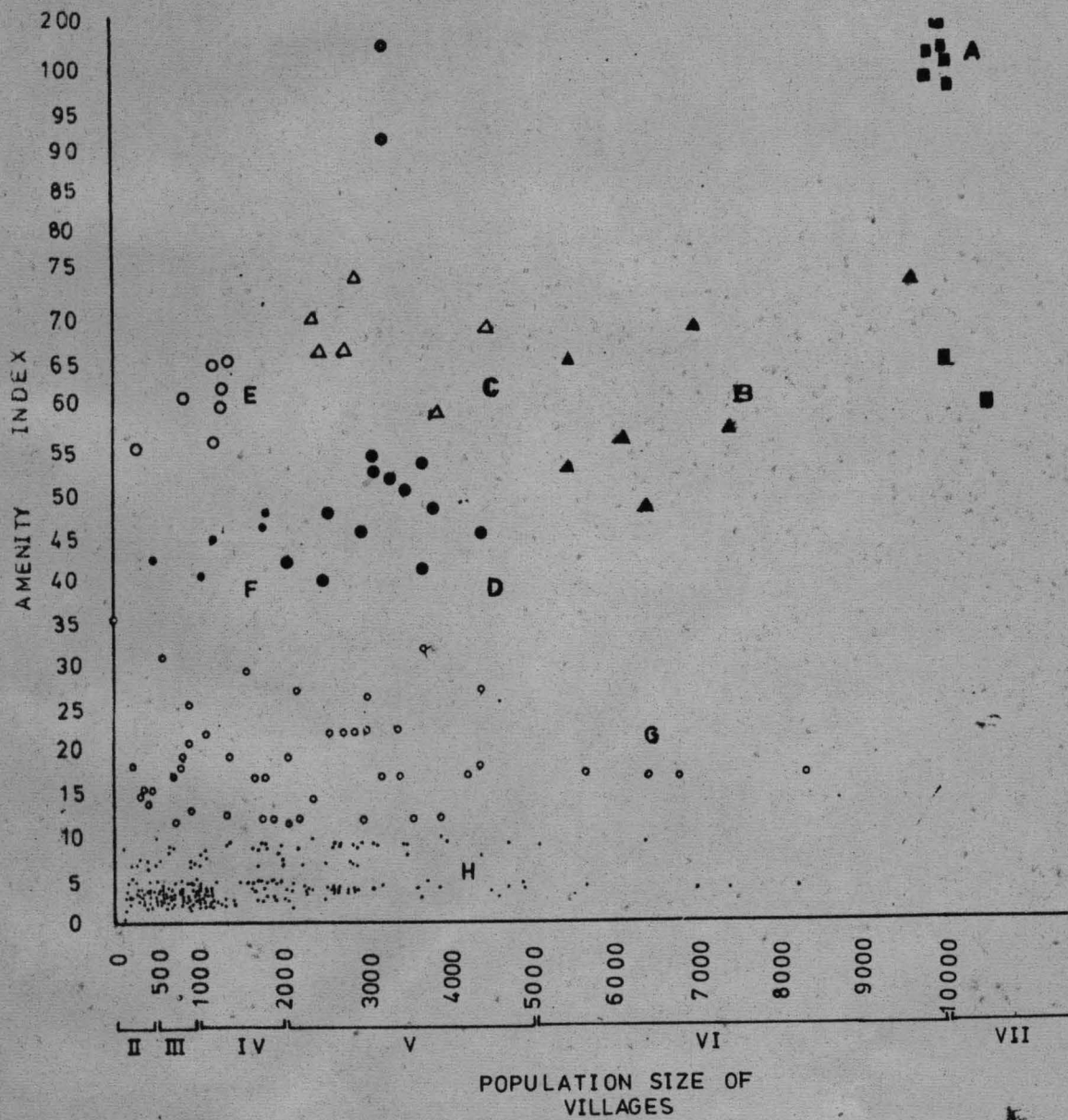
The identification of the functional tiers in rural settlement hierarchy was carried out by first assigning weights to the social facilities. The total villages served by one social facility quantified as its weightage in the flood plain region.

Weightage of social amenities = Total number of X facility/Total villages in the flood plain region.

The weightages that emerge are as follows :-

<u>Educational</u>	<u>Total Number of facility</u>	<u>Weightage to facility</u>
Primary school	174	3
Middle school	47	10
High School	36	13
<u>Medical</u>		
Dispensaries	18	26
Rural Health Centre	10	47

FUNCTIONAL TIERS IN RURAL SETTLEMENT HIERARCHY



Hospital	9	52
Maternity and Child Welfare Centre	11	43
Medical Practitioner	100	5
<u>Postal</u>		
Post office	148	4
Post & Telegraph Office	2	235

Total villages in the region which are habited 471

The weightages were multiplied by the number of facility X found at a village and added up to get the Amenity Index of that village.

These were then plotted against population size and A,B,C,D,E,F,G, level of villages identified which have a high or low population-size-Amenity Level combination. (Fig 4-1.

The A - G villages were plotted on the map (Fig 11) to identify the spatial distribution of these facilities. Chi Square test was used to identify the relation between prevalence of agriculture and household industry as occupations and level of social facility provided.

5.3

The largest settlements in greater than 1000⁰er

urban places (Group A) are seen to have the highest social facility index. These urban places again, do not have all the facilities but show a high number of schools at the primary, middle and high school level, medical care clinics, family planning centres and postal services. These places are the towns of Baghpat, Khekhra, Dankaur and Hodal. The towns which show a high school facility index are the industrial urban towns as Ghaziabad, Modinagar, Meerut, Faridabad, Ballabgarh and Falwal.

The B type settlements in the region are those which are of the population size 5500 to 7000 with a social facility index of 48 - 74. These villages are mostly in Ballabgarh, Panipat, Ghaziabad, Baghpat and Sonapat tehsils. These villages are at 1 mile distance from the Grand Trunk Road NHN 1, where Baghpat and Ghaziabad, Chaprauli (9664) Loni (5564) and Patta (7437) are at 6 miles distance to the Yamuna on the banks of the Hindan river. These villages are surrounded by villages of 2000-4999 size class which have no amenities in 1961.

The C type settlements are those which have 74-65 social facility index and a population size 2000 - 4999.

FLOODPLAIN OF THE NATIONAL CAPITAL REGION



ISOLINES SHOWING AREAS OF CONCENTRATION OF HOUSE HOLD
MANUFACTURING TERTIARY OTHER SERVICES WORKERS



NO WARRANTY OR REPRESENTATION
IS MADE BY THE UNITED STATES GOVERNMENT
AS TO THE ACCURACY OR COMPLETENESS OF
THE INFORMATION CONTAINED HEREIN

Again the tehsils of Ballabgarh, Sonapat, Panipat and Palwal with Delhi Union Territory have such villages. These villages are closer to the road and railway routes. In tehsil Panipat most of the villagers of the flood plain are of 1000-1999 size class, but the villages 2000-4999 which are larger in size class like Bahail (2514) Atah (3705) have a social facility index of 40-54.

The villages of 1000-1999 have a two tier division villages Group D with 50-65 amenity index and Group E 40-50 amenity index. Since the number of villagers with 50-65 Amenity ^{were} ~~was~~ only 6 and very few number they have been merged with the Index 40-50 Amenity level villages. E type villages are found mostly in Delhi and Sonapat. Anupshahr tehsil has two villages of Narora and Rajghat which depict these characteristics. The Barrage across the Ganga and the tourist attraction to this place could explain the feature.

In the flood plains of the Ganga & Yamuna, there is a marked difference in the amount of social facilities present. The villages and towns in the Ganga Flood plain have very few of the listed social facilities. Schools of all three stages

and rural health centres are found in the larger villages and the towns in the region.

The villages of the Yamuna flood plain on the other hand have two varieties of social amenities, those which cater to the roadways like motor and cycle repairs and shops selling food, and those that could indicate the status of the village like schools, hospitals, and postal services.

The identification of the location of villages with a minimum of 17 as amenity index are those which have a primary school and a medical practitioner. The villages which have facilities of greater than 100 are those with high school, hospital, rural health clinic and post and telegraph office. In this range according to population size 7 levels of villages have been identified. (Fig 4.2.)

5.4 Relationship between the level of Social facility and population size, distance from the nearest town and employment in agriculture, manufacturing and service functions.

The distribution of social facilities in relation

to population size of settlements as is seen in section 5.1 is related to the size of settlement only in villages which are near the road or railway or close to the town. It is also interesting to note that settlements of 500 - 999 and 1000 - 1999 also have a social facility index of 30-50.

The spatial distribution of the villages with a social facility index of greater than 30 and population size of higher than 1000 are all located ^{at 1 mile from} ~~near~~ the major roads and railway routes or at 1-2 mile distance from the town.

The relationship of population size and amenity index has another dimension of the fact that in the tehsils of the Haryana Sub-region, villages have at least a school a dispensary and a post office as the minimum social facility in all villages of greater than 1000 in population size. This situation results in almost all the villages close to the river having a minimum level of facility.

However in the Meerut-Bulendshahr region, social facilities are found only if the villages are greater than 2000 in population size. Again these

villages are oriented to the roads and railways and urban places as a result village remote from them are not provided with the amenity.

This phenomena is true about the villages along the Ganga where social facilities are almost absent in most villages or else a Rural Health Clinic or Maternity Centre are located.

Therefore, the villages near the river have mostly no facilities and even large settlements are not well supplied with amenities in this area.

When comparing the availability of social facilities with the population size of settlements the fact that amenities are higher in villages which are close to towns emerges. The following study of the employment structure in these villages reveals that following relationships.

Chi Square tests to define the relationship between employment and level of amenities clearly reveal the higher social facilities in villages where tertiary activities are higher. These villages as identified in Section 4.3 are mostly the large villages close to the urban places or mandi town.

The Chi Square values of the relationship between employment in agriculture, household, manufacturing and tertiary are as follows:

χ^2 % employment in agriculture	= 2.87	significant at 0.95 level but insignificant at 0.50 level which is = 3.30
χ^2 % total workers employed in manufacturing	= 3.2	significant at 0.95 level but insignificant at 0.50 level which is 3.34.
χ^2 % total workers employed in Household Industry	= 6.9	significant at 0.20 level but not significant at 0.10 level which is = 7.78.
χ^2 % total workers employed in Tertiary sector.	= 11.05	significant at 0.05 level but not significant at 0.01% level which is = 13.28.

As is evident the highest Chi Square value is that which establishes the relation between level of social facility and employment in tertiary activities.

The lowest and insignificant relationship between agricultural employment and social facility apart from being statistically not related explains the death of social facilities for settlements which are large in population size but low in amenities.

The villages where agriculture is the main occupation are on the Khadar lands along the river and often have population sizes of 2000-4999 persons. The low level of social facilities ^{have} made these villages unattractive for settlement.

Though the Chi Square value of household sector employment and social facility index are significantly related the villages where social facility index is high as also household employment are located mostly near Baghat and Tatiri towns.

Keeping in view the short comings of the Chi Square test in that it does not explain the nature of relationship the fact that two variable are significantly different which can be established from the contingency table is of value.

While carrying out this test villages with social facility of greater than 5 upto 70 were taken. This results in the total villages being

mostly of the 1000-4999 size class and greater than 5000 size class. In spite of the such selection the absence of any relationship between availability of social facility and employment in agriculture and household industries does indicate that it is only the urban oriented villages which are selected for the provision of higher order amenities like high schools, Dispensaries and Rural Health Clinics. These villages as is seen from Map II are all clustered in and around urban places.

From table 10 the hierarchy of amenities in the villages can be identified and Map 11 indicates their distribution.

The table reveals a systematic hierarchy of village having social facilities ranging from the facility of primary school, Post office and medical practitioner to selective facilities like Medical services and high schools in a few "Central Villages" with large population sizes.

The existing pattern of the location of these facilities reveals the problem of using size of villages alone as indicative of the villages which act as nodal points to surrounding villages. The large villages which fall into the category

of A & C level villages are situated at a maximum of 2 - 3 miles from the nearest town or 1 - 2 miles from the road. Apart from these villages are only 1 - 2 miles distant from each other and they are concentrated in one area.

In the villages of Ghaziabad and Ballabgarh tehsil, small villages close to the towns have higher social facility in them than the villages of larger population size located along the rivers.

5.5

The relationship between prevalence of social facilities population size and employment characteristics are as follows :

1. The social facility index as such is dependent on the extent to which a village is oriented to the town rather than the population size of the village.
2. Even in the villages with social facility index as 20 or more have only school and dispensary facilities which cater only to the village they are located in.
3. Tertiary services are higher in villages where social facilities are higher, whereas villages where agriculture is the dominant activity social facilities are absent.

CHAPTER - VI

(...) 'First the problem of social morphology - what kinds of social structures are there, what are their similarities and differences, how are they to be classified ? '
Radcliffe Brown

Conclusions

In this study of the characteristics of settlements in the flood plain region it was thought that a homogenous area with similar characteristics of terrain, problems of flooding, soil types as also khadar and bangar alluvial lands would reveal nearly similar demographic and employment characteristics in their settlements.

Further the fact that frequent water logging and scope of flooding would reduce the number of settlements close to the river and that the settlements that do exist in this area would have small populations size and be dependent only on agriculture or other activities for their livelihood.

From the foregoing analysis of the population size

growth rate and employment in primary sector, secondary sector and tertiary sector of villages in the flood plain of the Ganga and the Yamuna it is possible now to deduce the status of villages within this region.

Further, it is attempted to relate this to the location in the flood plain of the settlements, proximity to rail or road transport, and location near urban places in order to assess the extent to which villages change in their main activities.

It has been noted that along the flood plain of the Yamuna within the area which could be affected by flood and on the higher Khola area both and medium sized settlements of 200 - 499 and 500 - 999) population size are located. In the Ganga flood plain most of the settlements are of the (1000-1999) medium size class and very few settlements of the less than 500 size class are present.

Apart from these differences in size-class, growth rates of settlements are as high as 25 percent during 1951 to 1961 on both the flood plains with an average absolute increase in the same period of 230 to 300 persons in each settlement. The settlements of the 1000 to 1999 size class in the Yamuna and Ganga flood plain have a growth rate of 230

have employment in agriculture as 100 percent of total workers, they are mostly close to the river in both the flood plains and they have populations normally less than 300 persons.

The villages where agriculture employs 60 percent and household industries employs 15 percent and other services employ 25 percent are the villages which are located in the trans-Hindan tract and at 1 to 3 miles distance from the Yamuna. In the tehsils of Sikandrabad and Khurja too similar settlements are found. These settlements also exist in the Ganga flood plain in all the villages of the entire flood plain region.

The villages in both the regions which are close to Mandi towns or large villages and have good connecting roads have a decrease in the employment in household industries and an increase in other services sector.

The employment in villages of the household industries is higher mainly in production units of activities based on local resource. In the southern Ganga flood plain, pottery becomes an important household industry. Whereas in the area of Baghpat and Palwal tehsils, villages have more production units of rice and wheat milling and edible fat

The villages belonging to the first category are found in the flood plain where little or no direct urban influence on rural settlements in noticeable and agriculture is the main area where employment is higher.

In the Yamuna and Ganga flood plain the villages are mainly of this category, in the tehsils where urban population to total population is low and non farm workers to total workers is only 20 to 30 percent.

The second type of villages are found only in the Yamuna flood plain and that too only in such villages as are close to the rail and road routes radiating from the urban place. The Ganga flood plain does not have any similiar villages.

The number of villages with such a combination of employment are found mostly near industrial towns of the flood plain as in the Ghaziabad. Medinagar, and Meerut influence areas. Similiar situations are found in the villages surrounding the towns of Faridabad and Ballabgarh, and the area between Panipat, Sonapat and Alipur Block in Delhi Union Territory.

As regards the location of such settlements which

the flood plain by leaving the most affected areas to agriculture and farming and the development of mandi towns and urban industrial areas at 4-6 miles in the periphery of the flood plain. Along the Ganga however agricultural employment continues to dominate with new areas around towns with tertiary sector bias.

The villages with more workers employed in manufacturing have production units of bicycle and motor repair, iron and steel furniture making and wooden furniture as also hardware pipes and sanitary fittings.

Population size of settlements of 2000 and above are the only villages where social facilities are more. Moreover social facilities present in the villages are not really of the order that they cater to the surrounding villages as central villages with dependent settlements.

The conclusions of this study as enumerated above do allow the fact to be substantiated that the growth of urban industrial centres and transport links to serve the main towns and industrial areas of the flood plain impose a control on the nature of

production with tanning and leather works. The Ganga flood plain also has more units dealing with cotton, ginning, weaving and painting.

The change in employment pattern in 1951 to 1961 coverages on the fact that new areas of concentration emerge which are mostly of tertiary sector orientation.

The increase of non farm manufacturing activities in the Yamuna flood plain coverage in the time period and cross sectionally in the flood plain as between major towns - along rail and road routes and at 2-3 miles from the river.

The areas within 1-2 miles of the river remain in the same state as in 1951 of having 60-70 percent in agriculture. However in 1961 there are concentrations of 90 percent in agriculture only in a few villages.

The increase of population by 20 percent in the same time period and the shift to non farm tertiary activities within the village assuming high migration trends does indicate that the Yamuna flood plain has fairly counteracted the problem of using

activities in the villages and superimpose a new mosaic of activities on the existing pattern. This modification so as to say results in the light of an urban bias and the villages tend to become dependent on the town for its economy.

The villages which are not thus influenced remain outside this 'new economy' and carry on the functions of villages in an agricultural area. The coexistence of these two types with an effectively physical homogenous region bears relevance in deciding whether the planning for this region similar to the remaining areas of the National Capital Region () radial corridor plan would increase the gap between rural and so called semi rural and urban places.

These questions that emerge in the light of this study but are fairly well established in studies of the National Capital Region economy. However, an intensive and in depth studies of the villages themselves which within the flood plain have transformed their activities would contribute much to understanding the process of change.

Human adjustment studies too would prove to be vital for any further work on flood plain planning

for the preferences and the nature of adjustment to the flood affected areas in the two regions are unique.

It is however obvious that the secondary level data available on rural settlements is hardly sufficient to infer the reality of adjustment and transformation of settlements. Yet it is helpful in indicating the possible areas where investigation could be carried out in greater depth in the identified the villages which are unique and display characteristics of change and adaptation.

BIBLIOGRAPHY

STUDIES OF FLOOD PLAIN AND FLOOD HAZARD

(A) FLOOD PLAIN AND HUMAN RESPONSES

1. C.W.P.G., HIGH LEVEL COMMITTEE
ON FLOOD (1957).
2. Chaturvadi. B.N., ALLUVIAL MORPHOLOGY OF
THE UPPER GANGA YAMUNA
DOAB.
Deccan Geographer (1964).
3. Dasgupta. S.P., REPORT ON THE UPPER
GANGA KHADAR
National Atlas Organisation.
4. Eckstein. O., WATER RESOURCE DEVELOPMENT.
The Economics of Project
Evaluation & Cambridge, Mass.
Harvard University
Press (1958).
5. James. LD, Lee R.L., ECONOMICS OF WATER RESOURCE
PLANNING
Mcgraw - Hill Book
Company (1971).
6. Kates. R.W., HAZARD AND CHOICE PERCEPTION
IN FLOOD PLAIN MANAGEMENT
CHICAGO
The University of Chicago
Press, Department of Geography
Research Paper 78 (1962).
7. Murphy. F.S., REGULATING FLOOD PLAIN
DEVELOPMENT CHICAGO.
Department of Geography
Research Paper 56 (1958).

8. Ramachandran. R,
and Thakur. S.G., HUMAN PERCEPTION AND
ADJUSTMENT TO FLOOD HAZARD
IN THE GANGA FLOOD PLAINS
- Paper read at the 22nd IGU
Commission on Man and
Environment (1972).
9. White. G.F., CHOICE OF ADJUSTMENT TO
FLOODS CHICAGO.
- The University of Chicago
Press, Department of
Geography
Research Paper 93 (1964).
10. White. G.F., CHANGE IN HUMAN OCCUPANCE
OF FLOOD PLAINS IN THE
UNITED STATES
- University of Chicago Press
Department of Geography
Research Paper 57 (1958).
11. Mathur. R.N., STUDY OF GROUND WATER
HYDROLOGY IN MEERUT DISTRICT
(U.P.)
- Meerut University
Research Paper (1969).

(B) STUDIES ON THE GANGA YAMUNA DOAB

1. Mukherjee. A.B., AGRICULTURAL GEOGRAPHY OF
UPPER GANGA YAMUNA DOAB.
- Indian Geographer
Vol. 3 No. 1 (1957).
2. T C P O Report NATIONAL CAPITAL REGION
1967-73-74 .
3. Land Revenue Office NIRMAL AKIAT
Delhi Administration
Village Settlement
records (1945).

4. High Level Committee
on Floods

NATURE OF FLOOD PROBLEM
IN INDIA

Government of India
Ministry of Irrigation
and Power (1957).

5. Udai. P. and
Trivedi. G.,

FACTOR ANALYSIS OF THE
ECONOMIC STATUS OF FARMERS
IN INDIA

Case study of DMR.
Rural Sociology Vol 10 (1969).

(c) RURAL STUDIES

1. Ahmad Enayat

THE RURAL POPULATION OF
BIHAR GEOGRAPHICAL REVIEW

LI No. 2 (1961).

2. Inamdar. O.D., and
Reise. A.J.,

CHARACTERISTICS OF RURAL
AND URBAN COMMUNITIES

New York (1956).

3. Kayasthan. S.L.,

HUMAN HABITATIONS IN THE
HIMALAYAN BEAS BASIN

The Indian Geographer
Vol. IV No. 2 December
(1961).

...

4. Karn. R. PATTERN OF URBAN GROWTH IN LOWER WEST BENGAL.
Geographical Review of India
Vol. 24 No. 3-4~~1962~~ (1962)
5. Berry. B.J.L. MARKET CENTRES AND RETAIL DISTRIBUTION.
Eaglewood Clifton And Co. (1967)
6. Singh R.L. ed INDIA REGIONAL STUDIES
21st I.G.U. (1968)
7. U N E S C O SOCIAL RESEARCH PROBLEMS OF RURAL DEVELOPMENT IN SOUTH EAST ASIA (1970).
8. Weintraub, RURAL PERIPHERY, SOCIAL CENTRES AND THEIR INTERACTION IN THE PROCESS OF AGRARIAN DEVELOPMENT.
Rural Sociology 35.
A comparative analytical framework (1970)

D) METHODOLOGY

1. Yeates STATISTICAL METHODS FOR THE GEOGRAPHER.
2. Cole and King QUANTITATIVE GEOGRAPHY
3. Emerson JA and Fitzgerald B.P. SETTLEMENT GEOGRAPHY :
Concepts in Geography (1969)
4. Tayne P and Newby M TECHNIQUES IN GEOGRAPHY.
Macmillian (1969).
5. Carter H A STUDY OF URBANIZATION.
Arnold (1970)