# ASSESSMENT OF SPATIAL DISTRIBUTION OF POVERTY AND LAND USE/LAND COVER: A CASE STUDY OF DELHI

**Dissertation submitted to Jawaharlal Nehru University in partial fulfillment of the requirements for the award of the degree of**

**MASTER OF PHILOSOPHY**


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# DECLARATION

I, Sunita Kumari, declare that the dissertation entitled, '**ASSESSMENT OF SPATIAL DISTRIBUTION OF POVERTY AND LAND USE/LAND COVER: A CASE STUDY OF DELHI'**; submitted at the Jawaharlal Nehru University in partial fulfillment of the requirement for the award of the degree of MASTER OF PHILOSOPHY, is my bonafide work. The dissertation has not been submitted for the award of any degree of this or any other university.

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# CERTIFICATE

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

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**Dedicated**

**To**

**My loving and affectionate parents**

**My mother Mrs. Vimala Devi and my father**

**Shri. Rajendra Kumar, who always guided me**

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# CHAPTER 1

# INTRODUCTION

## 1. Background

In recent years we have witnessed a revolution in mapping the distribution of poverty. This revolution has been made possible by a number of important breakthroughs. Increasingly, major household survey efforts are being undertaken with an explicit spatial framework, making it easier to merge survey results into geographic databases. The computer technology that drives Geographic Information Systems (GIS) has become simpler to use as well as more powerful, making it easier for people to create maps and spatial databases out of information that otherwise would remain as tables of numbers[1].

In academics, as well as among policy-makers, poverty has been a major issue for debate. The debate became politicized with the "garibi hatao" campaign of the seventies and took it out of the confines of an economic problem. Not surprisingly, there seems to be no consensus regarding either its extent, or the nature of the mechanisms necessary to get rid of it. Nevertheless, all agree that poverty continues to be an important issue that needs to be tackled[2].

High poverty levels are synonymous with poor quality of life, deprivation, malnutrition, low literacy and low human resource development. The eradication of poverty has been an integral component of the strategy for economic development in India. The Planning Commission has been estimating the incidence of poverty at the national and state levels using the methodology contained in the report of the expert group on the poor (Lakdawala committee) and applying it to consumption expenditure data from the large sample surveys on consumer expenditure conducted by the NSSO at five-year intervals. According to the estimates of the Planning Commission, in 1999-2000, Delhi had 8 percent population below poverty line[3]. If we take this percentage to calculate the absolute number, it comes to around 1102638 (eleven lakh).

Studies of poverty have shown that people own conceptions of disadvantage often differ from those of professional experts. Great value is attached to qualitative

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[1] Center for International Earth Science Information Network (CIESIN) (2006), Where the poor are -Atlas of poverty, The Earth Institute at Columbia University, New York

[2] Gangopadhyay, S. (2002) Issues of poverty in India, ICRA bulletin, money and finance : 32-44

[3] Kumar, N. and Aggarwal, S.C.(2003) Patterns of Consumption and Poverty in Delhi Slums, Economic and Political Weekly, Vol. 38(50): 5294-5300

dimensions such as independence, security, self-respect, identity, close and non-exploitative, social relationships, decision-making freedom and legal and political rights. More generally, there has been a widening of the debates on poverty to include more subjective definitions such as vulnerability, entitlement and social exclusion. These concepts have been useful for analyzing what increases the risk of poverty and the underlying reasons why people remain in poverty. Vulnerability is not synonymous with poverty, but refers to defenselessness, insecurity and exposure to risk, shocks and stress. Vulnerability is reduced by assets, such as: human investment in health and education; productive assets including houses and domestic equipment; access to community infrastructure; stores of money, jewellery and gold; and claims on other households, patrons, the government and international community for resources at times of need.[4]

Entitlement refers to the complex ways in which individuals or households command resources which vary between people over time in response to shocks and long-term trends. Social exclusion is seen as a state of ill-being and disablement or disempowerment, inability which individuals and groups experience. It is manifest in 'patterns of social relationships in which individuals and groups are denied access to goods, services, activities and resources which are associated with citizenship[5].

This study intents to focus on spatiality of poverty and its interactions with prevailing land use/physical characteristics of landscape by using socio-economic data and earth observation datasets respectively. Once interactions are identified then attempt will be made to see historical and institutional intervention to address various dimensions of poverty.

Poverty estimates gives idea of inequalities over period of time, they tell us little about spatial distribution. The first step is to understand *who* the poor people on basis of deprivation criteria (specially based on livelihood approach) this information already begins to segment a poor population. *What* types of services they access and *why* they do? *What* landscape element they interact with, for example which social scheme they have access to, do they often visit service facility .The third element is *how to* target poor

[4] Wratten, E.(1995) Conceptualizing urban poverty in IIED, urban poverty: characteristics, causes and consequences, Environment and Urbanization, Vol. 7 (1)

[5] ILO, (1996) Social exclusion and anti-poverty strategies, research findings on the patterns and causes of social exclusion and the design of policies to promote integration, ILO, Geneva

more efficiently . *Who* the poor people are, what they access and *how* they are reached are known, and then further research can be done to find *where* people with poverty are located. So, big question is *where* do they live? This can be mapped with the help of location aware technologies that allow the collection of location information. The survey based data can be aggregated at administrative local (say municipal ward) or a specific cluster for targeting a social scheme.

Poverty related layers (generated in GIS environment) can also be overlaid with high resolution land use land cover , distribution networks, location of social facility centers, health centers, GRC's, JJ clusters and other layers of social importance for spatial analysis. For doing so, in modest way is integration of earth observation technologies along with ground based BPL survey and geographical information system all on single common platform. This will enable decision makers to take objective, effective and transparent decisions.

## 1.2 STUDY AREA

Delhi is located at 28° 37'N , 77°14'E , 28.61°N and 77.23°E as geographic extent, and lies in northern India. It borders the Indian states of Uttar Pradesh on East and Haryana on West, North and South. Delhi lies almost entirely in the Gangetic plains. Two prominent features of the geography of Delhi are the Yamuna flood plain and the Delhi ridge. The low-lying Yamuna flood plains provide fertile alluvial soil suitable for agriculture. However, these plains are prone to recurrent floods. Reaching up to a height of 318 m (1,043 ft), the ridge forms the most dominating feature in this region. It originates from the Aravalli Range in the south and encircles the west, northeast and northwest parts of the city. Yamuna, a sacred river in Hinduism, is the only major river flowing through Delhi[6].

[6] Yadav, C.S. (1979) Land use in big cities: A study of Delhi, : 272, Delhi: Inter-India Publications

### 1.2.1 Municipal areas

The National Capital Territory, Delhi (NCTD) area consists of the following three Municipal areas-

(i) New Delhi Municipal Corporation (NDMC)

(ii) Municipal Corporation of Delhi (MCD) area,

(iii) Delhi Cantonment

(i) **New Delhi municipal corporation (NDMC)** area at the core. This is the imperial Delhi spread over an area of 42.74 $km^2$ which was established in 1911. It comprises of government Offices & residential areas and commercial nodes with wide roads, parks and open spaces etc. The NDMC area is administered by an 11 member council comprising 3 MLA's; five government officers and 2 civilians nominated by Central Government; and a chairperson appointed by Central Government. The Council reports directly to Central Government.

(ii) **Municipal corporation of Delhi (MCD)** area, occupying 1397 sq. kms, or most of the area of the city. The MCD further comprises the following areas:

(a) Old Delhi comprising of the walled city (Shahajahanabad) and densely built up areas between the Red Fort and the New Delhi Railway Station on the periphery;

(b) Civil lines along the Ridge and Delhi University area in the North with large plots and open spaces;

(c) New colonies, which have come up in last 50 years on the Southern and Western sides;

(d) New development across the Yamuna River comprising of Shahadara in the North, Patparganj & Mayur Vihar in the South;

(e) 728 squatter settlements spread over an area of 9.68 $km^2$ all over the NCT

(f) Around 185 villages in outer Delhi area and 135 urban villages characterized by haphazard development with marginal municipal services etc. (outer Delhi is included in MCD limits and accounted for in the MCD area).

The MCD is administered by elected council comprising ward councilors from each of the 137 wards (as per 2001 Census) in the area. The MCD reports directly to the Central Government. As per MCD 2009, there are 272 wards excluding defense residential area.

(iii) **Delhi cantonment** area between the Airport and the NDMC area, spread over an area of 42.97 $km^2$. The cantonment area is administered by the Delhi Cantonment Board (DCB), which reorts directly to the Central Government (Ministry of Defence). The growth rate of population in the subsequent four decades has also been more rapid than that of any other metropolitan city. The rapid growth rate has been due to large migration mainly from Uttar Pradesh, Haryana and Punjab. Delhi's present population includes, however, besides predominantly Hindi and Punjabi speaking elements, large numbers of speakers of other Indian languages and an international community of considerable size[7].

**Table 1.1: Municipals areas of Delhi**

| Constituents | Total Area in $km^2$ (2001) | Total Population in '000 | |
|---|---|---|---|
| | | 1981 | 2001 |
| MCD AREA | 1397.3 | 6899 | 11244 |
| Walled City Area | 11.6 | 582 | 570 |
| Walled City Extension | 23.0 | 568 | 624 |
| Rest of MCD Area (including Urban Extn. and Rural areas) | 1362.7 | 3768 | 8049 |
| NDMC AREA | 42.7 | 496 | 587 |
| DELHI CANTONMENT BOARD | 43.0 | NA | NA |
| NCTD AREA | 1483 | - | - |

Source: (i) Master Plan of Delhi-2001 & 2021; (ii) Status Report for Delhi-21, Delhi Urban Environment and Infrastructure Improvement Project (DUEIIP), January 2001

### 1.2.2 Unplanned areas

The unplanned areas of the city include Slum and JJ Clusters, Resettlement colonies, unauthorized colonies and urban villages. The section below presents in detail the status of unauthorized colonies and urban villages[8].

**(I) Unauthorized colonies**

The large scale land acquisition by DDA, unregulated growth of urban fringes and housing shortage are the genesis of unauthorized colonies in Delhi. There are around 1432 unauthorized colonies providing shelter to around 30 lakh people. In the past unauthorized colonies have being regularized only twice in Delhi. Once in 1961 when

[7] Nath, V. (2003) Planning for Delhi, Centre for Policy Research, New Delhi, GeoJournal, Vol.29(2):171-180

[8] City development plan, (2006) Department of Urban Development, Government of Delhi

over 100 colonies were regularized and last time in 1977 when around 600 colonies where regularized. Affluent unauthorized colonies included Sanik Farm; Anant Ram Dairy (near RK Puram), Mahendru Enclave (near Model town); other colonies include Zakirnagar, Jamianagar, Anand Parbat, Khanpur Extension, Viswas Nagar, Bawana, Madanpur Khader etc .Around 1000 unauthorized colonies are on private land developed by builders.

The infrastructure status in these colonies is marginally better than slums. No metalled road exists in any of these colonies, nor is there a provision of sewer lines and other facilities.

**(II) Urban villages**

165 urban villages and 52 census towns form part of the National Capital Territory of Delhi (NCTD). These urban villages have undergone significant physical and functional transformation related to their specific location. Villages are characterized by a mix of different land uses and have similarities in compact built-up form, narrow circulation space and high density developments. These mainly accommodate residential, commercial, industrial and mixed uses. These areas, established with identified uses, continue to play an active economic role.

**(III) Squatter Settlements/ JJ Clusters**

The squatter settlements are encroachments on mainly public land. As such these are illegal clusters (JJCs) and are devoid of any legal entitlements. However, efforts have been made by the government to extend basic social and environmental services to them.

The spread of JJ clusters ranges from a plot of 0.4 acres with 8 JJs to JJCs as large as 50 acres with 10,000 households & 45000 population. The average number of JJ per acre comes to 200 with 193 being the lowest (Nazafgarh area) and 206 the highest (Gole Market and Kalkaji areas). The average area of JJ is $20m^2$. Some of the major area with such concentrations is given below-

**A) High concentration:**

(a) Minto Road/Gole Market/Matia Mahal (129 clusters, 43388 JJs, 215.08 acres)-NDMC Area

(b) Badarpur/Tulaqabad/Saket (79 clusters, 64187 JJs, 79 acres)-MCD Area

(c) Moti Nagar/ Patel Nagar/Rajendra Nagar (72 clusters, 35,427 JJs, 175.45 acres) - MCD Area

(d) Jahangirpuri/Adarsh Nagar/Model Town/Wazirpur (117 clusters, 71538 JJs, 356 acres) -MCD Area

(e) Badli/Shahbad-Daulatpur (21 clusters, 27,551 JJs, 137.70 acres) -MCD Area

**B) Medium concentration:**

(a) Delhi Cantonment/Janakpuri/Tilak Marg (17 clusters, 18,982 JJs, 95.03 acres) MCD Area

(b) Bishwas Nagar/ Shahdara/Babarpur (44 clusters, 18915 JJs, 88.91 acres) - MCD Hauzkhas/RK Puram (52 clusters, 14110 JJs, 70.22 acres)-NDMC Area

**C) Low concentration:**

(a) Nazargarh/Nasirpur/Palam (11 clusters, 363 JJs, 1.83 acres)-MCD Area

(b) Sarojini Nagar/Kalkaji/Malaviya Nagar/Ambedkar Nagar/ Kasturba Marg (45clusters, 11,802 JJs, 68.42 acres)-NDMC Area

**Table 1.2: Status of JJ Clusters in Delhi**

| YEAR | JJ CLUSTERS | JHUGGI HHS | AREA IN HA | POPULATION |
|---|---|---|---|---|
| 1951 | 199 | 12749 | 21.1 | 63745 |
| 1973 | 1373 | 98483 | 164.1 | 492415 |
| 1983 | 534 | 113000 | 188.3 | 565000 |
| 1990 | 929 | 259000 | 431.7 | 1295000 |
| 1997 | 1100 | 600000 | 902.1 | 3000000 |
| 2001 | 728 | 429662 | 650.2 | 2148310 |

Source: Slum Department, Municipal Corporation of Delhi, Delhi

About 49 thousand slums were estimated to be existence in urban India in 2008-09, 24% of them were located along *nallahs* and drains and 12% along railway lines[9]. The sanitary conditions in the slums in terms of latrine facility during 2008-09 showed considerable improvement since 2002. Latrines with septic tanks (or similar facility) were available in 68% notified and 47% non-notified slums (up from 66% and 35% respectively in 2002). At the other extreme, 10% notified and 20% non-notified slums (down from 17% and

[9] NSSO 64th round report: Some Characteristics of Urban Slums, 2008-09

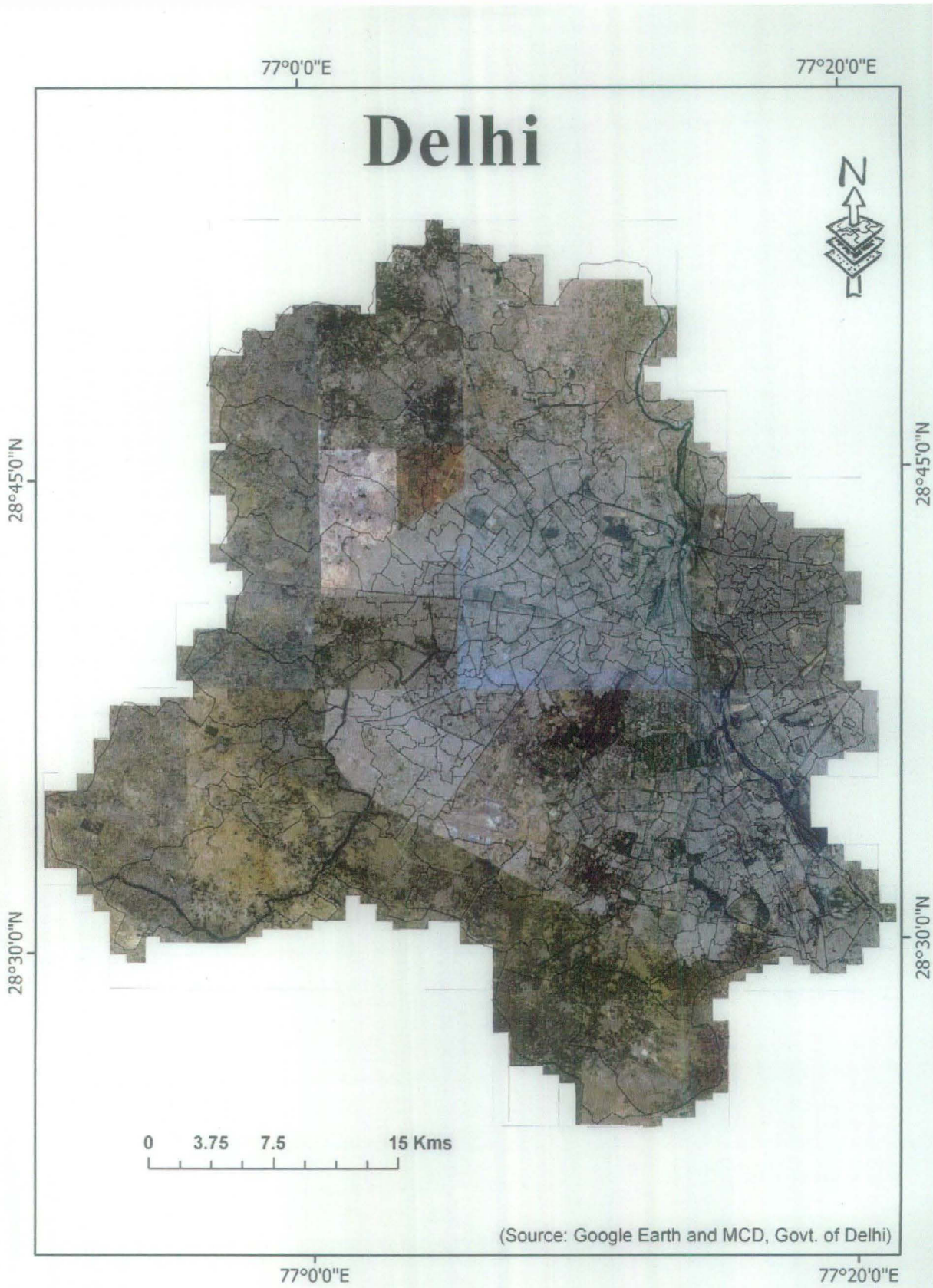


**Figure 1.1: Geographical area of Delhi**

51% in 2002) did not have any latrine facility at all. In Delhi 18 notified and 35 none notified slums were surveyed. Delhi has 6.4 % share of slums in India[10].

**Table 1.3: Distribution of slums by location of slum (per 1000)**

| | Fringe area | | | | | | other area | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| State/ UT | nallah /drain | Rail line | R. bank | R,bed | others | all | nallah /drain | rail line | R.bank | R.bed | others | all | Esti no. of slum | sample |
| Delhi | 71 | 41 | 0 | 0 | 114 | 233 | 191 | 60 | 0 | 0 | 516 | 767 | 3133 | 53 |

Source: NSSO 65th round report: Some Characteristics of Urban Slums, 2008-09

R.bank-along river bank, R.bed- along river bed, nallah- along nallah/drain

## 1.3 STATEMENT OF THE PROBLEM

Studies on urban poverty in India from last forty years are relatively few and are usually focused on unemployment issues or discussions on deprivations in slum areas in terms of infrastructure and services, without conceptualizing poverty directly. Earlier studies were concerned with employment and labor relation issues, focusing on the strength or weakness of the trade unions and other social ties in protecting workers basic rights. Studies in the 1990s mainly by planners and architects focused more explicitly on access of the poor to services and housing infrastructure, and concluded that discrimination was still prevalent the basis of caste, class and regional identities. The strength of these studies in connecting poverty to employment and living conditions is that illustrate the ways in which lack of infrastructure and services, political structure , and hierarchical labor relations influence people' social and economic mobility[11]. The weakness is that these studies utilize data at national or state level, and do not dis-aggregate to the city or within city level, and are currently ignored by most economists. Very few studies have been attempted any district level analysis. Again, most of them were based on a small segment of the country.

There are many problems using the National Sample Survey (NSS) Consumer Expenditure Survey (CES) data for district-level poverty estimates in its entirety based on the NSS 1999-2000 (55th round) survey [12].But the main bottleneck that refrained

[10] Ibid

[11] Kundu, A. and Mahadevia, D. (2002) Poverty and vulneralibility in globalizing metropolis Ahmedabad, New Delhi: Manak publishers

[12] Sastry, N. S. (2003) District Level Poverty Estimates: Feasibility of Using NSS Household Consumption Expenditure Survey Data, Economic & Political Weekly: 409-412

researchers from generating sub-state or district-level estimates from NSS data was the nature of sampling design. It was only in the 61st round survey of NSS (2004-05) that the sampling design defined rural and urban parts of districts as strata for selection of sample villages and urban blocks respectively. The two-stage stratified sampling design followed in NSS surveys prior to its 61st round (2004-05) did not use districts as strata in the urban sector and thus allowed generation of unbiased estimates of population parameters at most at NSS region level. This has paved the way for generating unbiased estimates of important socio-economic parameters at the district-level adequately supported by the sample design[13].

## 1.4 OBJECTIVES

1) Development of an index for identification of hot spots of poverty.

2) Assessing the spatial distribution & extent of poverty at ward level.

3) Assessing the spatial interactions between poverty and land use/land cover.

4) Explore the possible interventions to reduce poverty and policy implications.

## 1.5 RESEARCH QUESTIONS-

1) Is there any locational (geographical) influence on the spatial distribution of poverty?

2) Is built up area as a proxy indicator of urbanization has any relation with the incidence of poverty?

3) Is there any relation between high proportion ST/SC/Muslims population in total population and high levels of poverty in certain municipal wards?

4) Is spatial clustering of poverty is significantly associated with the spatial availability and access to basic amenity and infrastructure in municipal wards?

## 1.6 DATA BASE

1) BPL survey data 2008-09 conducted by Mission Convergence, Government of Delhi.

2) Earth observation data of Landsat TM for September 22, 2009.Landsat 5 carries the TM and has provided continuous coverage from 1st March 1984 till date. The satellite orbit at an altitude of 705 km and has 16 days revisit. The Landsat TM designed and operated to collect data over a 185 km swath. The wavelength range for the TM sensor is

[13] Chaudhari, S.and Gupta, N.(2009) levels of living and poverty patterns: a District-Wise analysis for India

from the visible, through mid-IR, into the thermal-IR of electromagnetic spectrum. The sensor has a spatial resolution of 30 meters for bands 1 through 5 and band 7, and a spatial resolution of 120 meters for band 6.

3) Generation of spatial data: Boundary layer for NCT from Topographical sheets from SOI, Municipal ward boundaries from MCD. All 272 existing MCD wards in 2009 plus eight Delhi contentment area wards were vectorised along with names of the wards.

## 1.7 METHODOLOGY-

In our study we are using three methodologies-

1)Principal component analysis with the help of it by using certain variables we will construct an index "principal component index" to identify "Hot Spot of poverty" in electoral wards. Principal component is a type of factor analysis, based on a statistical technique for reducing a given number of variables by extracting a linear combination which best describe these variables and transforming them into one index. This index of poverty or marginality, as it is often called, depending on the variables employed can provide a multidimensional community-level poverty indicator. The first principal component, the linear combination capturing the greatest variation among the set of variables, can be converted into factor scores, which serve as weights for the creation of the marginality index. For a poverty map the method requires census/ survey data at any level of political or geographical aggregation (from the household to the state level).

On the basis of this index we will do poverty mapping on ward level for Delhi with the help of GIS technique.

2)To assess the Land-use and Land-cover of Delhi satellite image of Delhi has been used and The Geographic Information System (GIS) and Remote Sensing (RS) tools have been applied to find out the land use / land cover in the National capital in 2009 with the help of supervised classification (Gaussian maximum likelihood classification).

3) For our 3$^{rd}$ objective analysis for interaction and patterns emerging from physical characteristics and poverty, the spatial analysis and functionality tools of ArcGIS will be explored.

## 1.8 ORGANIZATION OF STUDY

The study has been divided in six chapters.

The first chapter is an introduction, which includes statement of problem, objectives, research question, data base, and methodology and research design.

The second chapter contains an overview of the literature that highlights the approaches towards poverty, factors those are responsible for poverty, measurement of poverty, issues regarding poverty, studies about land use /land cover, poverty mapping, use of remote sensing and GIS, social vulnerability.

The third chapter deals with assessments of spatial distribution and extent of poverty, poverty mapping at ward level with the help of index by integrating BPL census data in ArcGIS environment.

The fourth chapter includes the land use/land cover analysis of Delhi for 2009, where area under each type of land use/land cover has been calculated.

The fifth chapter looks in the interactions between land use/land cover and spatial distribution of poverty at ward level.

The sixth chapter summarizes the study and ends with a conclusion.

# CHAPTER II

# LITERATURE REVIEW

## 2.1 Background

To get insight into the understanding of poverty, current issues related to poverty like measurement of poverty, ways to measure poverty, determinates of poverty, spatiality of poverty and for related issues, literature review has been undertaken. It has given scope to understand required indicators for poverty assessment and possible interaction with locational aspects. For doing this review has been divided in nine sections, namely- Defining poverty, Approaches towards poverty, Factors of poverty, Measurement of poverty, Issues of poverty, Spatiality of poverty, Land use and land cover, Remote sensing and GIS and Social vulnerability.

## 2.2 Defining poverty

Various scholars have given various definitions of poverty. Poverty is experienced differently according to social, gender, age and occupational groups. Process of impoverishment need to be disaggregated to show such differences (World Bank, 1995)[14] Poverty is the shortage of common things such as food, clothing, shelter and safe drinking water, all of which determine our quality of life. It may also include the lack of access to opportunities such as education and employment which aid the escape from poverty and/or allow one to enjoy the respect of fellow citizens[15]. According to Mollie Orshansky who developed the poverty measurements used by the U.S. government, "to be poor is to be deprived of those goods and services and pleasures which others around us take for granted." Ongoing debates over causes, effects and best ways to measure poverty, directly influence the design and implementation of poverty-reduction programmes and are therefore relevant to the fields of public administration and international development[16]. Conventional definitions of poverty refer to a national poverty line[17]. This is measured either as a minimum flow of real income per capita, or as

[14] World bank (1995) Kenya: poverty assessment, report no. 13152-KE, population and human resources division,Eastern Africa department ,Washington D.C.
[15] Mead, L. M. (1994) Poverty: How Little We Know, The Social Service Review, Vol. 68( 3) : 322-350
[16] Simler, K. R.(2007) Poverty comparisons with absolute poverty lines, Estimated from survey data, Poverty Reduction Group, The World Bank, Washington, DC Department of Agricultural Economics, Purdue University, West Lafayette, Indiana Review of Income and Wealth Series 53(2) :1475-4991
[17] Gillie, A. (1996) The Origin of the Poverty Line ,The Economic History Review, New Series, Vol. 49(4): 715-730

a bundle of 'basic needs', which may be quantified. People are considered poor when they are unable to satisfy their basic needs for food, clothing, shelter, and health[18].

Poverty is usually measured as either absolute or relative poverty (the latter being actually an index of income inequality). Absolute poverty refers to a set standard which is consistent over time and between countries. An example of an absolute measurement would be the percentage of the population eating less food than is required to sustain the human body (approximately 2000-2500 calories per day for an adult male). The World Bank defines extreme poverty as living on less than US $1 (PPP) per day, and moderate poverty as less than $2 a day, estimating that "in 2001, 1.1 billion people had consumption levels below $1 a day and 2.7 billion lived on less than $2 a day." The proportion of the developing world's population living in extreme economic poverty fell from 28 percent in 1990 to 21 percent in 2001. Looking at the period 1981-2001, the percentage of the world's population living on less than $1 per day has halved[19].

At the all discourses on poverty is the notion of a poverty line: a threshold of income, consumption, or, more generally, access to goods and services below which individuals are declared to be poor[20]. In India poverty is defined in terms of income, expenditure and nutritional value (calorie intake).social dimension of poverty is a neglected area in study poverty therefore poverty is a complex phenomenon of many dimension not merely the economic dimension[21].

A classic definition of poverty is 'the inability to attain a minimal standard of living' measured in terms of basic consumption needs or the income required for satisfying them. Poverty is thus characterized by the failure of individuals, households or entire communities to command sufficient resources to satisfy their basic necessities. Consumption based poverty lines are primarily concerned with physical measures of well

[18] Lakshman,Y. (1996) What Causes Poverty? A Postmodern View, Annals of the Association of American Geographers, Vol. 86, No. 4: 707-728 Published by: Taylor & Francis, Ltd. on behalf of the Association of American Geographers

[19] Meenakshi, J.V. and Viswanathan,B.( 2003) Calorie Deprivation in Rural India, Economic and Political Weekly, Vo.38:25-31

[20] Ray,D.(1998) Development of economics, Princeton university press

[21] Yesudiann, C.A.K. (2007) Poverty alleviation programmes in India: A social audit, Tata Institute of Social Sciences, Mumbai, India. Indian J Med Res 126: 364-373

being. The inability to attain minimal standards of consumption to meet basic physiological criteria is often termed absolute poverty or deprivation. It is most directly expressed as not having enough to eat or as hunger or malnutrition. This has been linked to income/consumption measures of poverty[22].

Income based definition of poverty have been widely criticized as being too narrow, especially in the developing country context. The human Development index is an important attempt to broaden the range of indicators while retaining the advantages of quantification and international comparability, it draws on a bundle of indicators referring to general standards of health, education, and wealth which may be used to indicate general levels of development[23].More recently poverty has been seen to encompass deprivation of basic capabilities, which in turn entails dispossession of health, education, participation in development, and the environment[24]. This has been recognized in the Millennium Development Goals (MDGs), wherein human development is central to economic growth and well being. In fact the manifestations of poverty are multifaceted. These include child malnutrition, infant and child mortality, illiteracy, inadequate sanitary conditions, and voicelessness of the poor. Poverty is fundamentally about exclusion from social participation, possessions and a decent quality of life. The term poverty can thus be used as a narrower economic notion of a low level of material consumption[25]. Thus poverty is not simply insufficient income, but an interdependent web of a lack of basic capabilities Poverty is defined as a situation where command over resources falls below a certain level[26].

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[22] Gauci, A. (2006) Targeting & mapping poverty,United Nations Economic Commission for Africa, poverty and social policy team, Economic and social policy division

[23] Ravallion, M. and Lokshin M.(2006) Testing Poverty Lines,Review of Income and Wealth, 52(3), 399–422

[24] Sen, A. (2001) capabilities: the Concept and its Operationalization, Working Paper no 66, Queen Elizabeth House, U.K.

[25] Hesselberg, J. (1997) Poverty in the South and in the North,Geografiska Annaler. Series B, Human Geography, Vol. 79(4): 227-241

[26] Goedhart,T., Halberstadt,V.and Praag,K.(1997) Bernard van The Poverty Line: Concept and Measurement , The Journal of Human Resources, Vol. 12(4): 503-520

## 2.3 Approaches towards poverty

There are mainly four approaches toward poverty[27].These are-

1. Monetary approach,
2. Capability approach,
3. Social exclusion, and
4. Participatory approach.

Monetary approach is the most commonly used. It identifies poverty with a shortfall in consumption (or income) from some poverty line, all measured in monetary values. The valuation of the different components of income or consumption is done at market prices, which requires identifications of the relevant market and imputation of monetary values for those items that are not valued through the market, such as subsistence production and in principle, public goods. Monetary poverty is arguably better measured by consumption data as this approximate welfare more closely than income.

According to Sen (1976), who pioneered capability approach, development should be seen as the expansion of human capabilities, not the maximization of utility or its proxy, money income. The capability approach rejects monetary income as its measure of well-being, and instead focuses on indicators of the freedom to live a valued life. In this framework, poverty is defined as deprivation in the space of capabilities, or failure to achieve certain minimal or basic capabilities, where basic capabilities are the ability to satisfy certain crucially important functioning up to certain minimally adequate levels[28].

The concept of social exclusion was developed in industrialized countries to describe the processes of marginalization and deprivation that can arise even in rich countries with comprehensive welfare provisions. It was a reminder of the multiple faces of deprivation in an affluent society. Conventional poverty estimates, including both monetary and capability estimates have been criticized for being externally imposed and

[27] Laderchi, R.C., Saith, R. and Stewart (2003) Does it matter that we do not agree on the definition of poverty? A comparison of four approaches, oxford development Studies, Vol.31(3): 244-274

[28] Sen, A. (1976) Poverty: an ordinal approach to measurement, Econometrica,Vol. 44:219-31

for not taking in to account the views of poor people themselves. The participatory approach pioneered by chambers aims to change this and get people themselves to participate in decisions about what it means to be poor and the magnitude of poverty [29]. There is no consensus on a definition of urban poverty but two broad complementary approaches are prevalent: economic and anthropological interpretations. Conventional economic definitions use income or consumption complemented by a range of other social indicators such as life expectancy, infant mortality, nutrition, the proportion of the household budget spent on food, literacy, school enrolment rates, access to health clinics or drinking water, to classify poor groups against a common index of material welfare. Alternative interpretations developed largely by rural anthropologists and social planners working with rural communities in the third world allow for local variation in the meaning of poverty, and expand the definition to encompass perceptions of non-material deprivation and social differentiation [30].

## 2.4 Factors of poverty

In developing countries urbanization has been considered as a main responsible factor for urban poverty, the rural to urban migration was caused by push factors, implying that it is poor who migrate, has led to increase in urban poverty incidence in recent times. Similarly, Rodgers (1989) argued that urban poverty was a spillover of the rural poverty through the labor market processes. These researchers have examined the effect of size-class on incidence of poverty. They find that with the increase in size of urban settlements, the incidence of poverty declines. The variation in incidence of poverty across different size of urban settlement is explained through the nature of employment and labor productivity. In small size towns, the labor productivity (measured through level of education) is lower and in the larger towns it is higher, resulting in higher poverty in former and lower poverty in latter[31].In a similar type of study, Dubey and

[29] Laderchi, R.C., Saith, R. and Stewart (2003) Does it matter that we do not agree on the definition of poverty? A comparison of four approaches, oxford development Studies, Vol.31(3): 244-274

[30] Wratten, E. (1995) Conceptualizing urban poverty in IIED, urban poverty: characteristics, causes and consequences', Environment and Urbanization, Vol. 7(1)

[31] Deolalikar, A. B. and Dubey, A. (2003 ) Levels and Determinants of Hunger Poverty in Urban India During the 1990's ,Paper prepared for Urban Research Symposium the World Bank 1818 H Street Washington DC 20433

Mahadevia (2002) estimate incidence of poverty in individual metropolitan cities in India for two years, 1987-88 and 1993-94.They also report that the incidence of poverty declines with the increase in size among the metropolitan cities also. Organization of economic activities in different size of urban settlements could be different. This could affect the level of productivity of labor located in urban settlements of varying sizes. This could affect labor earning and their poverty levels. The increased labor earnings would then have an impact on income and hunger poverty of the household Explained that this is accentuated by the fact that the most rapid urban growth rates are occurring in the poorest countries , creating serious cause for concern about the sustainability of urbanization of this nature[32].

There are three main causes of poverty: (a) individualistic causes (blaming poverty on dispositional or characterological weaknesses of the poor themselves),(b) fatalistic causes( blaming poverty on fate or bad luck),and (c) structural causes(blaming poverty on government or the social system)[33].Poverty vary significantly as a function of individual differences In demographics, dispositions, culture personality, age, income level , educational level ,religion ,nationality and type of academic training.

Williams (1984) reported that individualistic poverty attributions(i.e. blaming the poor for their own predicament) are often These included: (1) character logical laws of poor (low intelligence, lack of sexual impulse controlled.),(2) exploitation by external forces (foreign nations,multi-national corporations,etc.),(3) natural causes (poor climate, few natural resources ,etc),(4) Third world governments (government corruption , ineffiency, etc),(6) social inequalities (exploitation by rich families/minorities within Third world countries, inequitable land distribution, unfair labor practices, etc), and (7) fate ( will of god, bad luck , etc.)[34].

Illiteracy, low incomes, unemployment, malnutrition, frequent illnesses, high infant and child mortality and lower life expectancy are attributes of poverty. High birth

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[32] Dubey, A. and Mahadevia,D. (2002) Poverty and Inequality in Indian Metropolises, Indian journal of Labor Economics, 44 (2)

[33] Hine, D. W. and Montel, C. J.(1999) Poverty in developing nations: a cross- cultural attribution analyses, University of New England, Armidale, NSW, Australia

[34] William, B.(1984) Poverty ,Inequality and crime Criminology, Vol.22: 531-550

rates also co-exist with poverty though it is not high birth rates that breed poverty but it is poverty that breeds more children .Not only survival rates of children are poor in an environment of poverty but the very survival of the family may need more children to supply labor. Under such circumstances children are considered assets and the benefits derived by the family by having a larger number of children outweigh their costs[35].

Poverty in urban areas is affected by a particular combination of factors, which relate to the fact that in the city the poor are much more immersed in the cash economy. Not all find regular work, so that incomes are often erratic and unreliable, as well as small. In such circumstances, the purchase of basic needs such as food is often threatened by employment and/or income crises caused by ill health or other factors beyond the control of the individual household. Coping strategies to counter such periods of vulnerability may be quite limited in the city .The fragmented nature of the community and house hold, particularly for female headed household, often means that assets based on social claims are weaker. Physical assets too, such as land, are usually more limited, thus restricting the extent to which households may grow their own food to compensate for short-falls in purchased commodities. Of course, the poor do have their own coping mechanism to deal with worsening poverty, and these may relate to changing household composition, controls on consumption or attempts to increase assets. All of these events have increased vulnerability of low income groups through loss of income, as workers are replaced by cost recovery schemes. In such circumstances, the safety net of family saving has disappeared for even the regularly employed. For almost all poor families, food is the main priority and they often get only on a day to day basis. Thus families move out of low cost government housing and in to squatter settlements to save on rents; children are withdrawn from school, partly to save on fees and partly to extent the income – earning opportunities of the house hold[36].so we can say that High poverty levels are synonymous with poor quality of life, deprivation, malnutrition, low literacy and low human resource development.

Nath (1986) has considered urbanization as a main responsible factor for continuous increasing poverty in India. The realization that urbanization with focus on

[35] Krishan,T.N.(1992) Population, Poverty and Employment in India ,Economic and Political Weekly, Vol. 27 (46): 2479- 2497

[36] Aponte, A. and Julius (1985) Urban Poverty ,Annual Review of Sociology, Vol. 11: 231-258

rapid growth of the large metropolitan cities would involve such high costs of expansion of housing , and of urban infrastructures as could not be incurred by a low income country such as India. The failure to incur the costs because of resource constraints would lead to further aggravation of the problems of congestion, proliferation of slums and pressures on essential service facilitate transport, water and sanitation, electricity, education, health, and other which were already acute in the large cities. He has given some impacts of increasing poverty in urban areas: (1) increasing unemployment and under-employment in the cities and very low productivity in their informal sectors which have had to absorb most of the in –migrants; (2) acute shortage of housing and increasing pressures on urban services, which have led, in turn, to increasing congestion and proliferation of slums. (3) Progressive deterioration of environment[37].

Kundu (2003) has considered economic liberalization responsible for urban poverty, according to him the proponents of economic liberalization and associated structural reform have argued that this new strategy would accelerate rural-urban migration and boost the pace of urbanization. Linking India with the global economy would lead to massive inflows of capital from outside as also a rise in indigenous investment. This, in turn would give an impetus to the process of urbanization since much of the investment and consequent increase in employment would be either within or around the existing urban centers[38].

The extent of poverty in any country depends upon two factors- the average level of income and the degree of inequality in its distribution. Economic growth is likely to produce a more rapid rise in the demand for skilled labor compared to unskilled labor, leading to widening inequality in the early stages, when the supply of skilled labor expands relatively slowly. These disequalizing factors are often exacerbated by an institutional and policy framework that is biased in favor of the modern, urban sectors of the economy, leading to an excessive flow of resources to these sectors, and increasing the incentives for capital intensive production[39].

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[37] Nath, V. (1986) Urbanization in India: Review and Prospects, Economic and Political Weekly, Vol. 21( 8):339-352

[38] Kundu, A. (2003) Urbanization and Urban Governance: Search for a Perspective beyond Neo-Liberalism, Economic and Political Weekly, Vol. 38(29):3079-3087

[39] Ahluwalia, M. S. (2000) Economic Performance of States in Post-Reforms Period, Economic and Political Weekly: 1637-48

Different authors have given importance to different factors those have been considered responsible for poverty. Yesudiann (2007) has considered two important factors those are responsible for increasing urban poverty. First one is illiteracy, one third of the country population is still illiterate and a majority is not educated up to the age of 15 yr. Even among the educated, all do not have employable skills of the modern economy. The education system is not tuned to the changing economic scenario. The large agriculture workforce in rural areas is not sustainable with dwindling cultivable land and use of modern methods of cultivation. As a result, the rural labor is pushed in to cities in search of work but they do not have any employable skills in the urban formal sector often end up doing odd jobs in urban areas. Second is rural poverty, urbanization in this country is mainly due to acute poverty in rural areas rather than due to economic opportunities in urban areas[40].

Poverty does not reside exclusively in the external world independent of academic discourse that thinks about it; discourse is deeply implicated in creating poverty in so far as it conceals the social origins of scarcity .Although the experience of hunger and malnutrition is immediately material "poverty" exits in a discursive materialist formation where ideas, matter, discourse, and power are intertwined in ways that virtually defy dissection[41].

## 2.5 Measurement of poverty

In most developing countries, including India, poverty is measured in absolute sense. A common approach in measuring absolute poverty is specifying a bundle of goods and services deemed necessary to meet basic consumption needs. The most widely used estimates use food energy requirements to define basic consumption needs. The normative food energy intake was worked by the Task force constituted by the planning commission in 1979.This group accepted the calorie intake norms recommended by the Nutrition Expert Group(1968),according to fourteen age sex activity categories. The census based activity pattern, according to age and sex (different for rural and urban

[40] Yesudian, C.A.K. (2007) Poverty alleviation programmes in India: A social audit, Tata Institute of Social Sciences, Mumbai, India. Indian J Med Res 126: 364-373

[41] Yapa, L.(1996) What Causes Poverty?: A Postmodern View , Annals of the Association of American Geographers, Vol. 86(4): 707-728

populations), was superimposed on the rural and urban population .This specific calories norms assumed to be uniform for rural and urban population. The specific calories norms (assumed to be uniform for the rural and urban populations) were then weighted by the corresponding compositions of rural and urban population separately, to derive the rural and urban average uniform calorie norms. The daily calorie requirement per person worked out, on the average to be 2435 for rural and 2095 for urban areas. From the average quantities of food items that would meet this calorie requirement, the cost of food basket was calculated. The expenditure on food is used to identify the poverty line. Different poverty measures are like head count index, poverty gap index, FGT index and calorie[42].

According to Sen (1976) the measurement of poverty poses two fundamental questions. First, how does one identify the poor among the total population? Second, how does one can aggregate information on individuals and households in to a scalar measure of poverty? The first question has two components namely, how do we measure individual welfare and using this same metric, how do we determine the threshold that separate the poor from non-poor?[43] There has been substantial progress over the past three decades in measurement of poverty, with the development of additively decomposable measures that reflect not only the number of poor persons , but also the depth and severity of poverty for sub-groups of the population .As most poverty estimates comes from sample survey data, the statistical properties of poverty measure and appropriate inference procedures are important for evaluating the precision of poverty estimates and the statistical significance of poverty comparisons[44].

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[42] Deolalikar, A. B. and Dubey, A. (2003 ) Levels and Determinants of Hunger Poverty in Urban India During the 1990's, Paper prepared for Urban Research Symposium the World Bank 1818 H Street Washington DC 20433

[43] Sen, A. (1976) Poverty: an ordinal approach to measurement, Econometrica,Vol. 44:219-31

[44] Simler, K.R.(2007) Poverty comparisons with absolute poverty lines, Estimated from survey data,Poverty Reduction Group, The World Bank, Washington, DC Department of Agricultural Economics, Purdue University, West Lafayette, Indiana Review of Income and Wealth Series 53(2):1475-4991

Conventional definitions of poverty refer to a national poverty line .This is measured either as a minimum flow of real income per capita, or as a bundle of 'basic needs', which may be quantified[45].

Income based definition of poverty have been widely criticized as being too narrow, especially in the developing country context. The human Development index is an important attempt to broaden the range of indicators while retaining the advantages of quantification and international comparability, it draws on a bundle of indicators referring to general standards of health, education, and wealth which may be used to indicate general levels of development[46].

According to Radhakrishna, R. et al (2007), a household is considered chronically poor if its income is below the poverty line and if its children are suffering from malnutrition for a longer period of time. These studies employ income as the measurement of chronic poverty, but it is widely recognized that income poverty provides only a simplified view of poverty and the conceptualization of poverty should extend beyond what is captured by money metric measure. Any reduction in income poverty may not, pari passu, provide the escape from other forms of deprivation[47]. Richard has given the reason to refer consumption to income. Reason is that measurement error in consumption is less pronounced for those with few resources than is measurement error in income[48].

## 2.6 Issues of poverty

Various issues have been raised by scholars like Narayana (2001) has raised the issue that has poverty declined in India in the 1990? Believers in National Sample Survey (NSS) hold that poverty has not come down where as non-believers hold that poverty has come

[45] Gillie, A. (1996) The Origin of the Poverty Line ,The Economic History Review, New Series, Vol. 49( 4):715-730

[46] Patnaik, U.(2006) Poverty and neo-liberalism in India, Based on Rao Bahadur Kale Memorial Lecture delivered at Gokhale Institute of Politics and Economics, Pune

[47] Radhakrishna, R. ,Rao,K.H. and Reddy,B.S. (2007) Estimation and determination of chronic poverty in India: an alternative approach, Indira Gandhi Institute of Development Research Gen. A. K. Vaidya Marg, Goregaon

[48] Bevier, R. (2007 ) Reconciliation of Income and Consumption Data in Poverty Measurement ,Journal of policy analysis and management,Vol. 27(1): 40-62

down rapidly in the 1990s.The basic reasoning is that poverty reduction and income growth are related, especially in the absence of significant redistributive mechanisms. If it is observed that a database shows rapid decline in poverty in the absence of economic growth, then there is reason to doubt the database. It has been found that Market Information Survey of Household (MISH) of the National Council of Applied Economic Research (NCAER) shows a sensible relationship for the rural areas but not for urban areas. So, both the databases have their merits in interpreting this complex reality of Indian poverty. The long term reduction in poverty is largely a function of income growth and redistributive policies have not been implemented uniformly across the Indian states. Hence, income growth may be a considered as a key factor in poverty reduction and it is expected that there could be a strong relation-ship between the two. The attempts at relating poverty reduction with per capita income growth brings out that any single database is not good enough to analyze trends in both rural and urban poverty. While MISH is credible for analyzing urban poverty, NSSO is credible for analyzing the rural poverty. Taking MISH and NSSO for the urban and rural areas respectively, it may be concluded that growth has brought down poverty. But the disturbing trend of the 1990s is highly divergent income growth rates among the states and extremely low growth in those regions where poverty is concentrated[49].

According to Bhanumurthy and Mitra (2007) the change in the composition of growth (the shift in value added mix towards industry and tertiary activities) seems to have caused a larger decline in the incidence of poverty in the nineties than the eighties. Labor productivity growth and employment growth in the organized industry are also important for poverty reduction. Economic reforms seem to have a positive effect on the levels of living though a great deal needs to be done to reduce inequality in the process of growth and make the latter pro poor[50].

Yesudian (2007) has also discussed that the fruits of economic growth have not benefited everyone uniformly. Some are left behind and some others are not touched by

[49] Narayana, D. (2001) Has Poverty Declined in India in the 1990s?, Economic and Political Weekly,Vol. 36( 41): 3950-3952

[50] Bharatmurthy,N.R. and Mitra,A.(2007) Declining poverty in India: A decomposition analysis, Institute of Economic growth,Delhi University Enclave,Delhi

the benefits of economic growth. It is proved globally that the so called trickledown effect does not work in all the societies and India is no exception of this. There are various reasons for this uneven development in the society .Modern economy is technology driven and not labor intensive. High volume of high quality goods and services are produced with fewer labor hands. In short, the modern economy is not generating much employment and sometimes it displaced and replaces labor with machines and tools. The period of 1999-2000 to 2004-05 saw rapid economic growth in the country but it has not impacted on the unemployment problem of the country. During this period, the unemployment rate remained almost same for rural males and decreased by just one percentage for urban male. On the other hand the employment among females increased by one percentage for urban and rural females[51].

## 2.7 Spatiality of poverty

There are many urban problems in particular localities within metropolitan agglomerations. These problems are rarely understood as the outcome of emerging process of spatial segmentation in to privileged and underprivileged localities. The later are the marginal lands of the city core and peripheral areas bordering inner and outer municipal limits occupied by the poor who are newcomers or are being pushed out from the privileged localities of the city core[52].

One of the reasons for this increased space between poor and rich is that poor don't have command on resources. The present level of deprivation of the poor and the emergence of the violent social environment is a consequence of the failure of planning or in fact an outcome of planning being hijacked by market forces[53].

The sites for relocation are found on the periphery or even outside the city, and the residents are dumped in places with no drinking water, no sanitary arrangement and no roads. High poverty levels are synonymous with poor quality of life, deprivation,

[51] Yesudian, C.A.K. (2007) Poverty alleviation programmes in India: A social audit, Tata Institute of Social Sciences, Mumbai, India. Indian J Med Res 126: 364-373

[52] Kundu,A.(2000) Urban Development, Infrastructure financing and Emerging system of Governance in India, MOST Programme,UNESCO

[53] Kundu,A.(2009) Access to basic amenities and urban security: An interested analysis with a focus on the social sustainability of cities, Urban poverty report, Government of India

malnutrition, low literacy and low human resource development. The eradication of poverty has been an integral component of the strategy for economic development in India[54]

Poverty mapping is useful to display information on the spatial distribution of welfare and its determinants. It is also useful to display simultaneously different dimensions of poverty and/or its determinants. Poverty mapping, the spatial representation of indicators of poverty and its determinants for small geographic areas, is useful in a variety of ways[55]

Poverty maps are an extremely useful tool for poverty reduction. This is particularly so, if a specific poor area exhibits a lack of public endowments that stifle higher economic growth. Spatial maps pinpoint investment areas that need attention to accelerate economic growth and focus poverty reduction spending. Besides, private expenditure can be heightened in targeted areas for poverty reduction. Better roads for the poor to have access to markets do not reduce non poor use of such facilities[56].

Poverty mapping has two primary uses. The first is spatial identification of poor. Poverty mapping has in many stances served to target social, agricultural, emergency, environmental and anti-poverty programs. Poverty maps have been crossed with environmental and agricultural system maps in order to use visual spatial analysis to discern correlation. The second is to create as a product, explanatory and dependent spatial variables for use in multivariate analysis in combination with recently developed tools that permit the spatial dimension to be in corpated in multivariate examination of poverty issues.[57]

## 2.8 Land use and land cover

To meet the demands of large population means the need for more food production, more requirement of energy, more water requirement, better civic amenities

[54] Rao,V.L.S.(1983) Urbanization in India: Spatial dimension, concept Publication
[55] World bank report (2008) Poverty Analysis, Section Mapping Poverty

[56] Gauci, A. (2006) Targeting & mapping poverty, United Nations Economic Commission for Africa, poverty and social policy team, Economic and social policy division

[57] Benjamin, D. (2003) Choosing a method for poverty mapping, Agricultural and Economic development analysis Division, Food and agriculture organization of United Nations, Rome

for a reasonable quality of urban life, more infrastructure development to sustain increasing pressure and increased per capita expenditure for maintaining quality of life. This requires prudent use of land use/ land cover in the area. Land use refers to "man's activities and various uses, which are carried on land (such as agriculture, settlements, industry etc)". Land cover refers to the natural material present e.g. vegetation, water bodies, rocks/soils and other resulting from land transformations. Although land use is generally inferred based on the cover, yet both the terms land use and land cover being closely related are interchangeable. For example buildings/ settlement is cover but if we include whether it is being used for residence or industrial activity, it shows the land use component[58].

There is considerable diversity of opinion about what constitutes land use, although present use of land is one of the characteristics that are widely recognized as significant for planning and management purposes. One concept that has much merit is that land use refers to, "man's activities on land which are directly related to the land[59]. Land cover, on the other hand, describes, the vegetational and artificial constructions covering the land surface[60].

The study of land use land cover has recently become an important subject in studying social and economic dynamics of the landscape. Land use land cover change (LULCC) involves the interaction of biophysical, social, ecological, and human behavioral attributes over time and space[61]. The role of humans in abandonment, conversion or intensification of current agricultural land use or/and reshaping or expanding forest patches for diverse human objectives can be noticed in many rural parts of the world. These modifications at two levels: at the smaller scale, landowner's

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[58] Chaudhary, B. (2008) Human Induced Land Use/ Land Cover Changes in Northern Part of Gurgaon District, Haryana, India: Natural Resources Census Concept, J. Hum. Ecol., 23(3):243-252

[59] Clawson, M. and Stewart, C. L. (1965) Land use information. A critical survey of U.S. statistics including possibilities for greater uniformity: Baltimore, Md., The Johns Hopkins Press for Resources for the Future, Inc. : 402

[60] Burley, T. M. (1961) Land use or land utilization? Professional Geographer, Vol. 13(6):18-20

[61] Geoghegan, J.,Pritchard,L.,Ogneva-Himmelberger,Y.,Chowdhury,R.R.,Sanderson,S. & B.L. Turner II (1998) Socializing the Pixel and Pixelizing the Social in Land-Use and Land Cover Change, In D. Liverman, E.F. Moran, R.R. Rindfuss and P.C. Stern (eds.) People and Pixels: Linking Remote Sensing and Social Science. Washington DC: National Academy Press

economic or environmental concerns and at the larger scale, corporate economic interests and public policy, shape decisions. The major concerns of the environmental researchers are on the long-term consequences of the LULCC in a larger ecosystem such as in carbon sequestration, ecological diversity, land deterioration and fragmentation, water quality, and sustainability of the whole landscape[62] .

Studies of land use land cover changes help to locate areas that lag behind in economic development or areas facing deteriorating land resources. The identification and understanding of the dynamics underlying these local spatial characteristics establishes the linkage between poverty and land use land cover change. Studying the dynamics of LULCC in respect to the drivers of change such as human/household characteristics, institutions, and economic forces has been well-documented in recent research. However, research linking land use land cover to poverty or well-being requires a complex research agenda and therefore requires further exploration of more diverse methodologies[63].

The recent land use land cover studies have investigated the causes and consequences of land use land cover change related to human population dynamics (changes in density, composition, and species), and changes in the indices of poverty and well-being[64]. Differential impacts of land use land cover change involve land fragmentation or consolidation, degradation of agricultural productivity, decline or improvement in economic well- being, or changes in human population. For instance, the people who live in similar land use type may have differing socio-economic characteristics because their connections with places, institutions, and available resources are different[65].

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[62] Turner II, B.,Ross,L.and Skole, D. L. (1993) Relating land use and global land cover change, IGDP report no. 24; HDP report no. 5

[63] Jefferson, Rindfuss, R. R., Stephen j. W. and Mishra,V. (2003) People and the Environment approaches for linking household and community surveys to remote sensing and GIS. Kluwer Academic Publishers, Boston/Dordrecht/London

[64] Gilles,J. L. and Dalecki,M. (1988) Rural well-being and agricultural change in two farming regions Rural Sociology 53:40-55

[65] Turner II, B.,Ross,L. and Skole, D. L. (1993) Relating land use and global land cover change, IGDP report no. 24; HDP report no.

These kinds of databases are primarily important for national accounting of natural resources and planning at regular intervals. It is also necessary to perform reliable, verifiable and repeated national monitoring of land cover and land use processes from space. This information can be modeled and used for forecasting the land use and land cover changes and their direct and indirect impacts which in turn evaluate the societal consequences of the observed and predicted changes. Finally it can contribute to the establishment of the operational provision of data and information products, services, models and tools for multiple users like scientist, resource manager and policy makers[66].

Since poverty emerges from both unequal and unavailable access to resources and services as well as differences in household characteristics and relationship with institutions, decisions-making criteria of people for changing or retaining their current land use is affected. In addition, resource institutions and market forces are the dominant agents in resource use and management especially in the socio-economically vulnerable communities. As such their influence overshadows the landowners and defines the economic development possibilities in the communities. With the advances in remote sensing and GIS techniques and the availability of data at a finer scale, LULC research has the potential to link the social context of land use with issues of poverty or well-being at different scales. Land use studies in under-developed countries have proven that studying social issues spatially helps in understanding the history and root causes of economic and social problems. Spatial studies conducted in the Amazon Basin (Moran et al, 2003), Mexico (Turner et al, 2003), and Vietnam (Fox et al, 2003) employed LULCC to elicit the causes and processes of deforestation and fragmentation, and their linkage to poverty and well-being[67].

Land use is only one such aspect, but knowledge about land use and land cover has become increasingly important as the Nation plans to overcome the problems of haphazard, uncontrolled development, deteriorating environmental quality, loss of prime agricultural lands, destruction of important wetlands, and loss of fish and wildlife habitat.

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[66] Roy, P.S. and Giriraj,A (2008) Land use and land cover analysis in Indian context, Journal of Applied Science,Vol. 8: 1346-1358

[67] Gyawali,B. and Frazer,R.(2004) Land Cover and Socio-economic Characteristics in the Eight Counties of Alabama: A Spatial Analysis, American Agricultural Economics Association Annual Meeting, Denver, Colorado

Land use data are needed in the analysis of environmental processes and problems that must be understood if living conditions and standards are to be improved or maintained at current levels[68].

One of the prime prerequisites for better use of land is information on existing land use patterns and changes in land use through time. Knowledge of the present distribution and area of such agricultural, recreational, and urban lands, as well as information on their changing proportions, is needed by legislators, planners, and State and local governmental officials to determine better land use policy, to project transportation and utility demand, to identify future development pressure points and areas, and to implement effective plans for regional development. As Clawson and Stewart (1965) have stated[69].

In this dynamic situation, accurate, meaningful, current data on land use are essential. If public agencies and private organizations sit to know what is happening, and are to make sound plans for their own future action, then reliable information is critical.

The variety of land use and land cover data needs is exceedingly broad. Current land use and land cover data are needed for equalization of tax assessments in many States. Land use and land cover data also are needed by Federal, State, and local agencies for water resource inventory, flood control, water supply planning, and wastewater treatment. Many Federal agencies need current comprehensive inventories of existing activities on public lands combined with the existing and changing uses of adjacent private lands to improve the management of public lands. Federal agencies also need land use data to assess the environmental impact resulting from the development of energy resources, to manage wildlife resources and minimize man-wildlife ecosystem conflicts, to make national summaries of land use patterns and changes for national policy

[68] James, R. A., Ernest, E. H., John,T. R. and Richard, E. W. (1976) A Land Use and Land Cover Classification system for use with Remote sensing Data ,Geological survey professional paper 964

[69] Clawson, M. and Stewart, C. L. (1965) Land use information: A critical survey of U.S. statistics including possibilities for greater uniformity: Baltimore, Md., The Johns Hopkins Press for Resources for the Future, Inc., p 402

formulation, and to prepare environmental impact statements and assess future impacts on environmental quality[70].

It is necessary to have accurate information about present land use/ land cover so as to prepare integrated plans for optimal utilization of natural resources in the region. In earlier days, information on land use/ land cover was generated through conventional ground survey methods which were not only time consuming, tedious, costly and man power demanding but also impractical for monitoring dynamic changes over a shorter period, due to subjectivity and\ time constraint. Satellite data with synoptic view, repetitive coverage and multispectral viewing etc has brought drastic changes in the land use/ land cover mapping and monitoring. The applications of remote sensing techniques are well established in land use/ land cover studies[71].

## 2.9 Remote sensing and GIS

Historically, aerial photography interpretation (API) has been the basis for mapping land use/land cover in a region .The advantage of high spatial resolution (1–3m/pixel) aerial photography is the accuracy of the interpretation in a complex landscape and the ability to distinguish different types of land use as well as land cover. A major disadvantage is that API is considered costly and time-consuming to produce. Furthermore, API is subject to human interpretation errors. Because of the time and money involved, updated datasets are not generated at frequent intervals. In urban areas experiencing rapid change, events take place in the intermittent periods and important data may be permanently lost from the record[72].

While there have been significant improvements to deriving urban land use and land cover from satellite images, the question remains whether satellite-based classification works as well or better than aerial photography interpretation or on the ground observations. There have been several comparisons between the results of aerial

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[70] James, R. A., Ernest, E. H., John,T. R. and Richard, E. W. (1976) A Land Use and Land Cover Classification system for use with Remote sensing Data ,Geological survey professional paper 964

[71] Chaudhary, B.S. (2003) Integrated Land and Water Resources Management in Southern Part of Haryana Using Remote Sensing and Geographical Information Systems (GIS), Ph. D. Thesis (Unpublished), University of Rajasthan, Jaipur

[72] Elizabeth A. W., William L. S. ,Corinna, G. and Diane, H. (2004) Land use and land cover mapping from diverse data sources for an arid urban environments,Computers, Environment and Urban Systems ,xxx–xxx, pp 1-27

photography-based and satellite-based classifications in the literature for a variety of environments including wetlands in Australia, arctic vegetation, forest stands and urban areas. The conclusions reached in these studies are somewhat dependent upon the particular elements of interest and their characteristic scales. In general land use/land cover data obtained from satellite-derived information was reported to be at least as accurate data from aerial photography[73].

Remote sensing represents a major though still under-used source of urban data, providing spatially consistent coverage of large areas with both high geometric detail and high temporal frequency, including historical time series. Remote sensing methods have been widely applied in mapping land surface features in urban areas. Several recent developments in remote sensing have the potential to significantly improve the mapping of urban areas. These relate to the availability of data from new remote sensing systems such as the IKONOS-satellite, hyper-spectral sensors, and MODIS, all of which can support detailed and accurate urban area mapping at different spatial-temporal scales[74].

## 2.10 Social vulnerability

*"...the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist or recover from the impact of a hazard."*[75]

The word "vulnerability" is derived from the Latin word *vulnerare*, meaning "to wound." At a very basic level, vulnerability can be defined as "the capacity to be wounded" or the "potential for loss"[76]. Vulnerability is the exposure and susceptibility to losses and/or harm (Physical, Mental, Psychological, Social, and Biological).[77]

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[73] Ibid

[74] Martin, H.M.(2005) The role of spatial metrics in the analysis and modeling of urban land use change Computers, Environment and Urban Systems : 369–399

[75] Wisner, B. (2003) School Safety: Falling Between the Cracks?

[76] Dow, K. (1992) Exploring differences in our common future(s): The meaning of vulnerability to global environmental change, Geoforum, Vol.23: 417–436

[77] Sahay,R.(2001)En Gendered Vulnerability Feminine Perspective in the face of Disaster, National Disaster Management Authority, Government of India, New Delhi

'Vulnerability' can be defined as a situation where the people are more prone to face negative situations and there is a higher likelihood of succumbing to them. With reference to health, it implies a situation leading to increased morbidity and mortality[78].

However, general definitions of vulnerability do not specify the type of loss or the individuals, groups, or societies experiencing loss[79]. Dow (1992) and Cutter (1996) provide in-depth reviews of the development of the concept of vulnerability over the last several decades. Despite differences in the conceptualization of the term "vulnerability," two main perspectives have emerged. The first major research theme treats vulnerability as a pre-existing condition and focuses on potential exposure to hazards. The second major perspective on vulnerability suggests that not all individuals and groups exposed to a hazard are equally vulnerable; rather, affected people display patterns of differential loss[80]. In addition to exposure to some stress or crisis, this differential vulnerability also depends on the coping ability of those affected. Coping ability has been defined by, among others, Dow (1992), Cutter (1996), and Wu et al. (2002) as a combination of resistance (the ability to absorb the damaging impacts of a hazard and continue functioning) and resilience (the ability to recover from losses quickly).Studies that follow the second approach assess the social vulnerability of people and Communities [81]. People living at the margins – such as those without access to social services or political power – are more vulnerable than those with better access to resources[82]. For example, poor people are more likely to live in substandard housing and suffer from Malnourishment.

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[78] Loughhead, S.(2001) Urban Poverty and Vulnerability in India, New Delhi : Department for International Development (DfID)

[79] Cutter, S.L. (1996) Vulnerability to environmental hazards, Progress in Human Geography 20:529–539

[80] Wu, S.Y.,Yarnal, B. and Fisher, A. (2002) Vulnerability of coastal communities to sea-level rise: A case study of Cape May county, New Jersey, USA, Climate Research,Vol. 22:255–270

[81] Adger, N. and Kelly, M. (1999) Social vulnerability to climate change and the architecture of entitlement, Mitigation and Adaptation Strategies for Global Change 4:253–266

[82] Dow, K. (1992) Exploring differences in our common future(s): The meaning of vulnerability to global environmental change,Geoforum 23:417–436

They have fewer opportunities for education and, therefore, employment and are less likely to have health and property insurance[83].

Researchers who subscribe to the second major perspective stress that vulnerability is socially constructed because of differences in complex factors such as institutional development, social relations, and political power[84]. However, these multidimensional factors can be indicated and measured by single variables such as gender, race, age, and income[85].

Societal vulnerability focuses directly on the contextual factors, such as governmental structure, gender relationship, and attributes towards sexuality, religious beliefs and poverty[86]. In general, people living in poverty are more vulnerable than the wealthy to disasters .Poor people have less money to spend on preventative measures, emergency supplies, and recovery efforts.[87]

According to UNDRO (Office of the United Nations Disaster Relief) vulnerability has two sides. First side is the external side of risk, shock or stress to which an individual or household is subject to; and the other side is the Internal side which is defenselessness means lack of coping without damaging loss. Having these sides, the concept of vulnerability is described within five categories, which are economical, social, environmental, political, and cultural[88]. However, the assessment of vulnerability involves consideration of all significant elements in the society, including physical,

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[83] Anderson, M.B. and Woodrow, P.J. (1991) Reducing vulnerability to drought and famine: Developmental approaches to relief, *Disasters* 15: 43–54

[84] Cutter, S.L. (1996) Vulnerability to environmental hazards, Progress in Human Geography 20:529–539

[85] Wu, S.Y.,Yarnal, B. and Fisher, A. (2002) Vulnerability of coastal communities to sea-level rise: A case study of Cape May county, New Jersey, USA, Climate Research,Vol. 22:255–270

[86] Rao,B.T. and Thakur,J.S.(2007 ) Vulnerability assessment in slums of union territory, Chandigarh, School of Public Health, Department of Community Medicine, Post Graduate Institution of Medical Education and Research (PGIMER), Chandigarh, India

[87] Fothergill, A. and Peek, L.A.(2004) Poverty and disasters in the United States: A review of recent sociological findings, Natural Hazards,Vol. 32:89–110

[88] Haki,Z.,Akyurek and Duzgun,S.(2004) Assessment of Social Vulnerability Using Geographic Information Systems: Pendik, Istanbul Case Study,Middle East Technical University, Natural and Applied Sciences, Geodetic and Geographic Information Technologies06531- Ankara, Turkey

social, and economic considerations, and local coping mechanism. The main challenge in the assessment of vulnerability, which is determined in the literature, is to find out the ways of analyzing people's vulnerability implicit in daily life. In other words, people's actual living conditions must be investigated in these assessments, to understand their potentials and weaknesses, which can make them vulnerable for any possible hazard. In addition, the indicators of social vulnerability such as income levels, educational status, age or sex differentiations, kinship levels, or social support networks have to be identified. In fact, by defining the vulnerability just with the structures, the effect on the individuals and communities cannot be assessed properly. In this respect, vulnerability is generally defined as; "... the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impacts of natural or man-made hazards"[89]

Five Types of Vulnerability of the Poor has been discussed-

**1. Housing Vulnerability:**

Lack of tenure, poor quality shelter without ownership rights, no access to individual water connection / toilets, unhealthy and insanitary living conditions.

**2. Economic Vulnerability:**

Irregular / casual employment, low paid work, lack of access to credit on reasonable terms, lack of access to formal safety net programmes, low ownership of productive assets, poor net worth, legal constraints to self-employment.

**3. Social Vulnerability:**

Low education, lack of skills, low social capital / caste status, inadequate access to food security programmes, lack of access to health services, exclusion from local institutions.

**4. Personal Vulnerability:**

[89] International Federation of Red Cross and Red Crescent Societies (2000) Vulnerability and Capacity Assessment, AnInternational Federation Guide. International Federation of Red Cross and Red Crescent Societies press, USA

Proneness to violence or intimidation, especially to women, children, the elderly, disabled and destitute, belonging to low castes and minority groups, lack of information, lack of access to justice[90]

When we talk about poverty and vulnerability there are two contradictory view about this some scholar think that It is not the same as poverty, marginalization, or other conceptualizations that identify sections of the population who are deemed to be disadvantaged, at risk, or in other ways in need. Poverty is a measure of current status: vulnerability should involve a predictive quality: it is supposedly a way of conceptualizing what may happen to an identifiable population under conditions of particular risks and hazards. On the other side Poverty and vulnerability overlap. It is the poor who are also vulnerable who will suffer the most from shocks, stresses and critical trends. However, while all poor people are vulnerable, not all vulnerable people are poor. Poverty is a state of deprivation (lack of access) to key resources. It is thus thought about as current status, and often heavily associated with material/social status Vulnerability is more about defenselessness, insecurity, exposure to hazards/shocks and the ability to cope with them[91].

Social vulnerability is the complex set of characteristics that include a person's-

- initial well-being (nutritional status, physical and mental health, morale;
- livelihood and resilience (asset pattern and capitals, income and exchange options, qualifications;
- self-protection (the degree of protection afforded by capability and willingness to build safe home, use safe site)
- social protection (forms of hazard preparedness provided by society more generally, e.g. building codes, mitigation measures, shelters, preparedness);
- social and political networks and institutions (social capital, but also role of institutional environment in setting good conditions for hazard precautions, peoples' rights to express needs and of access to preparedness).

[90] Report of the steering committee on –Urban development(including Urban Transport),Urban Housing and Urban Poverty(with focus on slums) For The Tenth five year plan(2002-2007),Government of India, Planning commission,Oct,2001

[91] Hansjurgens,B.(2002) Mega cities, Risk and Social vulnerability

There are three basic characteristics that make some groups more vulnerable than others:

1. Proximity and exposure: people who live or work near some kind of hazard are more vulnerable than those who don't.
2. Poverty: people who have fewer options, few resources and few reserves can be pushed over the "edge" of survival more easily than those who are wealthier.

3. Exclusion / marginalization: People who are left out of economic and social systems or lack access to social services due to religion, race, gender, class and other factors are vulnerable[92].

Cannon has developed a parallel and overlapping view of social vulnerability, the components [93]-

1. Livelihood &its resilience (assets and income earning activities)
2. Baseline status- well being (health (physical and mental), nutrition)
3. Self-protection (quality of house construction & location)
4. Social protections (adequacy of building controls; large-scale measures)
5. Governance

Now the question arise in our mind that who are the Vulnerable[94]-

1. Poor and low-income households
2. Single-parent households.
3. Socially isolated households.
4. Recently arrived residents, immigrants, foreigners.
5. Senior citizens, children and young people.
6. People with a disease or a mental or physical disability.
7. Undocumented residents; refugees; war veterans.
8. Indigenous populations and subordinate ethnic groups.
9. Institutionalized populations; homeless residents.

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[92] Conflict and Humanitarian Assistance Department(CHAD) and Sustainable livelihoods support office (1998) "Social vulnerability" ,livelihood and Disasters Report to DFIDS, Conflict and Humanitarian Assistance Department(CHAD) and Sustainable livelihoods support office

[93] Wisner, B. (2003) School Safety: Falling Between the Cracks?

[94] Sahay,R.(2001)En Gendered Vulnerability Feminine Perspective in the face of Disaster, National Disaster Management Authority, Government of India, New Delhi

10. Women.

In our study data that we are using includes most of these groups of society those are residing in slums, resettlement colonies, along railway tracks etc. in189 wards of Delhi, capital city of India.

# CHAPTER III

# POVERTY AND SPATIAL ANALYSIS

## 3.1 Background

Poverty is being estimated by using various parameters like consumption pattern, expenditure, assessing assets, have or have not of access to resources. But the debate on the proportion (extent) of poverty in India has been a matter of interest to scholars namely for methodological, purpose (targeted/universal), threshold for poverty line, parameters dealing with inclusion and exclusion, rural and urban and ways of how to measure.

The periodic census to identify poor is done by planning commission to identify to below poverty line households who could be targeted under various programmes[95]. So far censuses has been carried out in each of the states of the India three times (1992,1997and 2002) in the last 17 years, and each time methodology used has been different, because each time it has been recognized that the methodology that was used earlier was seriously flawed.

This study categorically deals with BPL census done by Samajik Suvidha Sangam initiative of Delhi Government to identify most vulnerable sections of the society. The state governments can use this kind of database for variously targeting several schemes and services to the poor.

Mission Convergence has been formed with the objective of reaching social services to the economically and socially vulnerable sections of Delhi's population more transparently and more effectively, by a series of reforms including converging and rationalising all social sector schemes. The point of convergence for the beneficiaries would be the Office of the Deputy Commissioners (DCs), and at the state government in a State Mission for the Urban Poor, which will be chaired by the Chief Secretary. The convergence would entail the implementation of all the social sector schemes to be undertaken from the Deputy Commissioners Office, supported by the Line Departments and by the Programme Management Unit (PMU). The DCs will be assisted in their responsibilities by the Nodal NGOs and their network of gender resource centres (GRCs).

[95] The estimation of poverty by the planning commission is done on the basis of a large sample survey of consumer expenditure carried out by the national sample survey organization (NSSO) after an interval of five years approximately. The latest poverty estimates released by the planning commission, based on the 61st round of NSSO of 2004-05

Government of National Capital Territory of Delhi (GNCTD) is making all the necessary delegations: administrative, statutory and financial to empower the DCs in order to function in their new roles.

The basic premise of the new methodology for identifying urban vulnerable individuals and households is that it would depend on proxy indicators of income, Social vulnerability and access to public services to calculate the income and define vulnerability around income. The new methodology therefore proposes that the primary filter that should be used to identify poverty in the context of Delhi is place of residence of the "beneficiary", thus giving spatial approach to targeting the deprived.

The BPL list is of enormous practical importance to state government official to identify recipients of series of various social programmes. The objective is to provide economic assets and skills enhancements (as in case of GRC's of Delhi) to BPL families so that they get an increment income on a sustainable basis. Further governments also use this data base for targeting several schemes and services to the poor.

## 3.2 Theoretical framework

As we have explained earlier that we are dealing with poverty with the alternative approaches focus on the multiple sources of deprivation that poor households experience, and which hinder their efforts to obtain higher levels of well-being. These deprivations are linked to ways in which households live and work, the access they do or do not have to collective and/or state-provided resources, and the extent to which poor household can make their needs heard politically or can organize collectively to build up assets.

This is best illustrated by the 'assets/vulnerability' approach which recognizes that individuals and their households have differing sets of 'capitals' which they can use to improve their well-being, even when they have low incomes. In urban areas, such capitals consist of[96]:

[96] Baud,I.S.A; Pfeffer,K.and Sridharan,N.(2008) Mapping urban poverty for local governance in an Indian mega city; The case of Delhi, Urban Studies, Vol.45(7): 1385-1412

-Human capital (health, education and training, employment),

-Financial capital (savings and incomes, household assets (jewellery, other capital goods),

-Physical capital (housing electricity supply, drinking water and basic services),

-Social capital (extent of collective organization and social networks).

Formation of various indexes about poverty within the qualitative approach has been done by various scholars with the help of various indicators like in human poverty index indicators are-probability at birth of not surviving to age 60,adults lacking functional literacy skills, population below income poverty line, rate of long term unemployment (lasting 12 months or more) measuring deprivations in the three basic dimensions captured in the human development index — a long and healthy life, knowledge and a decent standard of living — and also capturing social exclusion. Isa Baud has used indicators like percentage of scheduled caste population, percentage of literate people, percentage of main workers, household dependency rate etc.

### 3.3 Methodology for Delhi BPL survey 2008-09

The new urban criteria for identification of BPL are being tried by GNCTD by including certain deprived households and excluding the major population those who are better off. Like exclude those households have at least one member working in the formal economy either in public or private sector. This is because they constitute barely 7% of nation's population, and by definition they do not experience the kind of vulnerability to exogenous shocks. The inclusion criteria use a multiple of principal for identifying the poor. There are essentially three inclusion criteria[97]:

1. Workers in low income –yielding, undignified, unsafe or highly vulnerable occupational categories.
2. Households where the bread earners working (and earning) capacity is significantly compromised by mostly constraints over which they have no control
3. Households subjected to social exclusion on the basis of their ascribed status in historically disadvantaged groups.

[97] Mehrotra, S., and Mader, H. (2009) How to identify the poor? A proposal. EPW, Vol. XLIV (19)

This can be summarized into occupational, social and affirmative action categories.

### 3.4 Selection of indicators

Broadly poverty has been discussed under two approaches one is conventional approach where poverty has been described in economic term like people not getting a particular amount within a month is considered as poor or on the basis of consumption level based on certain calorie norms (2400 calorie for rural and 2100 calorie for urban) and poverty refer to a notional poverty line ,other approach of poverty deals with the multidimensional deprivation of life, which has been explained by various scholars with different names like deprivation, Vulnerability, social exclusion etc, including various variables like education, health ,political participation, status of employment.

Scholars have used indicators according to their approach (economic or multidimensional). Richard Bevier has given importance to income and consumption both[98], according to Dr. S. Aggarwal, A. Satyavada, Kaushik and R. Kumar (2007) in their study about 'urbanization, urban poverty and health of urban poor' income is not an adequate indicator for accessing vulnerability; so taken indicators were like electricity, drainage, water, toilet, housing condition, education, status of health, credit facility, employment etc[99].

Assessment of social vulnerability in turkey by Zeynep Haki, Zuhal Akyürek, Şebnem Düzgün (2004) have explained poverty as social vulnerability with certain variables like employment status, education, household size, ownership of house, age, sex[100]. Terry Cannon, John Twigg and Jennifer Rowell (2001) have used several indicators like labor power, education, health, productive resources (land, tools, animal, housing, trees etc.), kinship network, common property and source of income. Romina Cavatassi, Benjamin Davis and Leslie Lipper (2004) in their study on -Estimating Poverty Over Time and Space: Construction of a Time-Variant Poverty Index for Costa

[98] Bevier, R. ( 2007) Reconciliation of Income and Consumption Data in Poverty Measurement

[99] Agarwal, S., Satyavada, A.,Kaushik ,S.and Kumar,R.(2007) Urbanization, urban poverty and health of urban poor: status,challenges and the way forward ,Demography India,Vol.36(1):121-134

[100] Haki,Z., Akyurek and Duzgun,S. (2004 ) Assessment of Social Vulnerability Using Geographic Information Systems: Pendik, Istanbul Case Study, Middle East Technical University, Natural and Applied Sciences, Geodetic and Geographic Information Technologies 06531- Ankara, Turkey

Rica have used several indicators like no bathroom, no hot water, use coal or wood, dirt floor, dependency ratio, house in bad condition, no washing machine, no electricity, no telephone, unemployed, illiterate, no water, no sewage, occupants per room and years of education to calculate a poverty index for Costa Rica with by using Principal Component Analysis method[101]. A study about the slum and pavement dwellers and squatter in Mumbai by Sunil Kumar Karn, Shigeo Shikura and Hideki Harada (2003) have worked with indicators like educational attainment of head of household, per capita space in urban poor settlement, water consumption and quality, toilet[102].

Rachel Masika with Arjan de Haan and Sally Baden (1997) have considered poverty as social vulnerability where they explained that vulnerability is not synonymous with poverty, but refers to defenselessness, insecurity and exposure to risk, shocks and stress. Vulnerability is reduced by assets, such as: human investment in health and education; productive assets including houses and domestic equipment; access to community infrastructure; stores of money, jewellery and gold; and claims on other households, patrons, the government and international community for resources at times of need[103].

There are two main approaches to poverty found in India; first set of approaches limiting poverty to deprivations in area of consumption and income, and second being the set of approaches which recognizes various factors as contributing to poverty (livelihoods approach).

Many Indian scholars like Naveen Kumar, Suresh Chandra Aggarwal (2003)[104], K.L.Dutta (2008)[105], Satya R.Chakravarty and Amita Majumdar (2007)[106], Raghbendra

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[101] Cavatassi, R.,Davis and Lipper (2004) Estimating Poverty Over Time and Space: Construction of a Time-Variant Poverty Index for Costa Rica" ESA Working Paper No. 04-21, Agricultural and Development Economics Division, The Food and Agriculture Organization of the United Nations

[102] Karn,S.K., Shikura,S., and Harada,H.(2003) Living Environment and Health of Urban Poor: A Study in Mumbai, Economic and Political Weekly, Vol. 38(34): 3575-3586

[103] Masika,R; Haan,A. and Baden,S. (1997) Urbanization and urban poverty : a gender analysis, BRIDGE (development - gender) Institute of Development Studies University of Sussex Brighton BN1 9RE, UK

[104] Kumar,N.and Aggarwal,S.(2003) pattern of consumption and poverty in Delhi slums, Economic and Political Weekly:5294-5300

[105] Dutta,K.L.(2008) An estimate of poverty reduction between 2004-05 and 2005-06, Economic and Political Weekly:61-67

[106] Chakravarty,S.R. and Majumdar,A.(2007) Measuring human poverty by population and factor decomposable indices,Indian economic journal,Vol.55(1): 67-77

Jha (2000)[107], Vashishtha (1993)[108], Dubey and Gangopadhyay (1998a)[109], ) Dubey and Mahadevia (2002)[110], Dev, S. M.(2000)[111] have defined poverty in economic term either consumption or income with conventional poverty lines .But Conventional poverty lines give scant attention to health and social indicators, hence failing to demonstrate the social and health dimensions of poverty so in this study poverty has defined as multiple deprivation in term of education, basic amenities, banking facility etc .

According to Krishna (2003)[112] the livelihoods approach recognizes a variety of capitals, which make a household capable of producing well-being for its members, or the lack of which prevent them from doing so. Saith (2005)[113] critiques the first approach because it does not capture adequately what poverty means in the lives of actual households. His main points of disagreement, which also inform our stance on poverty issues, are that it does not capture a number of issues influencing poverty in essential ways. First expenditure lines do not capture the lack of assets which household may have or sell which reduce their vulnerability in the longer term. These include land, homes, larger capital goods which may serve as forms of saving/assets to be sold off only in extreme circumstances. Their loss needs to be counted as part of poverty. Secondly, health situation of family members can be an assets or liability (where labor is directed to the care economy and ill family members cannot work).Third, approaches, despite the fact that it reduces household's access to state or community-provided resources.

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[107]Jha,R.(2000) Growth,inequality and poverty in India: spatial and temporal characteristics, Economic and Political Weekly, Vol. 35, No. 11 (Mar. 11-17):921-928

[108] Vashishtha, P.S. (1993), Regional Variation in Urban Poverty in India, *Margin*,October-December: 483-524

[109] Dubey, A. and Gangopadhyay, S. (1998a) Counting the Poor: Where are Poor in India, Sarvekshana: Analytical Report, No. 1

[110] Dubey, A. and D. Mahadevia (2002), Poverty and Inequality in Indian Metropolises, Indian journal of Labour Economics, Vol.44 (2)

[111] Dev,S. M.(2000) Economic Reforms, Poverty, Income Distribution and Employment, Economic and Political Weekly, Vol. 35: 823-835

[112] Krishna,A.(2003)Falling into poverty: the stages of poverty reduction, Economic and Political Weekly,vol.38(6):533-542

[113] Saith,A.(2005) poverty line versus the poor :methods versus meaning, Economic and Political Weekly:4601-4610

Baud and Sridharan (2008)[114] have adopted livelihood approach in their study about poverty in Delhi, where they have talked about index of multiple deprivations. In which they have selected certain indicators like percentage of literate people, percentage of workers, and percentage of household using banking services, percentage of households having no toilet-electricity, having little space to identify the poor or a deprived person.

So indicators those have been selected in this study like no basic services like water, electricity, toilet, bank account, unemployed, houseless, rented house, and suffering from some kind of disease, handicapped and illiterate. Multiple deprived can be more vulnerable like a person who is handicapped, don't have any source of income or don't have any employment, even he is not literate or don't have any kind of skill is more vulnerable. A woman who is single may be widow, separated or divorce, she is illiterate, there is no earning hand for her and in this situation she is suffering from any kind of diseases, she is more vulnerable than others. If a person doesn't have bank account it shows that he doesn't have money for that and he even don't know how to do because he is illiterate. So all the indicators are supporting each other to indentify a person who is more vulnerable for any kind of vulnerability than other.

Following indicators are used to analyze further-

1) No toilet - Percentage of people in a particular cluster or clusters of a ward not having toilet facility in their home.
2) No water supply- Percentage of people in a particular cluster or clusters of a ward not having safe drinking water supply in their home.
3) No electricity- Percentage of people in a particular cluster or clusters of a ward not having electricity in their home.
4) Illiterate- Percentage of illiterate people in a particular cluster or clusters of a ward.

[114] Baud,I.S.A; Pfeffer,K.and Sridharan,N.(2008) Mapping urban poverty for local governance in an Indian mega city; The case of Delhi, Urban Studies, Vol.45(7): 1385-1412

5) No bank account - Percentage of people without bank account in a particular cluster or clusters of wards.
6) Handicapped- Percentage of handicapped in a particular cluster or clusters of wards.
7) Unemployed- Percentage of people those are unemployed in a particular cluster or clusters of wards.
8) No house - Percentage of people those don't have house in a particular cluster or clusters of wards.
9) Rented house- percentage of people those are living in rented house in a particular cluster or clusters of wards.
10) Single women - percentage of single women (widow, separated or divorced) in a particular cluster or clusters of wards.
11) Disease- percentage of people those are suffering from some kind of disease in a particular cluster or clusters of wards.

## 3.5 Spatial distribution and analysis

### 3.5.1 No electricity –

Electricity is an essential part of life in present time, especially when we are thinking about the urban area. But there are many parts of city where people don't have electricity to light up their house and for many other works.

There are three wards, which are showing highest percentage of people without electricity. These are Ashok nagar (246) in east Delhi near Yamuna river, second is Pusa (150), which is located in new Delhi and third one is major Bhupindar Nagar (115) which is located in west central part of city. There are other wards of city where people are deprived form electricity like Najafgarh (138), Khera (140) located in southwest part of city, Mudka (30), Bawana (28), Sahibabad Daultpur (26), Bhalswa (26)in north central part, Banker (2) in north Delhi Ram nagar (247). In east Delhi near Yamuna River, Lajpat nagar (155), Sarita vihar (208) and Madanpur khaddar (207) in south and south-east part of city are showing more deprivation. Most of these wards are located on the periphery of the city (refer figure no.3.1).

There are some areas where relatively more people are having electricity, these are Timorpur (10),GTB nagar (12),Modal town (72),Kamala nagar (69),Nirmi colony

(65),Tri colony (61),Pahad ganj (89),Modal Basti (90),Saraswati nagar(60),Pascchim vihar north(58) and Paschim Vihar south(57).They are located in the central part of city which is old Delhi area.

Thus, municipal wards which are located on the periphery of the city are more deprived in term of electricity than in the central part of city.

### 3.5.2 No toilet at home

Toilet is a component of basic amenities so toilet has been considered as important indicator to identify a social deprives people.

There are three wards those are showing highest percentage of people without toilet at home these are Kotala enclave (63) in central part of city, Rohini north (45) and Lajpat Nagar (155) which is in south Delhi. Other locations which are showing high percentage of people without toilet are Mundka (30), Narela (1), Bakhtwarpur (4), and Bhalsawa Jahangir (5), Mangolpuri north(48),Pitampura north (54), Shalimar bagh north (55). Percentage of people without toilet is more concentrated in north part of city and in central part as it is clear from map (refers to figure 3.2).

There can be certain reasons for this like people don't have money to construct toilet at home or people are not aware about the importance of toilet at home or they lack knowledge about it, inverse impact of this on their health because they are not educate enough to understand about it.

Wards in which all the people are having toilet at their home are Sarai Pipla Thana (15), Adarsh Nagar (14),Indralok colony (74) in central part of city and other wards are near Yamuna river like Kasturba Nagar (157) on west side of Yamuna, Pandav nagar (224) and Shakarpur (223) east to Yamuna river.

So wards where toilet facility is least available at home are concentrated around centre and wards where all are having toilet at their homes are also concentrated in central part of city.

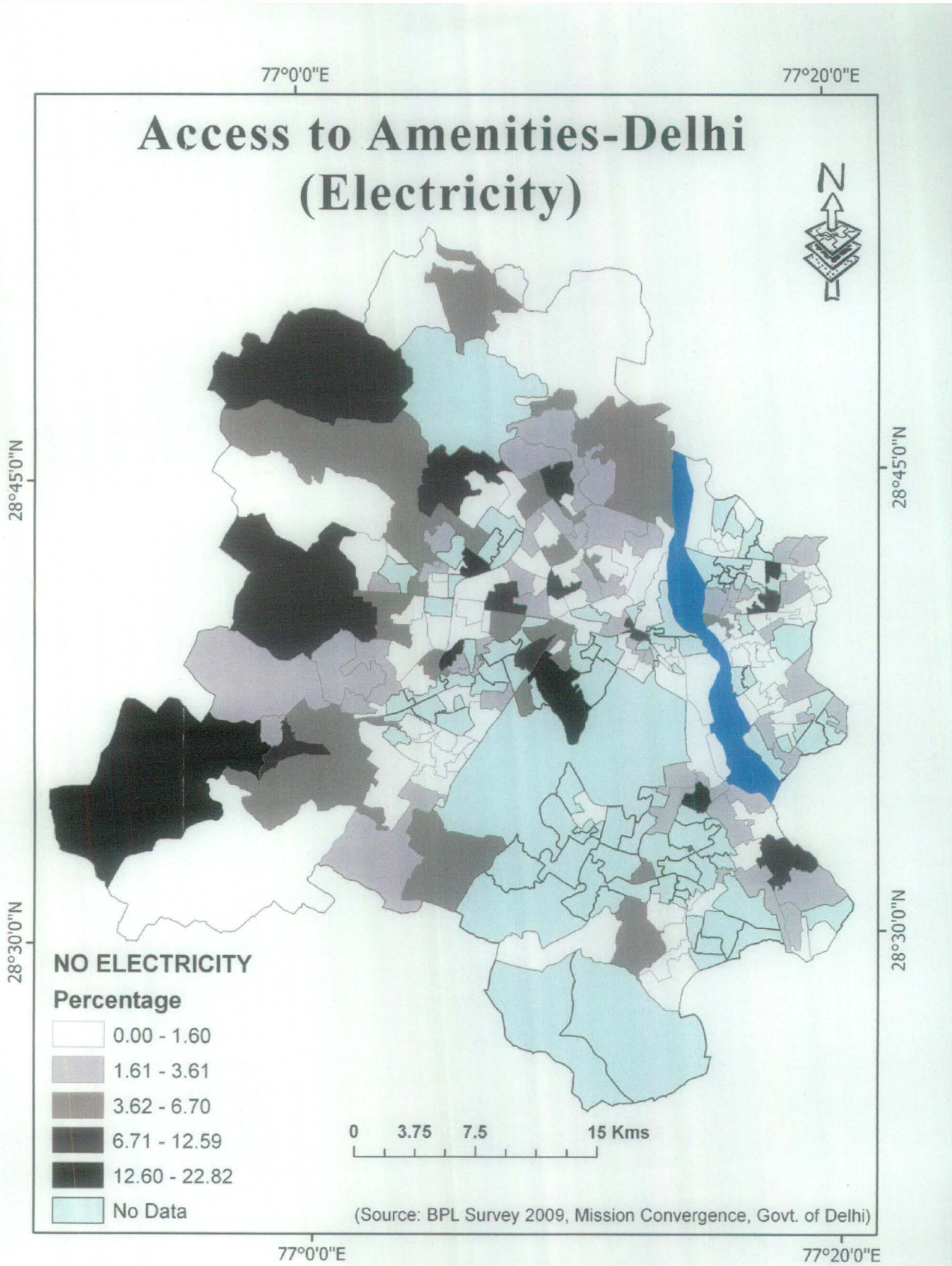


**Figure 3.1: Access to electricity in Delhi**

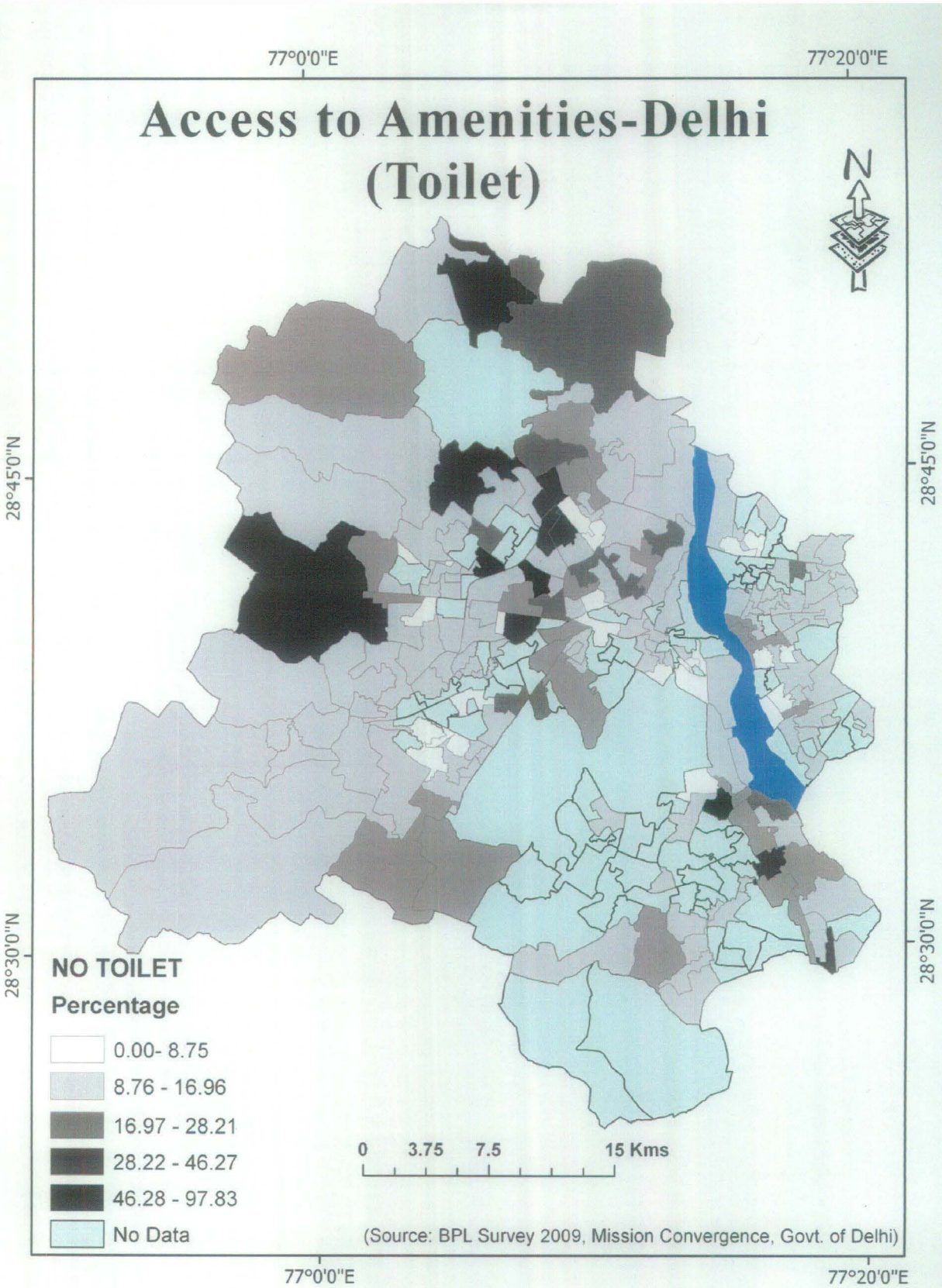


**Figure 3.2: Access to Toilet in Delhi**

### 3.5.3 No water supply

Water is very essential in life, a person can survive without food for a number of days but can't without drinking water. Water is also needed for various uses like to washing cloths, to clean utensils, having bath, to clean home and many more so life without water is not possible. But there are many poor people those don't even have access to safe drinking water to drink or water for other routine works.

In Okhala (206), Kasturba nagar (157) and Sangam vihar (177) more than 50 percentage people don't have access to water. Other areas where regular supply of water is not available are Roshan Pura(137),Dichaan Kalan (139) in south west, Bankner (2), Bhalswa Jahangir (5) and Jharoda (8) in north part of city.

Clusters like Rohini north (49),Timarpur (10),GTB nagar (12),Model town (72), Rana pratap bagh (70),Nimari (65) and Ashok vihar (68); most of the clusters located in the east of Yamuna nagar like I.P.Extension (227),Mandawali (218),Shakarpur (223),Pandav nagar (224),Mayur vihar phase 2(219) and Mayur vihar phase-1 (209),Harsh vihar (264) and Sabali (263) are getting regular water supply (refers to figure 3.3).

In these clusters those have been covered by BPL census, regular supply of water is not available; they don't have any regular source of water, no government water supply so somehow manage it to get by illegal pipelines from government supply etc, which is not even safe for their health.

### 3.5.4 No Bank account

In this indicator deprivation is maximum; there are 63 wards out of 189 (those have been surveyed) where all the people don't have account in bank. Other areas those are lacking behind are like Khera, Roshanpura, Najafgarh, Dichaan Kalan, Mundka, Nangli, Sakravati, Karala, Begumpur, Bawana , Kakrala and Mohan garden.

There is only few wards where all people have their account in bank is Shakarpur (223), in Samaypur badli (17) only 2.20 percentage and in Pandav Nagar (224) only 18.83

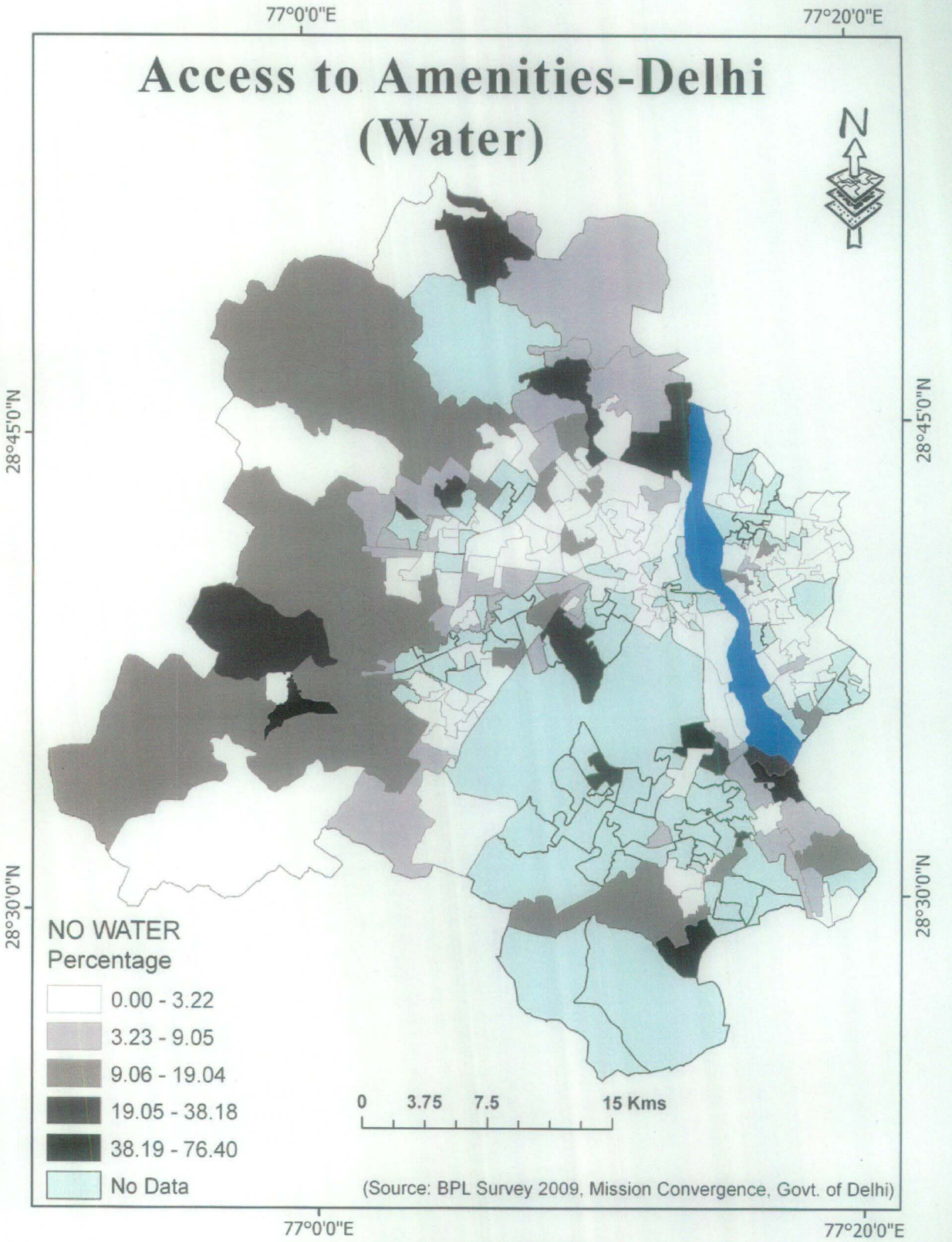


**Figure 3.3: Access to water in Delhi**

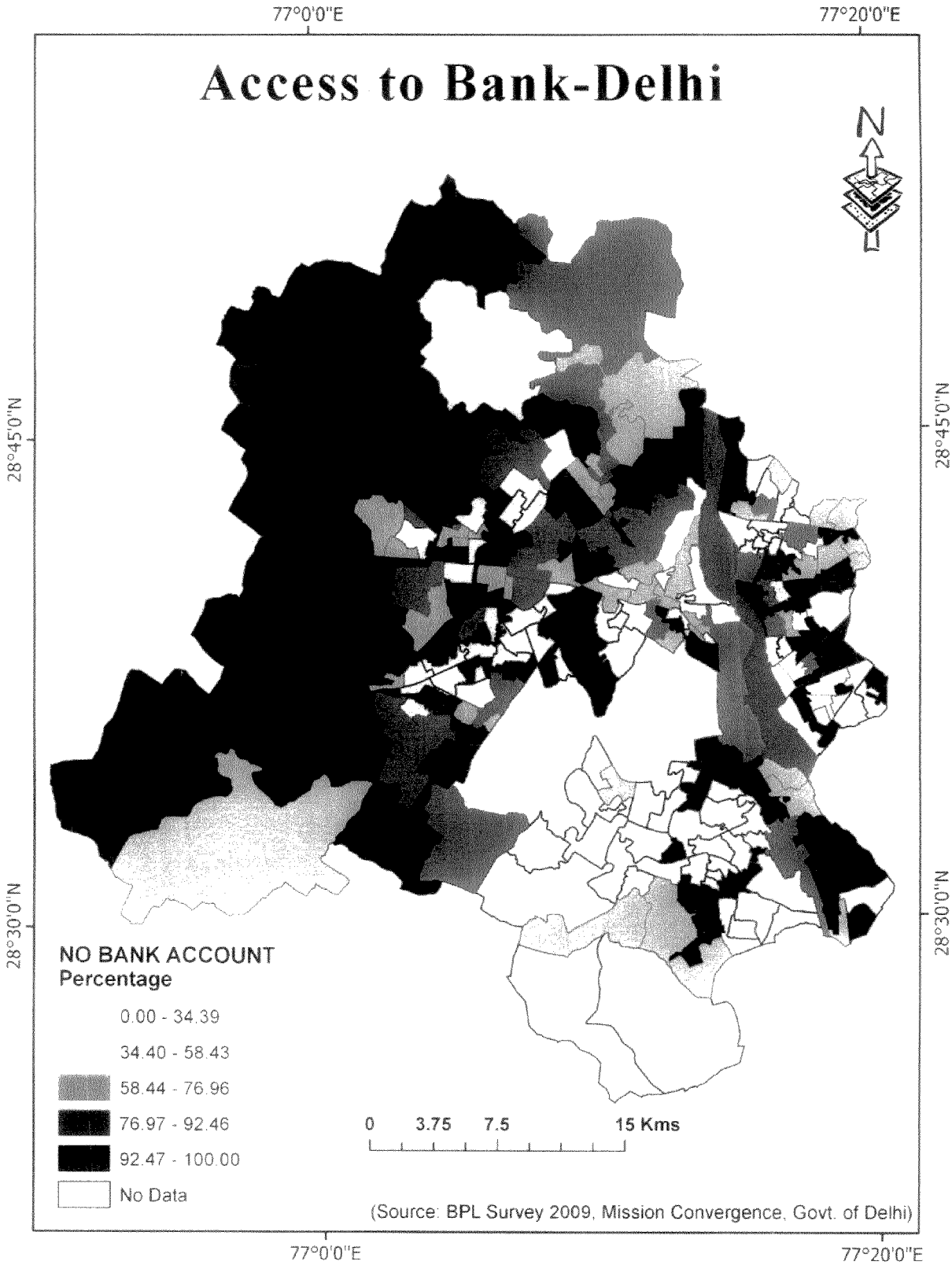


**Figure 3.4: Access to Bank in Delhi**

percentage people don't have account in Bank. Timorpur, Mayur Vihar Phase-1 and phase- 2 are showing comparatively better off (refers to figure 3.4).

There may be many reasons for not having account in bank, important one is this that when people don't have money even to fulfill their basic requirement like food, cloth and shelter then how can they save their money in bank thus they do not have any savings. Other possibility is that number of people those are illiterate is also more so people don't know how to open account in bank, they don't have knowledge.

### 3.5.5 Illiterate

According to Indian census a person who can read and write with understanding in any language, is considered as an illiterate. The person may or may not have received any formal education.[115]A vast majority (86%) of the urban poor in Delhi are illiterate compared with 14 per cent among the urban high income group and urban average of 27 per cent. The school attendance especially among girls is also much lower among the urban poor. The low level of education poses a number of challenges in the adoption of recommended behaviors pertaining to care of mothers and babies[116].

Spatial distribution of illiteracy pattern illustrates some clusters those have been surveyed like Kasturba Nagar (157) have more illiterate with 57.38 percentage, second is Ashok Nagar (246) with 48.42 percentage that is in east Delhi and third is Model Basti (90) with 48.31 percentage.

Other areas of low literacy are Bawana, Narela on north-western periphery, GTB Nagar, Pusa, Punjabi Bagh, Ashok Vihar, Kahat Enclave, Rohini north and Rohini south in core of city; Vivek Vihar, Kartam Puri, Mustafabad and new Seemapuri in East Delhi; Nizamuddin, Zakir nagar, Minto road and Shakarpur along Yamuna river. So, these areas are not concentrated at a single place. Between these areas of low literacy, some areas are showing bit less number of illiterate like Bindapur (128) in central Delhi where only 6.53 percentage people are illiterate,

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[115] Census of India(2001) State of literacy(chapter 7), Provisional Totals, Series 1,India

[116] Agarwal, S.,Srivastava, A.,Choudhary,B. and Kaushik,S.(2007) State of Urban health in Delhi, Government of India,,Ministry of Health & Family Welfare,Nirman bhawan, New Delhi

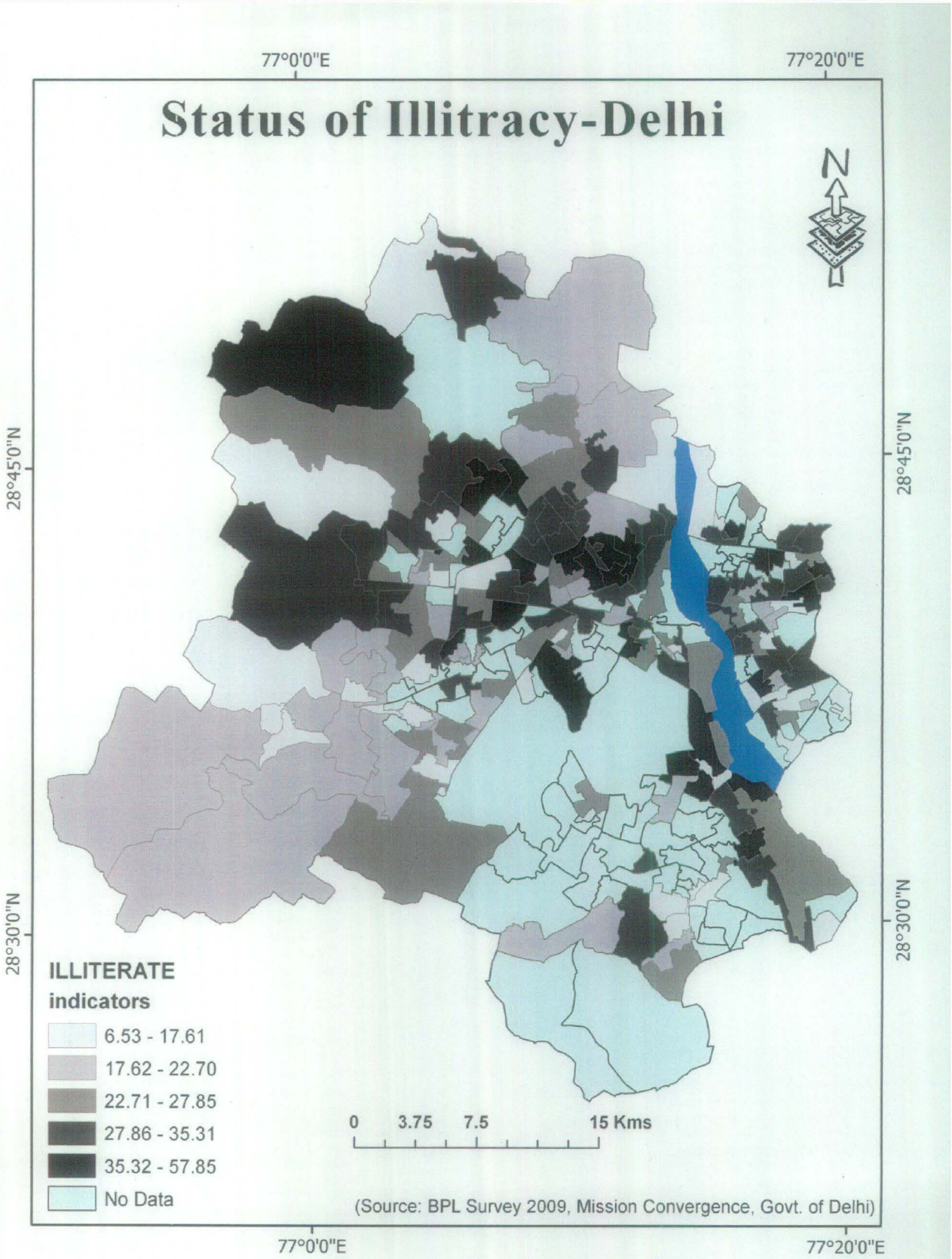


**Figure 3.5: Status of Illiteracy in Delhi**

Jhilmil (238) in east Delhi where illiteracy is 11.91 percentage and Meetheypur (202) with 12.16 percentage people are illiterate. Like areas of high illiteracy, areas of low illiteracy are not concentrated at any one place they are dispersed between the areas of high illiteracy (refers to figure no. 3.5).

### 3.5.6 Physical disabilities

In this survey eight categories of physical disabilities have been included, these are –

1) Feet, 2) Hand, 3) Eye, 4) Ear, 5) Speech, 6) Mental, 7) Other and 8) Multiple

Numbers of handicapped or physically disabled people is only significant in Nirmi Colony (65) in central part of city where 62.64 percentage people are having some kind of disability, second is Village Hauz Rani (162) with 23.46 percentage of disable people and third high concentration of physical disable is in Sri Niwas puri (193) in south Delhi on western river front of Yamuna.

Other significant numbers of disable is in Bijawasan (141) and Mahavir Enclave (147) in south-west Delhi. Areas like Vikas Nagar (124) near Yamuna, Khanpur (181) in south Delhi, Shakarpur (223) on eastern river front of Yamuna and Pahadganj (89) in old Delhi area don't have any disable people. In other parts of city percentage of disable people is less than 4 percentage (refers to figure 3.6).

### 3.5.7 Unemployed

A person is called unemployed when he is willing to work but currently without work, does not include full time students, the retired, children or those not actually looking for any job.

According to Krishna (1973)[117] a person is unemployed when

1) He gainfully occupied during the year for a number of hours(or days) less than some normal or optional hours(or days) defined as full employment hours or days, or

[117] Krishna,R.(1973) Unemployment in India, Economic and Political Weekly, Vol.8(9): 475-484

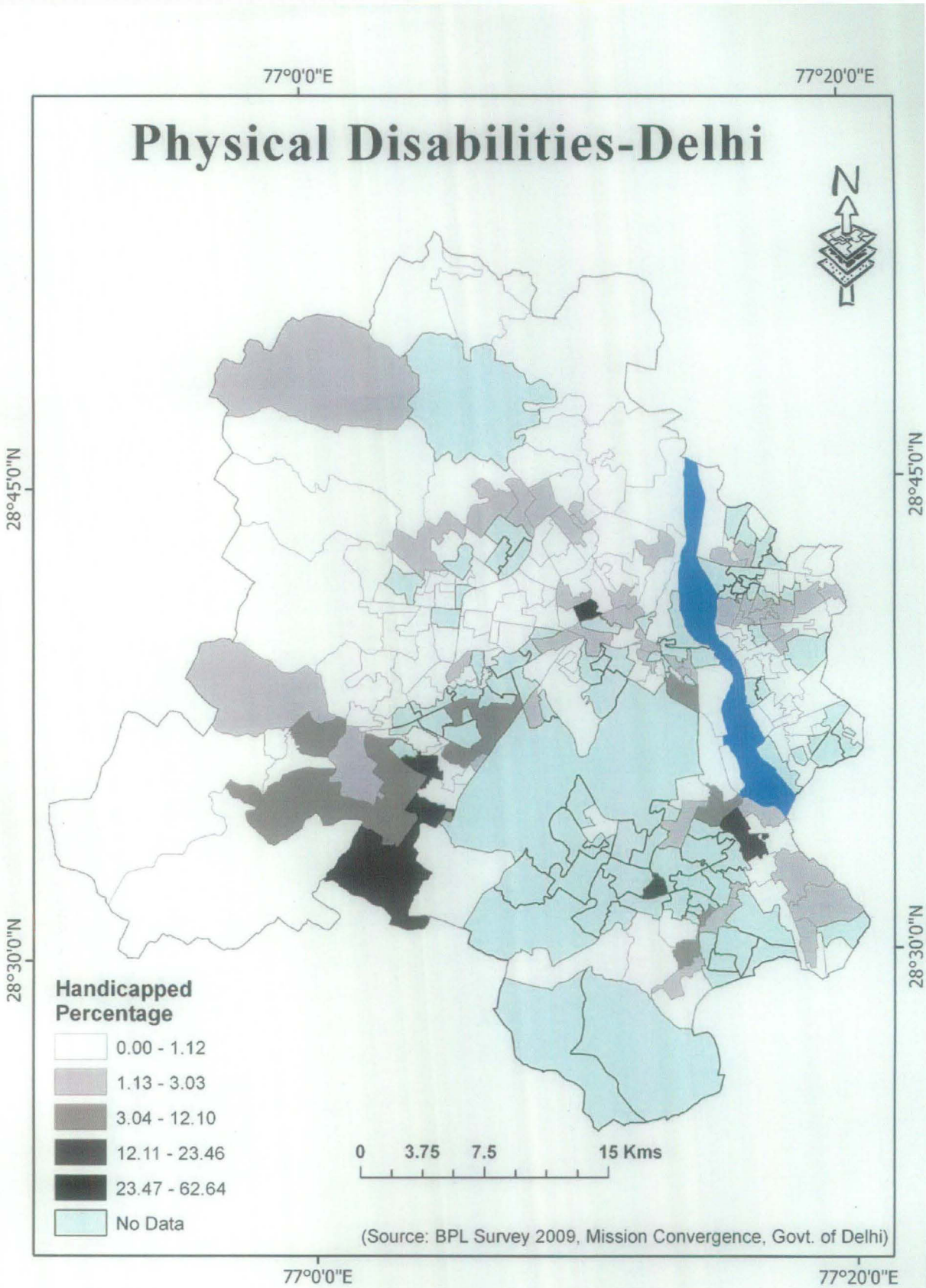


**Figure 3.6: Physical disabilities in Delhi**

2) He earn an income per year less than some desirable minimum, or
3) He is willing to do more work than he is doing at present, he may either be actively searching for more work or be available for more work if it is offered on terms to which he is accustomed, or
4) He is removable from his present employment in the sense that his contribution to output is less than some normal productivity, and therefore his removal would not reduce output if the productivity of the remaining workers is normalized with minor changes to technique and/or organization.

So he has considered three criteria's: 1) the time 2) the income and 3) the willingness

Percentage of Unemployment is highest in Minto Road (81) on western river front of Yamuna where 80 percentage people are unemployed, second is Mustafabad (268) in East Delhi with 77.76 percentage of people without employment and third is Nehru Vihar (267) where 75.81 percentage don't have employment.

In east Delhi areas with high unemployed people are Khajari Khas (269), Shiv Vihar (265), Sabali (263), Harsh Vihar (264), Ramnagar (274), Ashok nagar (246), Kartam Puri (258), Dilsad Garden (241), New Seema puri (242) and Dilshad Colony (240).

Percentage of unemployed people is also high in central Delhi and along Yamina River. In central Delhi wards are Kamala Nagar (69),Kishan Ganj (75), Indarlok Colony (74), Rana Pratap Bagh (70), Sawan Park (66), Model town (72),GTB Nagar (12), Majnu ka tila (78), Ashok vihar(68), Deputy Ganj (274) and Model Basti (90).Along Yamuna are Nizamuddin, Kasturba nagar,Okhala, Pandav nagar, Shakarpur, Geeta colony, Ghandli and Azad nagar.

Areas those are located on periphery are better off in term of employment, in these wards percentage of unemployed people is very less (refers to figure 3.7).

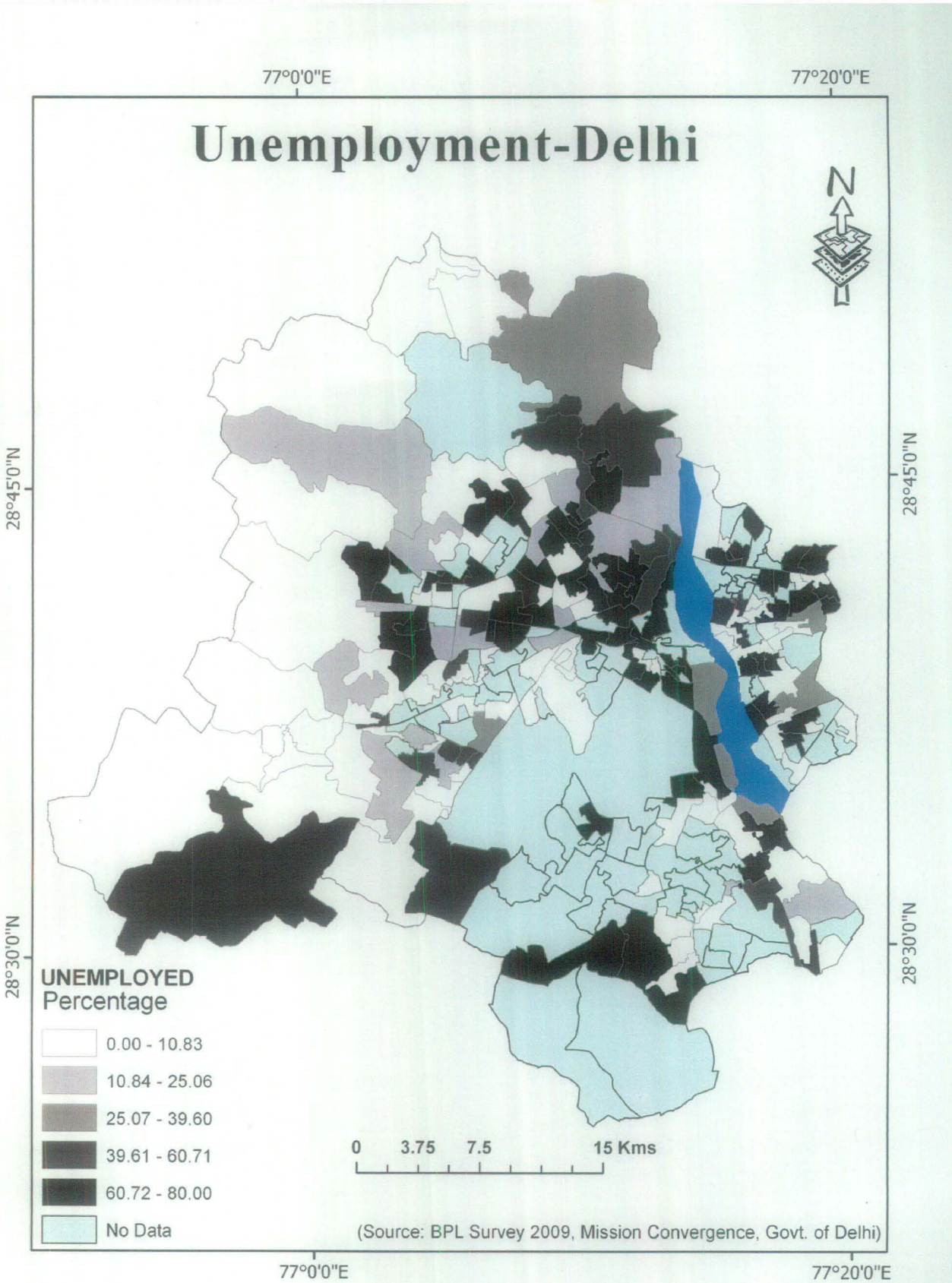


**Figure 3.7: Unemployment in Delhi**

### 3.5.8 Disease

The urban poor in Delhi also suffer from a huge burden of communicable and vector borne diseases such as tuberculosis, malaria, dengue and chikungunya. Poor environmental conditions, overcrowding and poor nutritional status make urban slums a fertile ground for the spread of these diseases. The prevalence of tuberculosis among the urban poor in Delhi is 1315 per 100,000 persons which is double that of the urban average. Similarly, the prevalence of malaria among the urban poor at 784 per 100,000 persons is double that of the urban rich. In 2006, there was an outbreak of dengue in Delhi in which 2950 cases and 65 deaths were reported[118].

In this survey nine types of diseases have been included, these are-

1) T.B,
2) Respiratory disease,
3) Cancer,
4) Leprosy,
5) Heart disease,
6) Mental disease,
7) Seizure,
8) Kidney fail, and
9) Paralysis

In case of disease wards those are situated in central part of city are better off than areas on the periphery, on periphery number of wards in which percentage of people suffering from any kind of disease is on lower side. In centre there are some wards with high concentration like Hari Nagar (111) with 10.70 percentage, Village Hauz Rani (162) in south, Bindapur (128)

[118] City development plan, 2006, Department of Urban Development, Government of Delhi

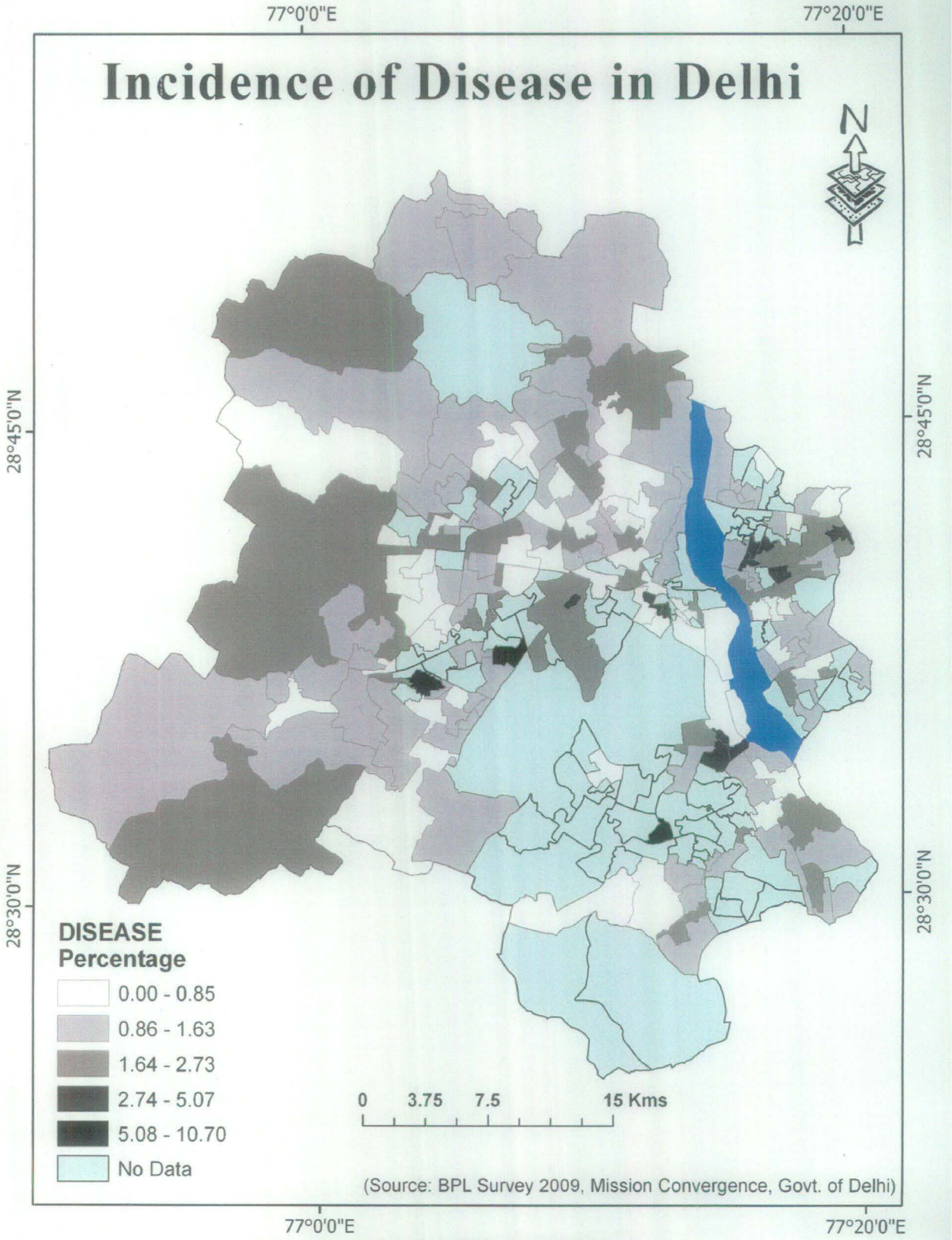


**Figure 3.8: Incidence of Disease in Delhi**

with 6.31 percentage, west Patel Nagar (94) in central part of city, Lajpat nagar (155) and Bhogal (156). This is matter of further investigation, why people suffering from any kind of disease are concentrated only in these wards. Wards along the river Yamuna are also showing more percentage of people suffering from any disease, these are Shahadara (237),Zaffarabad (250),Chauhan Bangar (249) and Janta colony (259).Percentage is also high in new Seema Puri (242) which is located on the eastern periphery of city(refers to figure 3.8).

### 3.5.9 No house

The census of India defines houseless population as the persons who are not living in census house. A census house is referred to a structure with roof. The enumerators are instructed to take note of the possible places where the houseless population is likely to live such as on the roadside, pavements, in hump pipes, under staircases or in the open, temples, mandaps, platforms and the likes[119].

The picture that emerge in front us after seeing the map is that in wards those are located on western periphery, in north and north-western side of city; have more percentage of people without home than the central, south, south eastern part of city. But wards with highest percentage of people without home are also located in central part of city like Wazirpur (67) with 25.57 percentage of people without house, Rani bagh (59) with 8.85 percentage, Rohini north (21) with 5.46 percentage, Baljeet nagar (93),Pusa (150) and Nangal Raya (110).

[119] Census of India (1991) Instruction to enumerators for filling up the household schedule and individual slip. Office of the registrar general & census commissioner for India, Ministry of home affairs, New Delhi

Houseless people are also in the Eastern Delhi but this percentage is less than 2. Even along the both front of river Yamuna concentration of people without house is not high.

There are many wards where all people have house, percentage of people without home is 0. In central delhi these are Dhirpur (13),Timorpur (10),Mukharjee nagar (11),GTB nagar (12),Sawan park (66), Nirmi colony (74); in south delhi these are Kapsahera (143),Chhattarpur (174),R.K.Puram (167) and Khanpur (181); in West Delhi these are Nithali (32),Nangai east (43),Sultan pur marja (37); In east Delhi these are Preet vihar (228),I.P.extension (227),Kartam pur (258),Mustafabad (268) and Dharampura (233) please refers to figure 3.9.

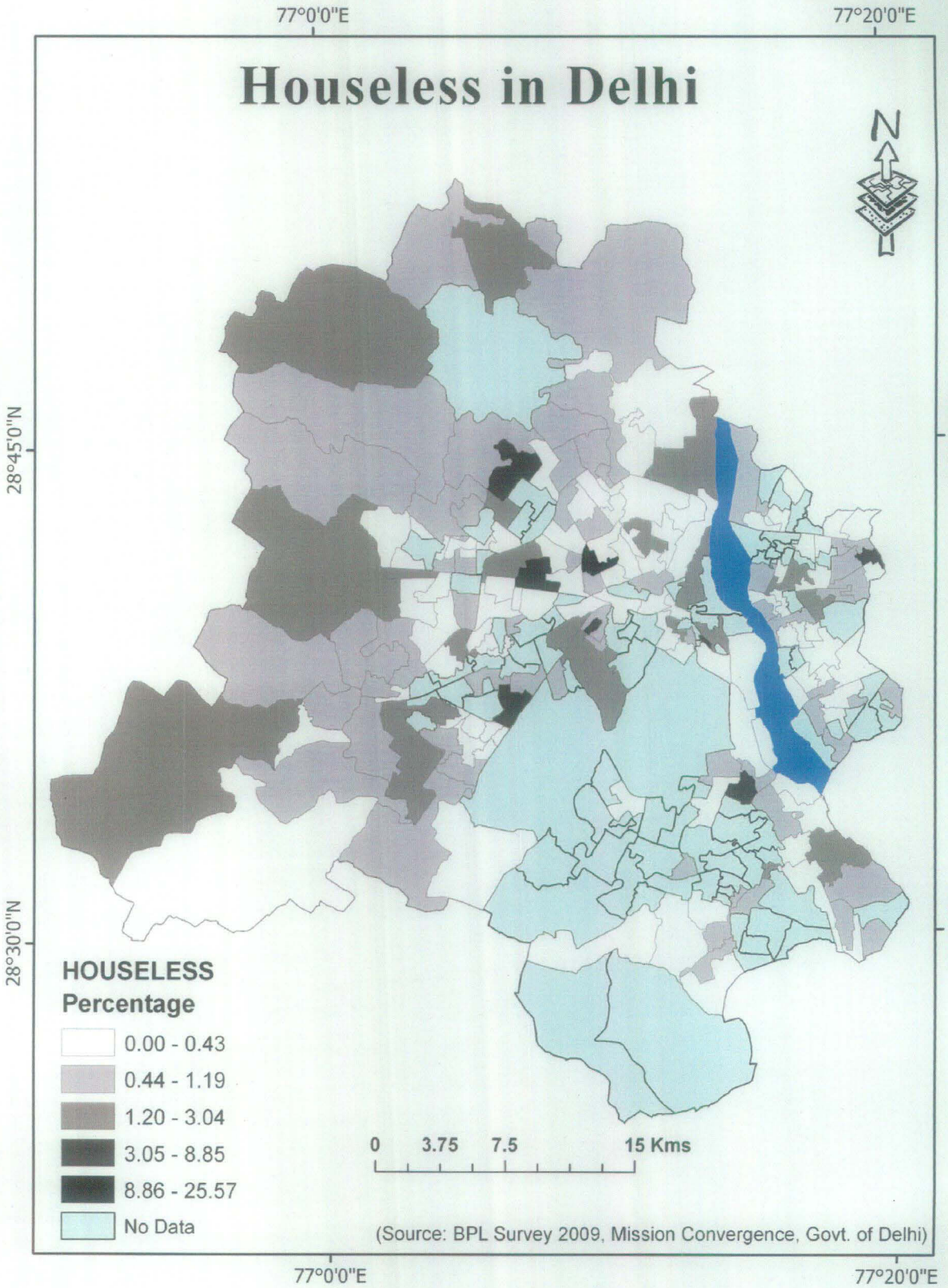


**Figure 3.9: Houseless in Delhi**

### 3.5.10 Rented house

There are many people in Delhi those are living in rented house, because they don't have their own house. When we see the distribution of percentage of people those are living in rented house, we find that this is not following any pattern as such for concentration in any one part of city ( refers to figure 3.10). There are several clusters in different parts of city like in core Paharganj (89) with 88.55 percentages of people those are living in rented house, Darayaganj (153) with 83.49 percentages of people without their own home, Rithala (22) with 72.76 percentages of people those are living in rented house.

In South Delhi these areas with more number of people staying in rented house are Khanpur (181), Tugalakabad Extension (185), Said-ul-ajab (173), Chhatarpur (174), Kapasahera (143), Bijwasan (141) and Palam (145).

In central Delhi these areas are Tri Nagar (61), Paschim vihar north (58), Shalimarbagh (55), Model town (72),Kishan ganj (75) and Paharganj (89).

Along Yamuna there are some wards where number of people living in rented house is significant, these are Daryaganj (153),Minto road (81), Nizamuddin (154), New Ashok nagar (212) and Geeta colony (230).

### 3.5.11 Single women

In this study widow, separated and divorce have considered as single woman. Single women constitute a small fraction of total population. Highest percentage of single women is in Shahdara (237) in east Delhi that is 5.85 percentage, in Tagore garden (106) 5.22 percentage, in Ramnagar (87) 4.91 percentage in central part of city. Other areas with significant number of single women are Dhirpur (13), Wazirpur (67), Trinagar(61), Northranjitnagar (96), Qasabpura (88),Ramnagar (87), Ragubir nagar(102) and Vishnu garden(107) are in central part of city.

In south west these wards are Bindapur (128),Roshanpura (137), in south-east these are Bhogal (156), Sarita vihar (208), Badar pur (203) and Deoli (178), in east these are Welcome (248),Gandhi Nagar (234),Nand Nagari (243),Sunder Nagari (244) and Preet vihar (228) kindly refer figure 3.11.

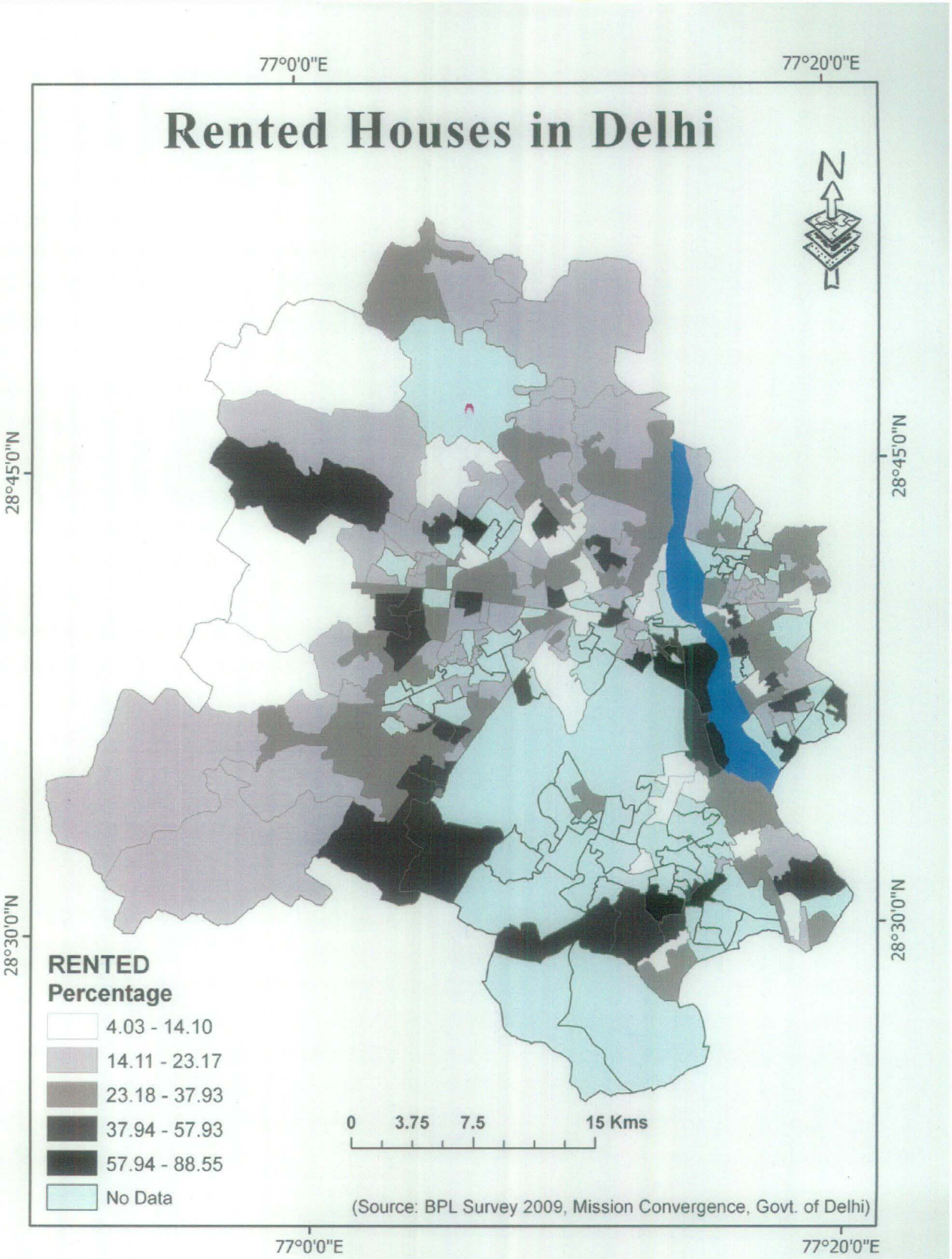


**Figure 3.10: Rented house in Delhi**

Areas where percentage of single women is very less are Minto road, Nizamuddin, Daryaganj (along Yamuna river); Sawan park, GTB nagar, Model basti, Mukharjee nagar, Paharganj Punjabi bagh , and Rani bagh in central part of city; Bijawasan (141),Chhatarpur (174), Said-ul-ajaib(173), and R.K.Puram (167) in south Delhi; Geeta colony(230), Anarkali (232) and Shakarpur (223) in East Delhi (refers to figure 3.11).

### 3.6 Index of multiple deprivation

Index of multiple deprivations has been calculated with the Principal Component Analysis (PCA), by looking at 11 indicators for all wards of NCT (national capital territory) for 2009, with the help of BPL census data for 189 wards, conducted by Delhi government in 2008-09.

The first question raised for analysis concerned the extent to which different aspects of poverty are spatially concentrated in Delhi, such that hotspots of poverty emerge. Such that concentration of multiple deprivation concentrated in one area makes it difficult for households to find a way out of poverty because they have to deal with several deprivations at the same time. It also means that innervations programmes would have to do the same to have a meaningful impact.

After analyzing the results those are coming from index of multiple deprivation and resulting map shows that areas those are emerging as hot spot of multiple deprivation are not concentrated at any one place. The areas of maximum deprivation are in centre like highest deprivation is in Wazirpur (67) which is located in central part of city, second highest is in Bindapur (128) which is located in south-western part of city and third highest is Shahdara (237) which is situated in East Delhi .

Other areas those are showing high levels of deprivation are Qasabpura (88) in central Delhi, Tagore garden (106) in central Delhi, New Ranjit Nagar (96) in central Delhi, Ram Nagar (87) in central part of city. Other areas of high concentration are Hari Nagar (111), Vishnu Nagar (107), Shankurpur (64), West Patel Nagar (94), Mangolpuri West (48), Sultanpuri South (40) and Sultanpur Majra (39) in central part of city; in North east these are Dhirpur (13), Jharoda (8) and Sonia Vihar (272). Dichaan Kalan (139) and Roshan pura(137) &Mohan garden (125) in southern-western part are emerging as hot spot of multiple deprivation.

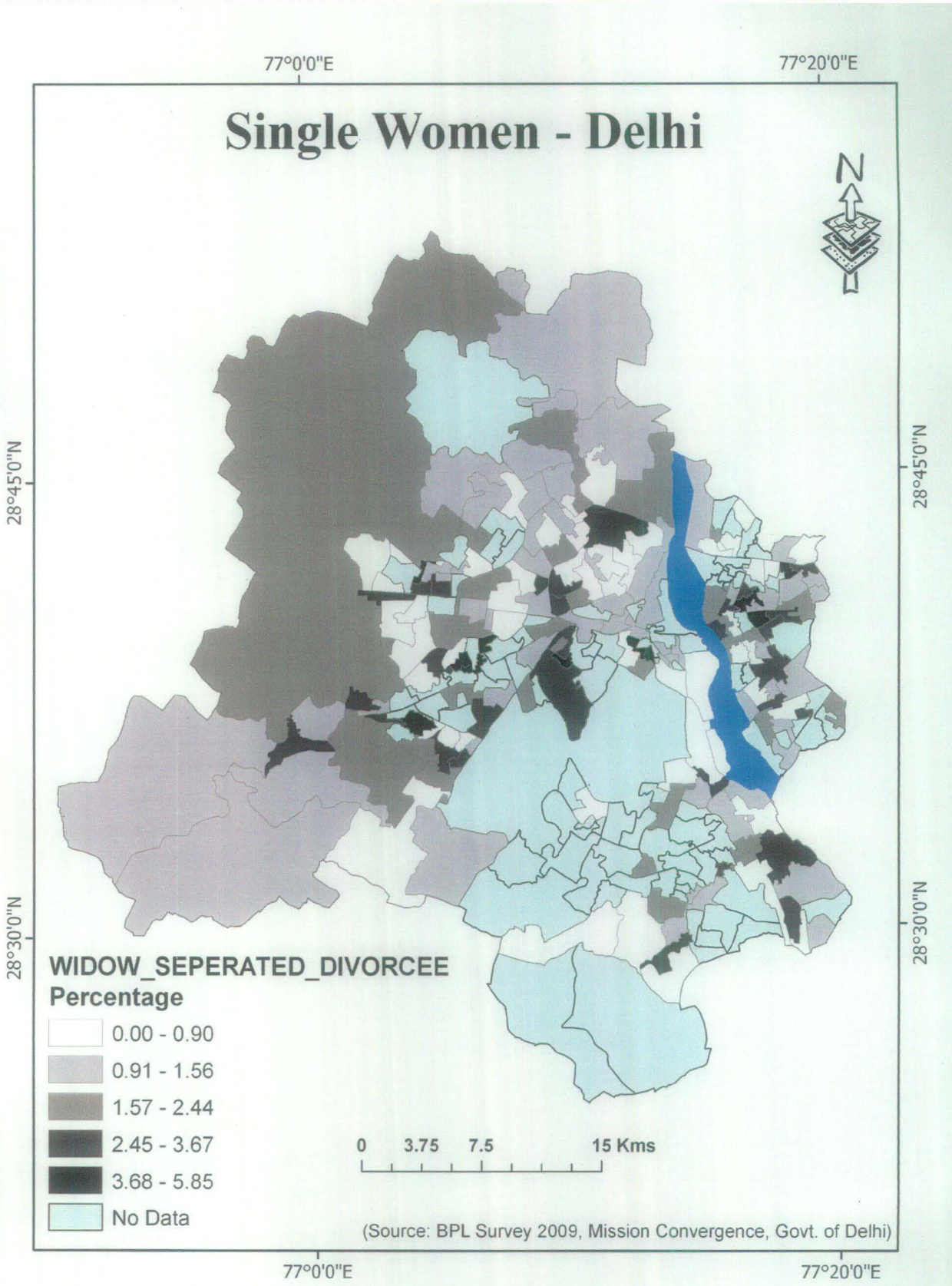


**Figure 3.11: Single women in Delhi**

Some ward are also located in East Delhi those are showing a high concentration of multiple deprivation like Jhilmil (238),Vishwash Nagar (226), Zaffarabad (250),Welcome colony (248), Janta colony(259) and Nand Nagari (243). These wards with high multiple deprivations have been emerged as hot spot of multiple deprivation.

Deprivation index is lowest in Rohini south (45), second lowest is Model Basti (90) both are located in central Delhi and third lowest is in Ashok Nagar (246) which is located in east Delhi. Other areas with low deprivation are Punjabi Bagh (103), Kohat Enclave (63), Ashok Vihar (68), Sawan Park (66), GTB Nagar (12), Model Town (72) and Rana Pratap Bagh; all are located in central part of the city.

Some areas of low deprivation are also located in East Delhi like Ram Nagar (247), Harsh Vihar (264), Mayur Vihar phase 1(209) and Mayur Vihar phase-2 (219).

Results of index shows that and is also clear from map that wards which surround the hotspots of poverty Wazirpur (67), Bindapur and Qasabpura (88),Hari nagar (111), Deoli (178), Bhogal (156), Kalian Puri (113) are wards with much lower level of deprivation on the multiple deprivation. So, wards with a high Index of multiple deprivation are thus fairly isolated and can be found adjacent to wards with lower levels of deprivation.

In Delhi industrial concentration is at certain location, these locations are Wazirpur (which is showing highest multiple deprivations according to index of multiple deprivation), Shahdara, Vishwas nagar, Okhala, Mangol Puri, Bawana, Narela, Hastsal, Mundka, where concentration of poor people is in large number in these industrial areas because they are getting some type of employment (refers to figure 3.12).

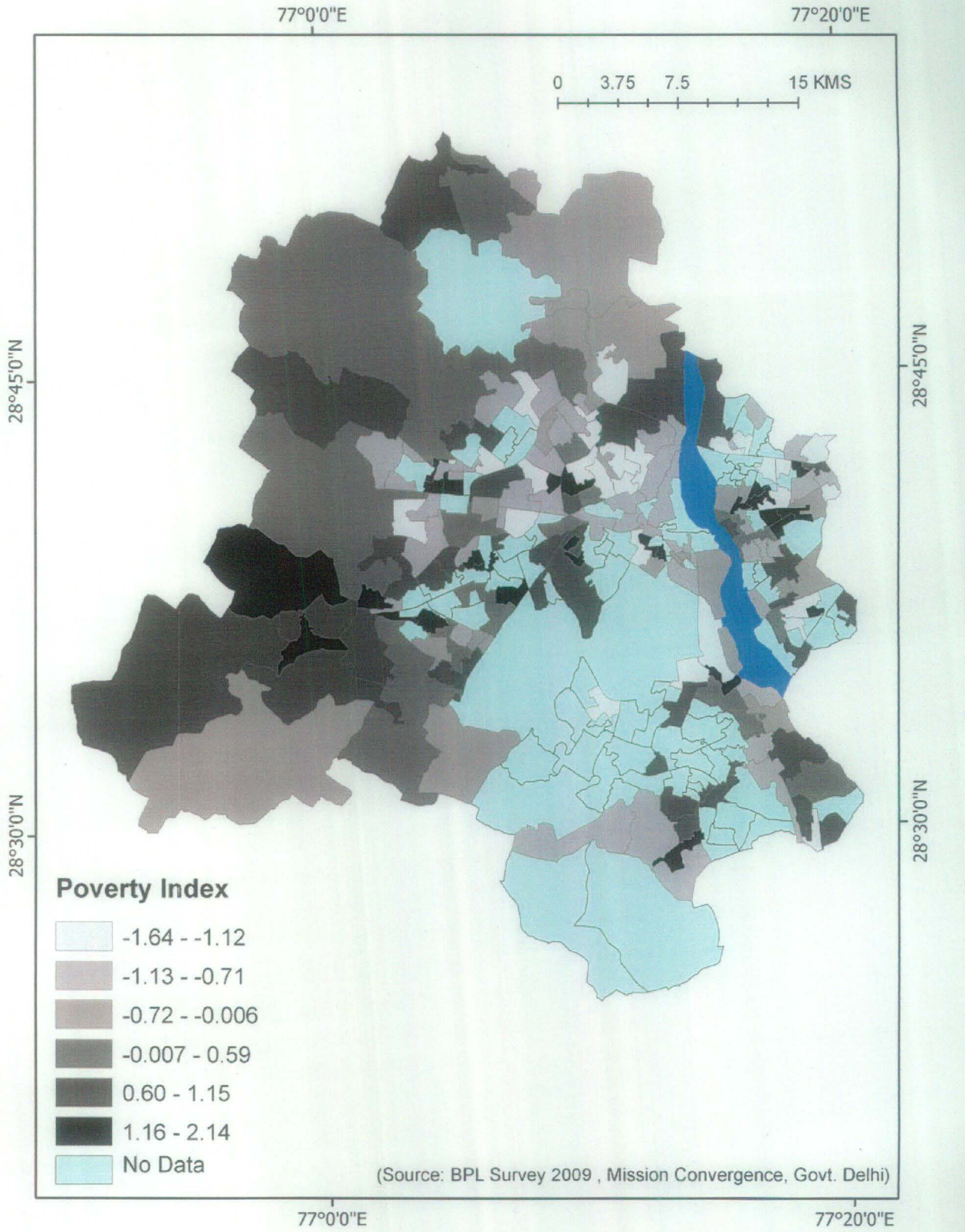


**Figure 3.12: Multiple Deprivation Index for Delhi**

## 3.7Relation between high percentage of Muslims/SC/ST and high level of multiple deprivation

### 3.7.1 Distribution of Muslim population

After analyzing the of percentage of Muslims data in each ward of Delhi and getting the levels of multiple deprivation with the help of multiple deprivation index, results reflects that clusters with high percentage of Muslim population is on eastern river front of Yamuna are Mustafa Bad (268) with 98.02 percentage of Muslims in total population, Nehru vihar (267) with 97.17 percentage, Chauhan Banger(249) with 92.53 percentage, Geeta colony (230) with 87.35 percentage, Kartam Puri (258) with 81.93 percentage, Janta colony (259) with 76.51 percentage and Khajoori Khas (269) with 75.14 percentage.

Out of all these clusters only in Janta colony is showing a high level of multiple deprivation with high percentage of Muslim population.

Wards located on western river front of Yamuna like Minto Road (81); in this cluster all the residents (100 percentage) are Muslims, Okhala (206) with 94.29 percentage of Muslim population, Kucha Pandit (82) with 87.91 percentage, Nizamuddin (154) with 88.38 percentage, Jama Masjid (79) with 86.72 percentage, Ballimaran (86) with 74 percentage, Jakir Nagar(205) with 59.93 percentage and Daryaganj (153) with 54.91 percentage are showing a good concentration of Muslim population but there is not a single ward which shows concurrence with hot spots of multiple deprivation (refers to figure no.3.13). Level of deprivation is moderate in all wards even having a high proportion of Muslim population in total population. Same is also repeating in other parts of city.

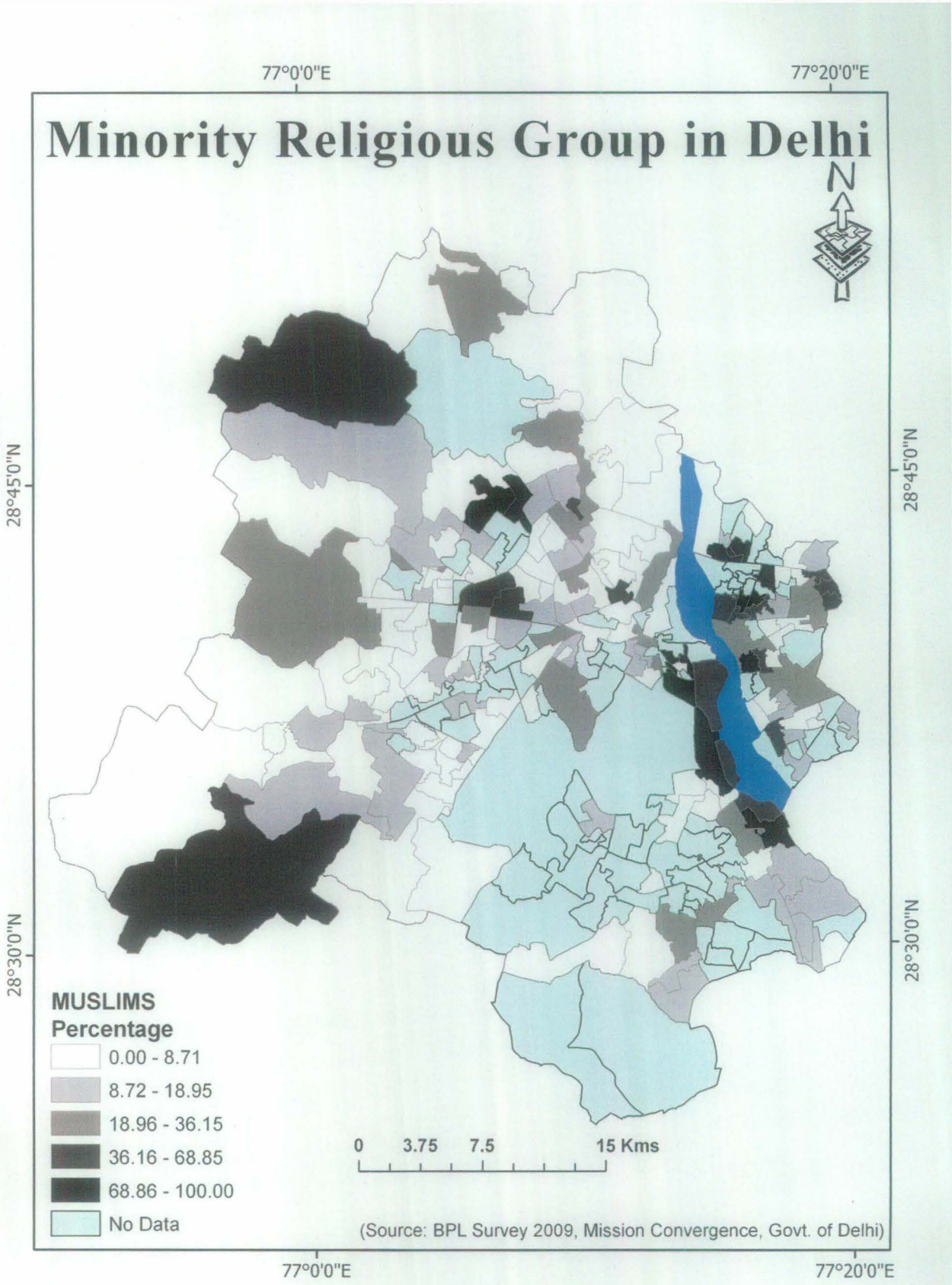


**Figure 3.13: Minority Religious group in Delhi**

### 3.7.2 Scheduled caste distribution

At the bottom of the social ladder are the niravasita meanings excluded or the exterior castes, so called casteless, officially scheduled castes. Since the government of India act of 1935, they have been listed in special official schedules for administrative and representational purpose. Article 341 of the constitution provides that the president may, with respect to any state or union territory, specify the castes, races or tribes or parts of groups within the castes, races or tribes which shall for purposes of the constitution be deemed to be Scheduled castes in relation to that state/union territory. In pursuance of these provisions, the lists of scheduled castes are notified for each state and Union territory and are valid only within the jurisdiction of that state or Union territory and not outside. In Delhi population of SC population is 16.92 percentage of total population[120].

In case of SC population, there are twenty three wards where percentage of SC population is more than 55 percentage; these are Madipur (104) with 81 percentage of SC population in total population, in central Delhi Model Basti (90) with 80.99 percentage, Adarsh Nagar (14) with 75.7 percentage, Sultan Puri east ( 37) with 76.53 percentage, Sawan Park (66) with 65.95 percentage, Kamla Nagar (69) with 63.85 percentage, Qasabpura (88) with 62.31 percentage and Pitampura south (53) with 56.41 percentage, Rohini south(45), Major Bhupinder Singh nagar (115), Hari nagar (111), Janak Puri south (109), Majnu ka tilla (78),Pahar Ganj (89); in south east Delhi these are Kasturba Nagar (157), Lajpat Nagar (155) and Deoli (178) ;in east Delhi Ashok Nagar (246), Ram Nagar (247), Shahdara (237), Dharam Pura (233) and Mayur vihar phase-1 (209); Mahavir Enclave (147) in South west part of Delhi. Out of these only four wards are showing high level of multiple deprivation, these are Deoli in south west Delhi, Hari nagar and Qasabpura in central Delhi and Shahdara in East Delhi. In other wards level of multiple deprivations is comparatively low (refers to figure no.3.14).

[120] Khullar,R.(2006) India: a comprehensive geography,Kalyani publication :1-868

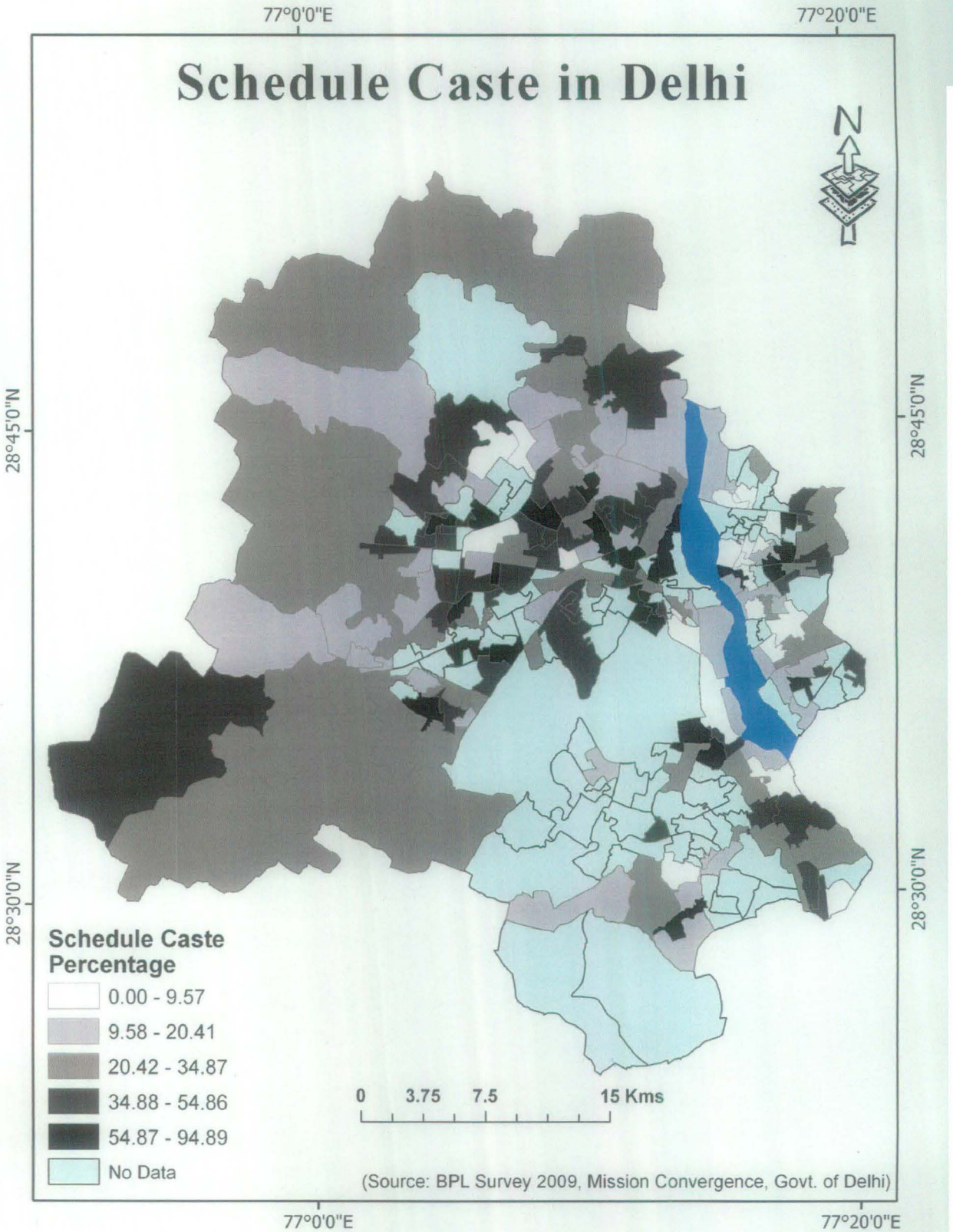


**Figure 3.14: Schedule Caste in Delhi**

### 3.7.3 Schedule tribe distribution

The term Scheduled tribe refers to specific indigenous peoples whose status is acknowledged to some formal degree by national legislation. This is a full list of ST in India as recognized in India's constitution, a total 645 district tribes[121]. This is normally considered that tribal people are more socially deprived.

Concentration of ST population is low in Delhi; there are only five wards out of 189 where percentage of ST population is more than 20 percentages. Possible reason for this may be because tribal people live in relative isolation (forest, mountainous areas) with distinct culture, religion, in the contemporary world they are considered socially and economically backward. Economically they are self sufficient, so they don't want to intermingle with modern urban society; therefore they are less migrated from their native place to urban area particularly metropolitan cities. These wards are Sadh nagar (146) located in south-west Delhi, where percentage of ST population is 39.43 which is highest, Kirti nagar (97) with 27.52 percentage, Dhirpur (13) with 36.49 percentage, Jahangir Puri (16) with 20.81 percentage ,all three are located in central Delhi and Sita Puri (120) with 21.5 percentage in south west Delhi. But multiple deprivations are of moderate level in these wards (refers to figure no.3.15).

[121] Census of India(2001) India at a glance: Scheduled caste and scheduled tribes population

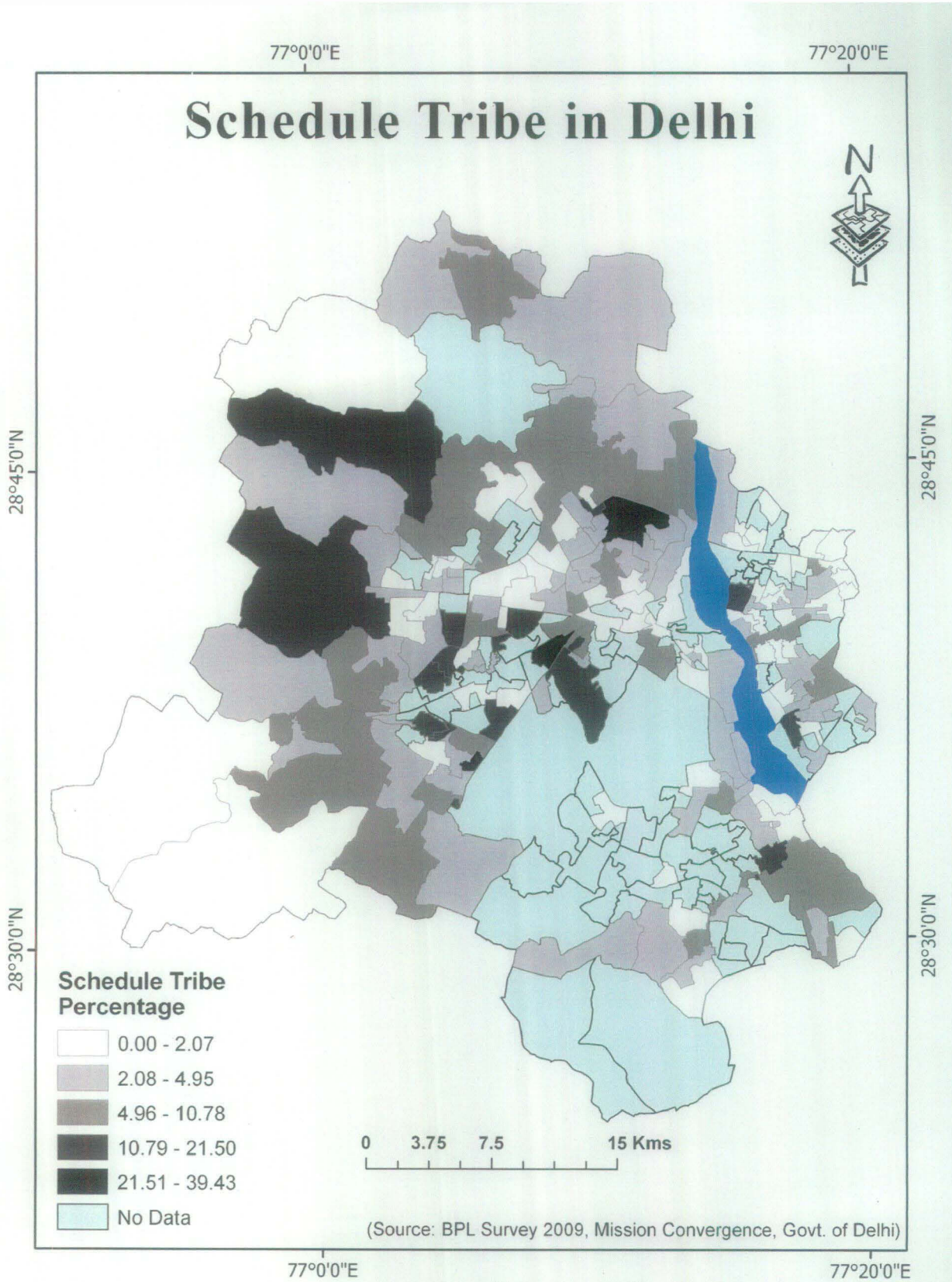


**Figure 3.15: Schedule Tribe in Delhi**

## 3.8 Correlation between indicators

**Table: 3.1: Correlation between indicators**

| | Nto | Nwa | Nele | Ill | Nba | Hand | Une | Nho | Rente | SW | Dis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No toilet | **1** | 0.12 | 0.42 | 0.33 | 0.04 | -0.04 | -0.01 | 0.04 | -0.17 | -0.16 | 0.01 |
| No water supply | 0.12 | **1** | 0.22 | 0.01 | 0.07 | -0.04 | -0.14 | 0.04 | -0.05 | -0.01 | 0.06 |
| No electricity | 0.42 | 0.22 | **1** | 0.28 | 0.16 | -0.05 | -0.14 | 0.14 | -0.26 | 0.02 | 0.07 |
| Illiterate | 0.33 | 0.01 | 0.28 | **1** | -0.24 | -0.01 | 0.48 | -0.01 | -0.30 | -0.38 | -0.06 |
| No bank | 0.04 | 0.07 | 0.16 | -0.24 | **1** | 0.12 | -0.82 | 0.14 | -0.11 | 0.60 | 0.33 |
| Handicapped | -0.04 | -0.04 | -0.05 | -0.01 | 0.12 | **1** | -0.12 | -0.01 | -0.05 | -0.011 | 0.11 |
| Unemployment | -0.01 | -0.14 | -0.14 | 0.48 | -0.82 | -0.12 | **1** | -0.14 | 0.09 | -0.69 | -0.36 |
| No house | 0.04 | 0.04 | 0.14 | -0.01 | 0.14 | -0.01 | -0.14 | **1** | -0.02 | 0.16 | 0.12 |
| Rented house | -0.17 | -0.05 | -0.26 | -0.30 | -0.1 | -0.05 | 0.09 | -0.02 | **1** | -0.218 | -0.31 |
| Single woman | -0.16 | -0.01 | 0.02 | -0.38 | 0.6 | -0.01 | -0.69 | 0.16 | -0.21 | **1** | 0.4 |
| Disease | 0.01 | 0.06 | 0.07 | -0.06 | 0.33 | 0.11 | -0.36 | 0.12 | -0.31 | 0.39 | **1** |

Nto = no toilet, New = no water supply, Nele=no electricity, Ill=illiterate, Hand=handicapped, Une=unemployment, Nho= No house, Rente= rented house, SW = widow, separated or divorced, Nba- no bank account.

Significance of relationships has been tested using the corresponding number of observations. Kundu (2002) has explained in his study-"Dichotomy or Continuum Analysis of Impact of Urban Centre's on Their Periphery" that however, given the large number of sample size even small values of the coefficients like 0.1 turn out significant[122].So in this study where data size is large around 5.2 millions so we have considered .3 or .4 as significant correlation.

No toilet is showing relatively strong significant positive correlations with the lack of basic amenities like no electricity, no water supply and also with illiteracy, correlation with no bank account, no house is significant but it's relatively moderate correlation. So this is clear that all the reciprocal indicators of basic amenities are correlated to each other and have positive correlation, its also positive with illiteracy which shows that a person who is illiterate, might not realize the importance and significance of toilet at home.

[122] Kundu, A., Pradhan, B.K. and Subramanian, A. (2002) Dichotomy or Continuum Analysis of Impact of Urban Centres on Their Periphery, Economic and Political Weekly: 5039-5046

No water supply has a good significant correlation with lack of amenities but with other indicators correlation is not significant. No electricity is also has a good significant correlation with lack of amenities and with other indicators this is not significant.

Correlation of illiteracy is moderately significant with unemployment and a slightly significant with no toilet and no electricity so this is showing illiterate person don't have any employment. No bank account is moderate significantly correlated with disease but correlation with reciprocal of basic amenities, handicapped and no house is slightly significant, so a person who don't have bank account, also suffering from any type of disease don't have access to basic amenities and don't have house because he don't have enough money for that.. Correlation between handicapped and disease is slightly significant so a person who is handicapped is also suffering by any kind of disease. No house is positively correlated with single woman and disease but this correlation is slightly significant. Correlation between single women and no bank account is highly significant and correlation between single woman and no electricity-no house is weak, correlation between disease and single women is slightly significant so a woman who is single is suffering any type of diseases because may be don't have enough money for treatment, don't have home to live.

### 3.9 Conclusion

Some indicators like illiteracy, no bank account, unemployment and rented house are showing concurrence with high level of deprivation. So intervention programmes could focus on improving access/provision of schooling, employment programmes and housing. Level of deprivation in these indicators is high in most of the wards and while the other Indicators represent low Level of deprivation in the same wards. There is not any ward which represents a complete pattern of deprivation with reference to all indicators. Some wards are showing concurrence with high illiteracy, some with unemployment, some with disease, some with no electricity, some with handicapped so policies should be form on the basis of these concurrences, and policy on the basis of one ward can not apply to all wards because forms of deprivation in one ward are different from other in form and type.

Areas those are showing concurrence with high level of multiple deprivation are not concentrated in any particular location. Areas with high multiple deprivation are located in central part of the city as well as on the periphery, like Wazirpur which is showing highest multiple deprivation is located in central Delhi and Dichaon Kala on western periphery with high multiple deprivation but number of wards with high multiple deprivation are located in central part of city.

Second important thing that is emerging from this analysis is that all the areas those are social deprived/ vulnerable, are not equally vulnerable and it is essential to focus on the most vulnerable. There are some areas where level of multiple deprivation is lower than other areas like Model Basti, Model town, GTB nagar, Panjabi Bagh, Rani Bagh, Mukund Pur in central part , Nitholi in west ,R.K. Puram in south etc. so preference should be give to highly vulnerable areas.

All the reciprocal indicators of basic amenities are positively correlated with each other and illiteracy, which shows that those are illiterate they are also not aware about amenities. Correlation between illiterate and unemployed is high which shows that those are illiterate they don't have any kind of employment. Handicapped are positively correlated with persons those are suffering from any kind of disease. Correlation between no bank account, disease and single women is significant, which shows that a woman who is single (widow/separated/divorcee), suffering from any kind of disease and she don't have bank account, it mean that she also don't have money.

People of religious minorities, caste minorities are considered as more socially deprived than other sections of society but results of this study shows that areas where concentration of these section of society is more, level of multiple deprivation are not relatively much high. So poverty is not only concentrated in these areas where these people are concentrated. Like in Kasturba Nagar (157) in south east Delhi percentage of SC population in total population is 94.89 percentage but this is showing concurrence with very low level of multiple deprivation according to index of multiple deprivation. In case of religious minority cluster in Minto road (81) in which all the residence are Muslims, but level of multiple deprivation is low.

Results of this analysis are able to answer our research questions that:

There is geographical influence on the incidence of poverty. Like the wards along the Najafgarh nallah, along Yamuna River are showing high level of multiple deprivation. There is no relation between high proportion ST/SC/Muslims population in total population and high levels of poverty in certain municipal wards because high percentage of Muslims/SC/ST in wards is not showing concurrence with high level of multiple of multiple deprivation.

Policy makers can fruitfully apply GIS mapping methods, to target wards which need priority, because they experience the highest cumulative levels of poverty. For each ward ,the criteria maps indicate which specific type of deprivation occurs in that ward, allowing the ward officer and councilors to identify specific areas of activities which would reduce existing deprivation. It also allows the corporation to identify the wards which would have priority in finance allocation to address specific deprivation.

# CHAPTER IV

# ESTIMATION OF LAND USE/LAND COVER

## 4.1 Background

To meet the demands of ever growing population tremendous pressure is exerted on the natural resources for more food production, energy, water requirement etc. Natural resources being finite imply more intensive use of land and depletion of its bio-, geo- and hydro- resources such as minerals, water, fuel and energy at much faster rate. The unsustainable and unplanned exploitation of land / natural resources is the major reason for degradation of our environment like deforestation, desertification, soil erosion, soil salinity, water logging, floods, droughts and extinction of countless species of plant and animal species. An important issue is to bring a balance between economic development and conservation of resources. It can be achieved through proper inventory and management of the natural resources on a periodic basis.

India is bestowed with valuable natural resources consisting of forests, mineral deposits, wetlands, rivers, surface water bodies and vast areas of agriculture serving the needs of sustenance of around a billion population and varied ecological functions. Due to increase in population, industrialization and migration of people coupled with large variations in climate and natural disasters, the natural resources management has become very complex. Since independence the population has increased by 284 percent (363 to 1033 M) and food grain production by 386 percent (51 to 196 MT). On the other hand, 260 M population still lives below the poverty line .The country has 150 Million ha of agricultural area and about 24% GDP is met from the agricultural production.

Over a period of two and half decades, rapid improvements in remote sensing and Geographic Information System technologies, enabled to generate and update the natural resources information in spatial format at faster rates and more frequent intervals. Up-to-date information on natural resources is essential for sustainable development of resources.

## 4.2 Datasets used

Earth observation data of Landsat TM for September 22, 2009 (refers to figure no.4.1). Landsat 5 carries the TM and has provided continuous coverage from 1$^{st}$ March 1984 till date. The satellite orbit at an altitude of 705 km and has 16 days revisit. The Landsat TM designed and operated to collect data over a 185 km swath.

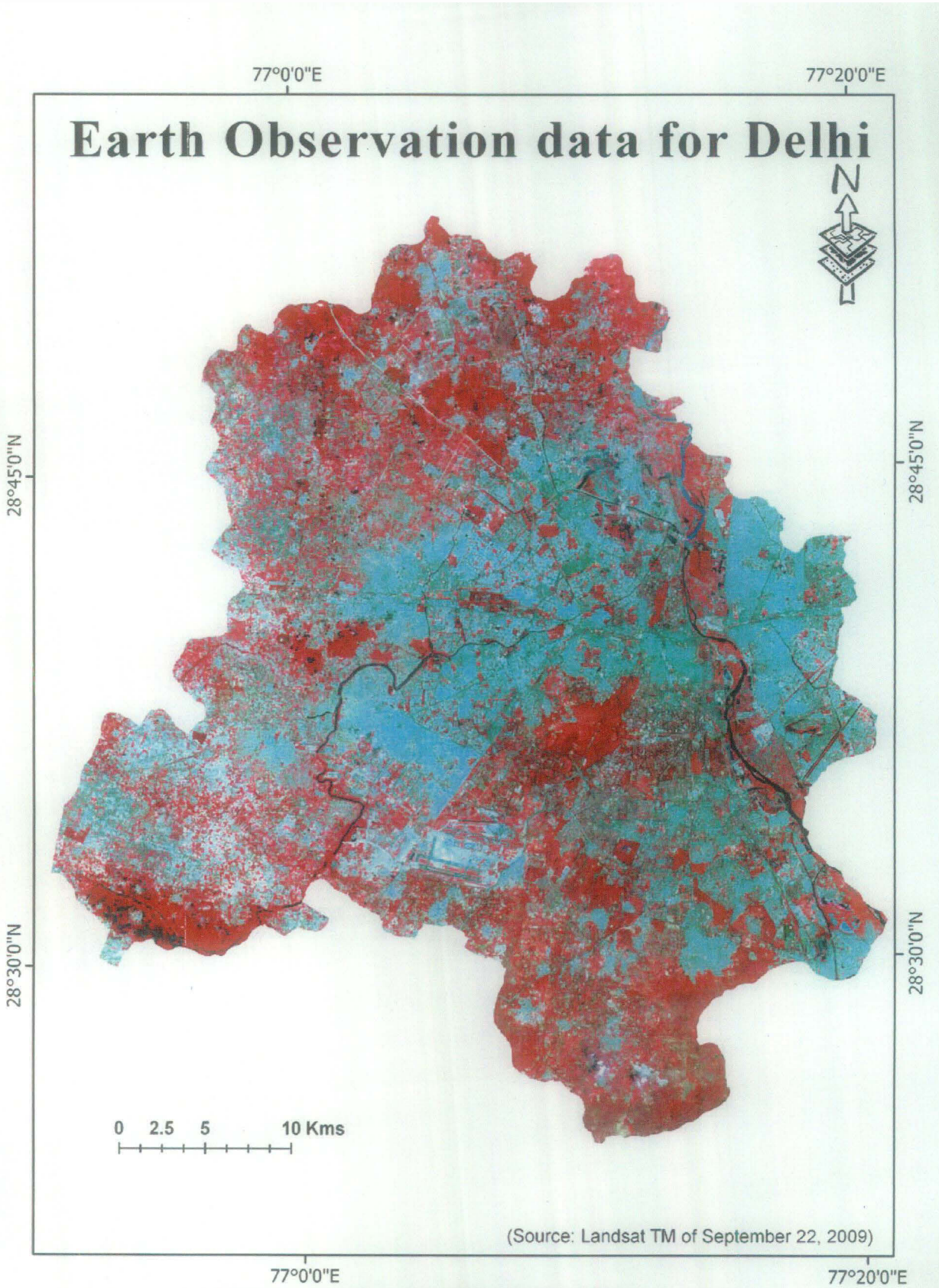


**Figure 4.1: Earth observation data for Delhi**

## 4.3 Image classification technique

The overall objective of image classification procedures is to automically categorizes all pixels in an image into land use/land cover classes or themes. Digital classification can be broadly categorized into two type's viz. supervised and unsupervised classification. Supervised classification involves creation of training sets followed by classification step. Conversely, in the unsupervised classification approach, the image data are classified by aggregating them into the natural spectral grouping, or clusters, present in the image on the basis of clustering algorithms. The major classifiers are minimum distance to mean (MDM) classifier, parallelepiped classifier, and maximum likelihood classifier (MLC). Gaussian Maximum Likelihood Classifier is the most commonly used supervised method and is supposed to provide better results compared to other supervised methods[123].

### 4.3.1 Supervised classification

In supervised classification, the image analyst "supervises" the pixel categorization process by specifying the numerical descriptors of the various land cover types present in a scene. It involves three steps – (1) training stage: identifying representative training areas and developing a numerical description of the spectral attributes of each land cover type in the scene, known as *training set*, (2) classification stage: each pixel in the image data set is categorized into the land cover class it most closely resembles, and (3) output stage: the process consists of a matrix of interpreted land cover category types[124] . The following subsections discuss the classification strategies that use the '*training set*' descriptions of the category spectral response patterns as interpretation keys by which pixels of unidentified cover type are categorised into their appropriate classes .

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[123] Foody,G.M.,Campell,N.A.,Trodd,N.M. and Wood,T.F.(1992) Derivation and Application of probabilistic measures of class membership from the Maximum Likelihood Classification:Photogrammetric Engineering and Remote Sensing,v.59(9):1335-1341

[124] Lillesand, T.M. and Kiefer. R. W.(2002) Remote Sensing and Image Interpretation, Fourth Edition, John Wiley and Sons, ISBN 9971-51-427-3

#### 4.3.1.1 Gaussian maximum likelihood classifier (GMLC)

The maximum likelihood classifier quantitatively evaluates both the variance and covariance of the category spectral response patterns when classifying an unknown pixel. It is assumed that the distribution of the cloud of points forming the category training data is Gaussian (normally distributed). This assumption of normality is generally reasonable for common spectral response distributions. Under this assumption, the distribution of a category response pattern can be completely described by the mean vector and the covariance matrix. With these parameters, the statistical probability of a given pixel value being a member of a particular land cover class can be computed. The resulting bell-shaped surfaces are called probability functions, and there is one such function for each spectral category[125].

The probability density functions are used to classify an unidentified pixel by computing the probability of the pixel value belonging to each category. After evaluating the probability in each category, the pixel is assigned to the most likely class (highest probability value) or can be labelled as "unknown" if the probability values are all below a threshold set by the analyst. Essentially, the maximum likelihood classifier delineates ellipsoidal "equiprobability contours" through a scatter diagram as shown in figure 4.2[126].

An extension of the maximum likelihood approach is the Bayesian classifier. This technique applies two weighting factors to the probability estimate. First, the "a priori probability", or the anticipated likelihood of occurrence for each class in the given scene is determined. Secondly, a weight associated with the "cost" of misclassification is applied to each class. Together, these factors act to minimize the "cost" of misclassification, resulting in a theoretically optimum classification. Most maximum likelihood classifications are performed assuming equal probability of occurrence and cost of misclassification for all classes. If suitable data exist for these factors, the Bayesian implementation of the classifier is preferable[127].

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[125] Ibid

[126] Ibid

[127] Ibid

In this study Gaussian maximum likelihood classifier has been used for image classification.

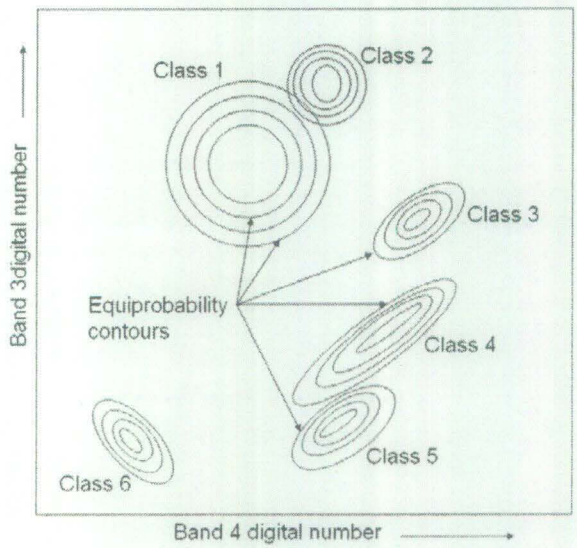


**Figure 4.2: Clustering of classes B4 Vs B3**

## 4.4 Classification scheme

Keeping in view of the objectives, satellites data was used for preparation of land use/land cover map for Delhi, and seven major classes were made as per Anderson et al[128], 1976 classification scheme, which is as follows:

1) High dense built-up,
2) Low dense built-up,
3) Water bodies,
4) Agriculture cropland,
5) Dense vegetation(forest),
6) Sparse vegetation(including parks) and
7) Scrubs and bare soil

[128] Anderson,J.,Hardy,E.E.,Roach,J.T, and Witmer, R. E. (1976) A Land Use and Land Cover Classification System for Use with Remote Sensor Data,A revision of the land use classification system as presented in U.S. Geological Survey Circular 671,U.S.Government printing office,Washington,D.C.:28

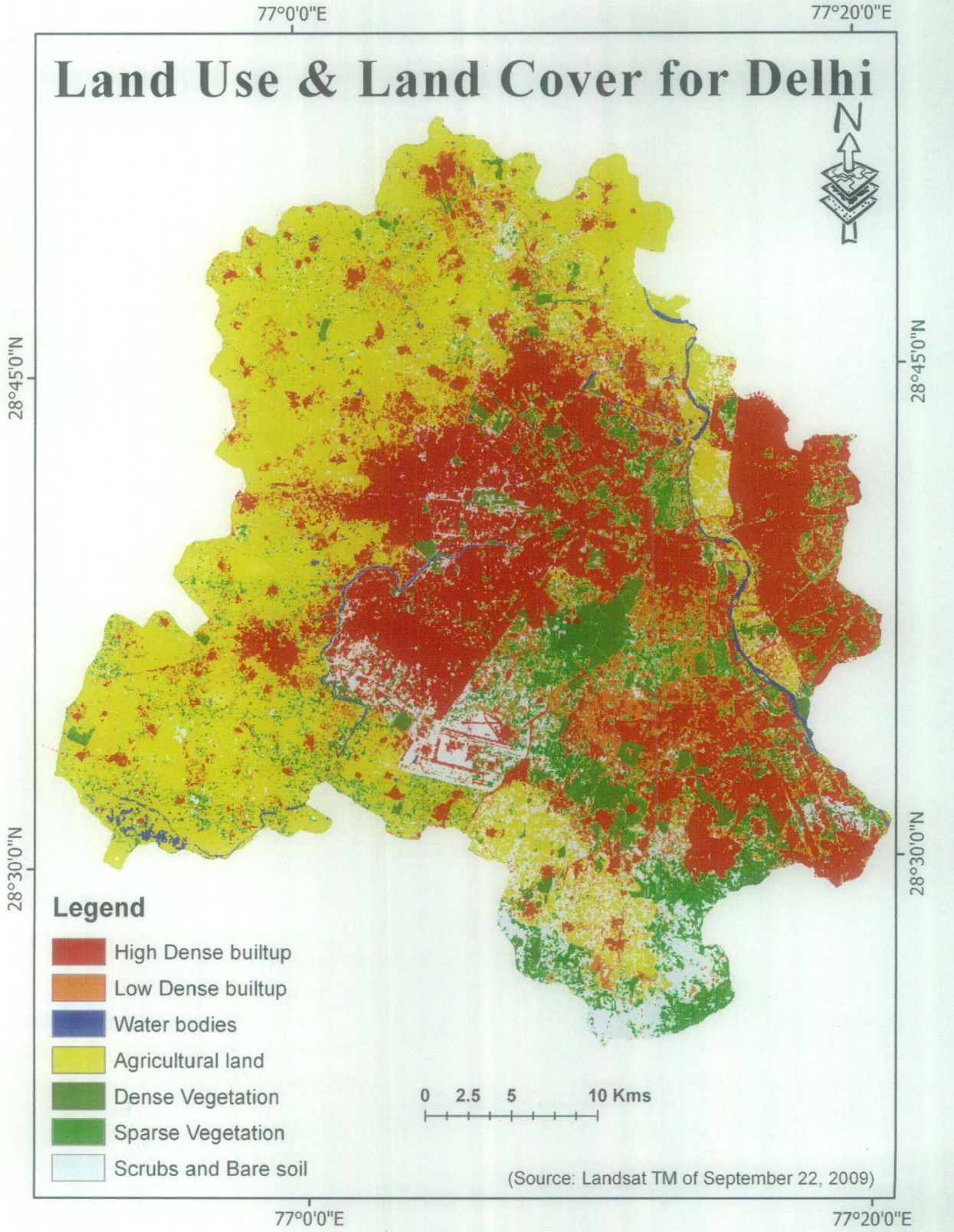


**Figure 4.4: Land use and land cover of Delhi**

## 4.5 Statistics of Land use and Land cover

In this land use/land cover classification high dense built has been represented by dark red color, low dense built up by orange color, agriculture by yellow color, Dense agriculture by green color, sparse vegetation by parrot color and Scrubs-bare soil by grey color (refers to figure no.4.4).

**Table 4.1: Land use /land cover statistics 2009 for Delhi**

| S.No | Class | Area in hectares | Area in kilometers | percentage |
|---|---|---|---|---|
| 1 | High Dense built-up | 40960.8 | 409.60 | 27.88 |
| 2 | Low Dense built-up | 15319.35 | 153.19 | 10.42 |
| 3 | Water bodies | 1658.43 | 16.58 | 1.13 |
| 4 | Agricultural land | 48358.53 | 483.57 | 32.92 |
| 5 | Dense Vegetation | 8922.51 | 89.19 | 6.07 |
| 6 | Sparse Vegetation | 13939.11 | 139.38 | 9.49 |
| 7 | Scrubs and Bare soil | 17749.62 | 177.49 | 12.88 |
| | Total | | 1483 | 100 |

(Source: Landsat TM of September 22, 2009)

Urban or Built-up Land is comprised of areas of intensive use with much of the land covered by structures. Included in this category are cities, towns, villages, strip developments along highways, transportation, power, and communications facilities, and areas such as those occupied by mills, shopping centers, industrial and commercial complexes, and institutions that may, in some instances, be isolated from urban areas. Agricultural land, forest, wetland, or water areas on the fringe of urban or Built-up areas will not be included except where they are surrounded and dominated by urban development. The Urban or Built-up category takes precedence over others when the criteria for more than one category are met. For example, residential areas that have sufficient tree cover to meet Forest Land criteria will be placed in the Residential category[129]. It range from high density, represented by the multiple unit structures of urban cores, to low density, where houses are on lots of more than an acre, on the periphery of urban expansion.

[129] Anderson,J., Hardy,E.E.,Roach,J.T. and Witmer, R. E. (1976) A Land Use and Land Cover Classification System for Use with Remote Sensor Data,A revision of the land use classification system as presented in U.S. Geological Survey Circular 671,U.S.Government printing office,Washington,D.C.:28

As development progresses, land having less intensive or nonconforming use may be located in the midst of urban or Built-up areas and will generally be included in this category[130].

Built-up accounted a large proportion of **38.2 percent** area in National capital territory of Delhi; built-up has been divided in two categories: High dense built-up which accounted for about **27.88 per cent** and low dense built-up which accounted for about **10.42 percent** of total area of Delhi. All the part of central Delhi and eastern Delhi and some parts of south-west Delhi is coming under high dense built-up, which is showing a high concentration of population.

The delineation of water areas depends on the scale of data presentation and the scale and resolution characteristics of the remote sensor data used for interpretation of land use and land cover. These frequently can be obtained from small-scale remote sensor data with considerable accuracy[131]. A small proportion of **1.13 per cent** is under water bodies which include Najafgarh nallah, River Yamuna and other water bodies.

Agricultural Land may be defined broadly as land used primarily for production of food and fiber. On high-altitude imagery, the chief indications of agricultural activity will, be distinctive geometric field and road patterns on the landscape and the traces produced by livestock or mechanized equipment. Distinguishing between Agricultural and Urban or Built-up Lands ordinarily should be possible on the basis of urban activity indicators and the associated concentration of population. The number of building complexes is smaller and the density of the road and highway network is much lower in Agricultural Land than in Urban or Built-up Land[132]. In Delhi Total 483.57 square kms is under agriculture which is **32.92 per cent** of total geographical area of Delhi so area under agriculture land is quite high, this shows that the population is engaged in commercialized agricultural practice and which is the basis for living.

Vegetation has been also divided in two categories:

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[130] Anderson,J., Hardy,E.E.,Roach,J.T. and Witmer, R. E. (1976) A Land Use and Land Cover Classification System for Use with Remote Sensor Data,A revision of the land use classification system as presented in U.S. Geological Survey Circular 671,U.S.Government printing office,Washington,D.C.:28

[131] Ibid

[132] Ibid

Dense vegetation and sparse vegetation (also include parks). In which dense vegetation covers **6.07 percent** of total geographical area and sparse vegetation covers **9.49 percent** of total geographical area of Delhi.

There are fourteen city forests developed in the city by the Department of Forests and Wild Life as shown below:

**Table 4.2: District wise city forests**

| S. No. | Name of City Forest | Area (ha) | District |
|---|---|---|---|
| 1. | Nasirpur City Forest | 28.00 | South West |
| 2. | Alipur City Forest | 16.80 | North |
| 3. | Hauzrani City Forest | 28.80 | South |
| 4. | Mitraon City Forest | 40.00 | South-West |
| 5. | Sultanpur City Forest | 48.00 | North-West |
| 6. | Ghummanhera City Forest | 32.00 | South-West |
| 7. | Ghoga | 10.40 | East |
| 8. | Shahapur Garhi | 08.00 | North-East |
| 9. | Mamurpur | 56.00 | North-East |
| 10. | Jindpur | 47.60 | North-East |
| 11. | Mukhmelpur | 53.00 | North-East |
| 12. | Bawana | 32.00 | North- West |
| 13. | Garhi Mandu | 300.00 | East |
| 14. | Anand Vihar | 32.00 | East |

Source: Department of Forests & Wild Life

The Delhi Ridge is an important constituent of the forest cover of Delhi and covers 7784 ha. The Delhi Ridge is an extension of the Aravallis and extends into Delhi from Haryana at Tughlakabad Bhatti Mines – Dera Mandi axis moving north, covering parts of Delhi Cantonment, Lutyen's Zone and culminating at Delhi University. This area is also included in the Notified Forest Areas in Delhi There is one man-made wildlife sanctuary in Delhi managed by the Department of Forests and Wildlife that is Asola Wildlife Sanctuary.[133].

As per the MPD (Master plan for Delhi) 2001, 8422 ha of land has been earmarked for park greens. There are district parks (part of the Delhi Ridge),

[133] City development plan, Delhi (2006) Department of urban development, Government of Delhi

Neighborhood Parks, City Forests, Historical Landscapes, Sports complexes, Landmark Greens and Green Belts. There are 14500 big and small parks managed by the local and semi government agencies. Few of the prominent parks of Delhi are: Lodhi Gardens, Garden of Five Senses, Indraprastha Park and Nehru Park.

Scrubs and bare soil is comprises by 12.88 per cent of the total geographical area of Delhi.

## 4.6 Conclusion

This is clear that in Delhi most of the area is under built-up. This is around 39 percentage of the total geographical area of Delhi. Area under high dense built-up is more than low dense built-up. Built-up is mainly concentrate in central-eastern and some part of south-east Delhi. Second highest area is under agriculture which is 33 percentage of total geographical area of Delhi that is bit surprising because Delhi is national capital city of India which is considered as highly urbanized with concentration of secondary and tertiary activities. Area under agriculture is mainly concentrated in north, west & south-west part of city and along the eastern river front of Yamuna. Almost 16 percentage of area is under vegetation, which is mainly concentrated on ridge. Least is under Scrubs and bare soil.

# CHAPTER V

# POVERTY AND LAND USE LAND COVER

## 5.1 Background

Location is a powerful determinant of poverty. Spatial patterns of inequality between and within territories/administrative smallest polygon features have become an important focus of the development community, and research on patterns of poverty and inequality across districts, municipalities, and communities has accelerated over the past decade. While the absence of data once impeded the examination of local information on poverty (Universal methods like NSSO survey 61$^{st}$ round), a technique for estimation of poverty at a local level by combining census and household survey information can be a better choice. The result—the small area ward level poverty map— can give insight in deepened our understanding of the determinants of poverty and led to improvements in the design of policies tailored to local conditions.

Poverty and environment has been considered to link to each other. There is little evidence of urban poverty being a significant contributor to environmental degradations but strong evidence that urban environmental hazards are major contributors to urban poverty. If individuals or households find minimum standard accommodation too costly, they have to make certain sacrifices in the accommodation they choose to bring down the price. They usually make sacrifices in environmental quality[134].

This chapter is an attempt to address possible interaction between poverty hotspots and prevailing land use over landscape. Secondly for interventions and (to look for policies) that can be influenced by poverty maps, including, but not limited to, the location of services, the creation of municipal development plans, and the allocation of grants and fiscal transfers.

Poverty maps are likewise used to examine the geographical determinants of poverty. By combining the poverty maps with other spatial data sets, one may analyze the extent to which natural geography and climate (for example, land use, elevation, rainfall, and temperatures) and infrastructure (such as roads, railways, and markets) determines poverty levels within an area.

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[134] Satterthwaite, D. (2003) The Links between Poverty and the Environment in Urban Areas of Africa, Asia, and Latin America, Annals of the American Academy of Political and Social Science, Vol. 590, Rethinking Sustainable Development :73-92

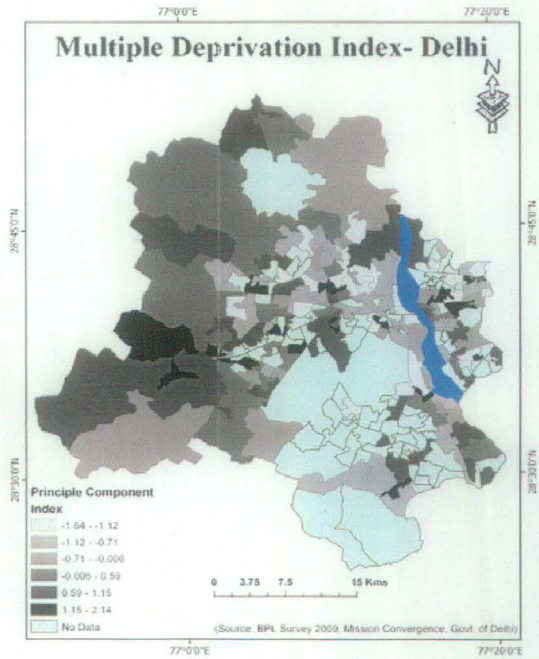
## 5.2 Interaction between poverty hotspots and land use land cover

### 5.2.1 Locational

This is typically done using a geographic information system (GIS), which systematically organizes data on the location and characteristics of points of service, various sorts of zones, or networks. These features are not specific to poverty maps; indeed, more aggregate poverty estimates from survey data alone may also be projected onto maps. However, more aggregate poverty maps are typically too coarse to provide substantial insights on the spatial correlates of poverty. In other words, until the advent of the poverty maps, poverty data were often a weak link in GIS analysis because the poverty data were at much lower resolution than the other spatial data.

The combination of data from different sources and at various levels of analysis has allowed to deep understanding of poverty and its determinants. This may then lead to shifts in the approaches adopted by governments to fight poverty, design new programs, revise strategies, and so on, in addition to changes in existing programs. Overlaying the poverty map and a map depicting access to nearby markets or cities has demonstrated that poverty incidence is highly correlated with geographical isolation as measured by distance to the nearest market or city. This can prompt a shift to an emphasis on reaching areas that are more isolated. Although this simple visual correlation does not provide conclusive evidence on causal relationships, it does help identify relationships that merit closer investigation.

As we can see from the maps that wards those are emerging as hot spot of multiple deprivation, these are located in the central part of city like Wazirpur (67) Qasabpura (88) ,Tagore garden (106) ,New Ranjit nagar (96) ,Ram nagar (87), Shankurpur (64),West Patel nagar(94) and Mangolpuri west(48), land use these is high dense built up, other hot spots are located in east Delhi like Jhilmil (238),Vishwash nagar (226),Zaffarabad (250),Welcome colony(248),Janta colony(259) and Nand Nagari (243), these are also located in high dense builtup.



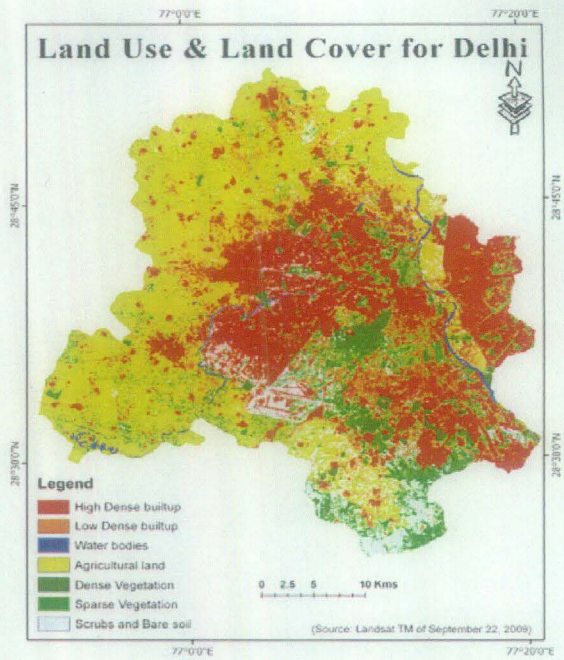




**Figure 5.1(a): Multiple deprivations** **Figure 5.1(b): Land use/ land cover of Delhi**

Wards those are located near to Najafgarh Nalla like Vikas Puri east (116),Vikas nagar(124), Hastsal (122),Mohan garden(125), Dichon kalan (139), Nangli Sakravati (134), Roshan Pura (137) and Kakrola (135) are showing a bit high levels of multiple deprivation, in these areas land use is high dense built-up.

All the land in under agriculture on the northern-north western-western and south western periphery of NCT of Delhi and built up is not dense in these areas. Between them there are some patches of high dense built- up like Narela (ward no. 1) and Bankner (ward no. 2), in these wards multiple deprivation is also moderately high.

Wards those are located in the south east part of city like Tigri (179),Khanpur (181), Sarita vihar(208), Badarpur (203) and Meeteypur (202) are showing high dense built up along with multiple deprivation in these wards is high.

So areas those are located in the high dense built up type of land use, they are also reflecting more multiple deprivation.

### 5.2.2 Centrality/Proximity

Central Feature (Spatial Statistics) is the Central Feature method, which identifies the most centrally located feature in a point, line, or polygon feature class. Distances from each feature centroid to every other feature centroid in the dataset are

calculated and summed. Then the feature associated with the shortest accumulative distance to all other features is selected. Potential applications, for example, if we wanted to build a performing arts center, you could calculate the central feature of a block group feature class weighted by population to identify the part of the town is accessible to the most people in the region and make it a top candidate. The Central Feature is useful for finding the center when there is travel between the features and the center.

Dev Nagar, adjoining to Karol Bag (ward No 92) is the identified central geographic feature in Delhi using ArcGIS environment. A buffer of 5 and 15 km from central feature is generated to identify poverty hotspots on the proximity basis.

Seven wards which have relatively high poverty within 5 kms buffer viz., New Ranjeet nagar (96), Baljit nagar (93), Qasabpura (88), Ramnagar (87), Wazirpur (67), Shankurpur (64) and harinagar (111).

Between 5 and 15 kms of buffer, seventeen wards have relatively high poverty. Out of seventeen, eight wards are in western delhi, cluster of six wards in trans Yamuna area of delhi around Shadara, Nand Nagari (243) and Kalian Puri (213) are also in high poverty index. Bhogal (156) near Yamuna is also in high poverty Index value between 5 and 15 kms of buffer.

Only three wards have high poverty index values after 15 kms of buffer from central part of Delhi. These wards are Dichaon kalan (139), Roshan Pura (137) in western part and Deoli (178) in south-east. These wards are corresponding to agriculturally potential areas.

All wards which have relatively low poverty are within 15 kms of buffer, without even an exception. Twenty four out of 27 wards with high multiple deprivation are within 15 kms of buffer area from central part of Delhi. All these wards are also corresponding within limits of dense built up area (refer Figure 5.2).

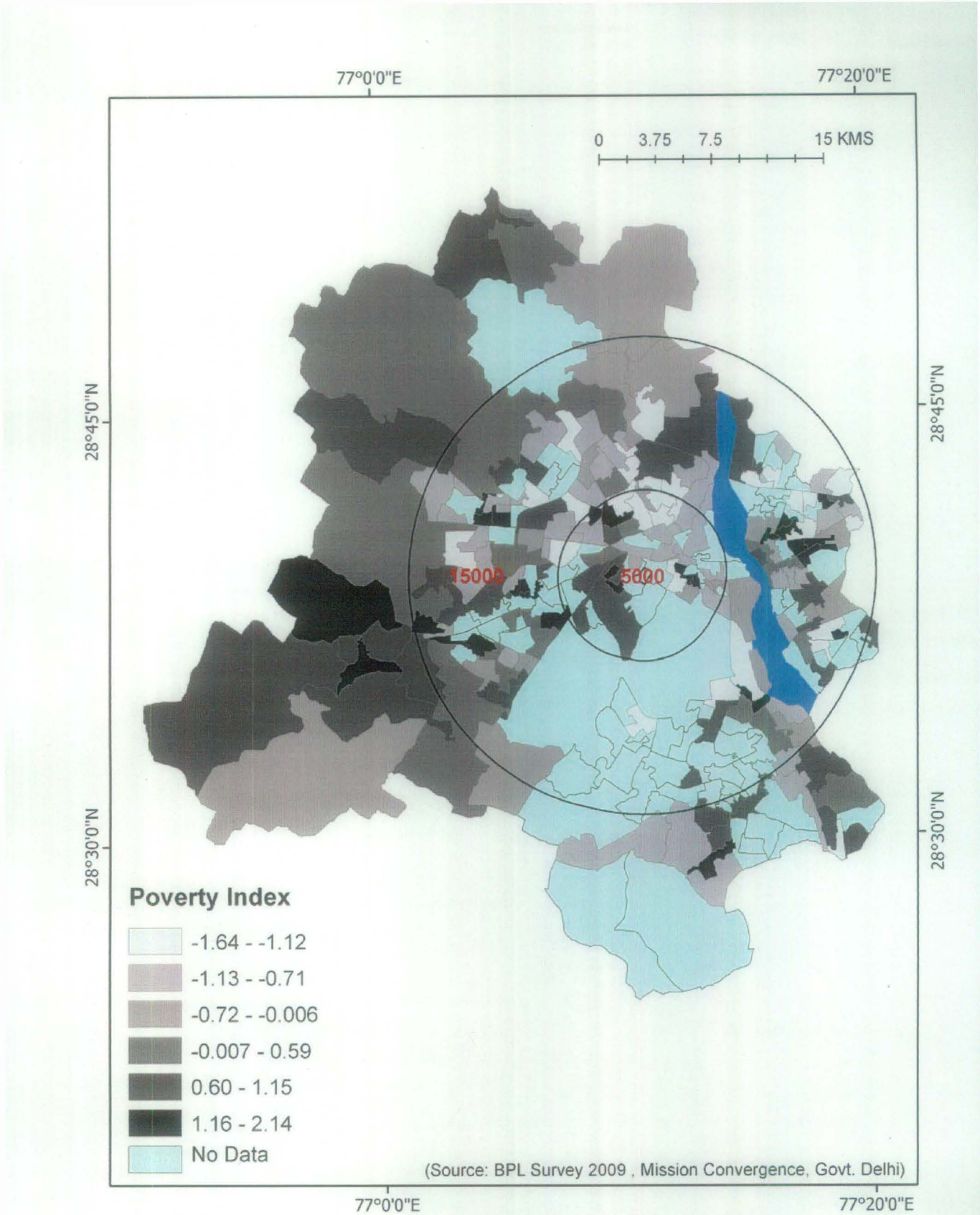



**Figure 5.2: Proximity Analysis and Poverty**

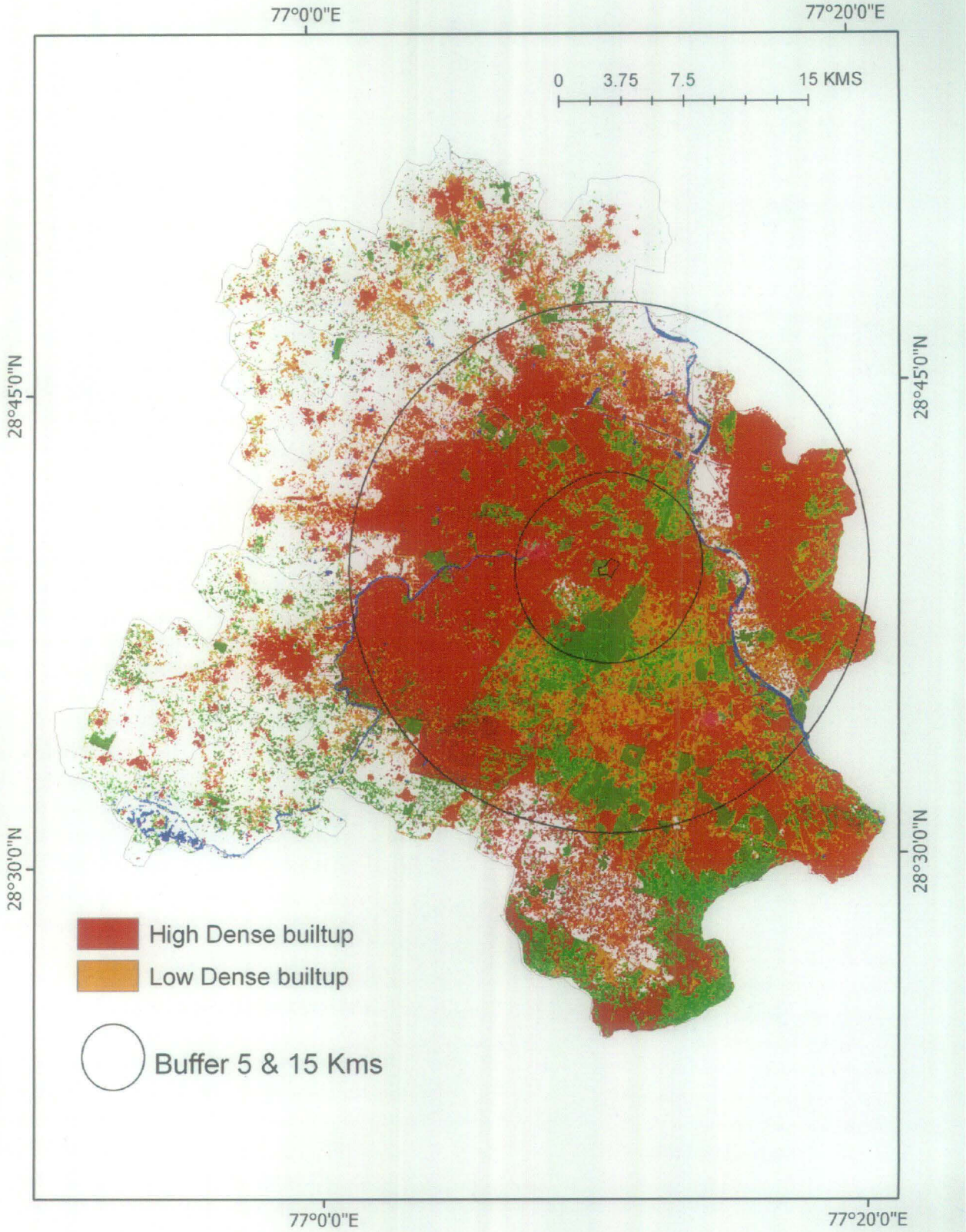



**Figure 5.3: Proximity Analysis and Built Up**

## 5.3 Conclusion

There is a relationship between the built up area and high level of multiple deprivation. Central part of Delhi specially the 5 km buffer has the ward having highest value of multiple deprivation. Second fifteen km. buffer is also representing the pattern i.e. high proportion of dense built up and high level of multiple deprivation. In this zone the number of wards having high level of multiple deprivation, it is maximum among three zones. The peripheral wards have the low level of built up area and low level multiple deprivation. Because this region represents an agriculture type of land use and the economy. Thus the hypothesis considering built up area as proxy indicator of urbanization is true and it has a positive relationship with the high level of multiple deprivation.

# CHAPTER VI
# CONCLUSION

## 6.1 Conclusion

The resultant presentation as a map not only summarizes a large volume of data concisely, but it also enhances the interpretation of that data by preserving the spatial relationships among different areas, something that simply is not possible in a tabular data format. Poverty maps are likewise used to examine the geographical determinants of poverty. This study has shown the potential of combining the poverty maps with other spatial data sets, one may analyze the extent to which natural geography (for example, land use land cover ) and social infrastructure determine poverty levels within an area. The maps create an important opportunity for different actors to join in the public debate on poverty. This space for dialogue is critical because it brings together many actors who probably would not otherwise speak on such issues and creates a forum for them to reflect on poverty.

Some of the findings are summarized as per the objectives and sync with research questions:

Indicators like illiteracy, no bank account, unemployment and rented house are showing concurrence with high level of deprivation. So intervention programmes could focus on improving access/provision of schooling, employment programmes and housing. Level of deprivation in these indicators is high in most of the wards and while the other Indicators represent low level of deprivation in the same wards. There is not any ward which represents a complete pattern of deprivation with reference to all indicators. Some wards are showing concurrence with high illiteracy, some with unemployment, some with disease, some with no electricity, and some with handicapped so policies should be form on the basis of these concurrences, and policy on the basis of one ward can not apply to all wards because forms of deprivation in one ward are different from other. Across the wards there is diversity in combination of deprivations.

Second, areas which are showing concurrence with high level of multiple deprivations are not concentrated in any particular location. Thus there is need for further interpretation at micro level for historical and institutional interventions for finding locational inconsistencies.

However, distance from the center reflects some patterns. Areas with high multiple deprivation are located in central part of the city as well as on the periphery, like

wazirpur which is showing highest multiple deprivation is located in central Delhi and Dichaon kala on western periphery with high multiple deprivation but number of wards with high multiple deprivation are located in central part of city.

Third important thing that is emerging from this study is that all the municipal wards those are social deprived/ vulnerable, are not equally vulnerable and it is essential to focus on the most vulnerable. There are some areas where level of multiple deprivation is lower than other areas like Model Basti, Model town, GTB nagar, Panjabi Bagh, Rani Bagh, Mukund Pur in central part , Nitholi in west , R.K.Puram in south etc. So preference should be give to highly vulnerable areas.

Fourth, reciprocal indicators of basic amenities are positively correlated with each other and illiteracy, which shows that those are illiterate they are also not aware about amenities. Correlation between illiterate and unemployed is high which shows that those are illiterate they don't have any kind of employment. Handicapped are positively correlated with persons those are suffering from any kind of disease. Correlation between no bank account, disease and single women is significant, which shows that a woman who is single (widow/separated/divorcee), suffering from any kind of disease and she don't have bank account, it mean that she also don't have money.

Fifth municipal wards with percentage people of religious minorities, social groups are considered as more socially deprived than other sections of society. But results out of this study shows that areas where concentration of these section of society is more, level of multiple deprivation are not relatively much high. So poverty is not only concentrated in these areas where minority/ social groups are concentrated. Like cluster which is in Kasturba nagar (157) in south east Delhi percentage of SC population in total population is 94.89 percentages but this is showing concurrence with very low level of multiple deprivations according to index of multiple deprivations. In case of religious minority cluster in Minto road (81) in which all the residence are Muslims, level of multiple deprivation is low.

Sixth, Results of this analysis are able to answer our research questions that: There is geographical influence on the incidence of poverty. Like the wards along the Najafgarh nallah, along Yamuna River are showing high level of multiple deprivation. There is no relation between high proportion ST/SC/Muslims population in total

population and high levels of poverty in certain electoral wards because high percentage of Muslims/SC/ST in wards is not showing concurrence with high level of multiple of multiple deprivation. And there are wards which are showing good condition of basic amenities but level of multiple deprivation is high, others with high level of multiple deprivation in basic amenities and infrastructure but deprivation level is not much high. Because basic amenities are not only factors those are responsible for high levels of multiple deprivation.

Seventh, Policy makers can fruitfully apply GIS mapping methods, to target wards which need priority, because they experience the highest cumulative levels of poverty. For each ward, the maps indicate which specific type of deprivation occurs in that ward, allowing the ward officer and councilors to identify specific areas of activities which would reduce existing deprivation. It also allows the corporation to identify the wards which would have priority in finance allocation to address specific deprivation.

This is clear that in Delhi most of the area is under built-up. This is around 39 percentage of total geographical area of Delhi. Area under high dense built-up is more than low dense built-up. Built-up is mainly concentrate in central-eastern and some part of south-east Delhi. Second highest area is under agriculture which is 33 percentage of total geographical area of Delhi that is bit surprising because Delhi is national capital city of India which is considered as highly urbanized with concentration of secondary and tertiary activities. Area under agriculture is mainly concentrated in north, west & south-west part of city and along the eastern river front of Yamuna. Almost 16 percentage of area is under vegetation, which is mainly concentrated on ridge. Least is under scrubs and bare soil.

Wards which have lowest poverty are within 15 kms of buffer, without even an exception. There are 27 wards with high poverty, 24 out of these 27 wards are within 15 kms of buffer area in central part of Delhi. All these wards are also corresponding within limits of dense built up area. Only three wards have high poverty index values and are out of 15 kms of buffer from central part of Delhi. These wards are Dichaon kalan (139), Roshan Pura (137) in western part and Deoli (178) in south-east. These wards are corresponding to agriculturally potential areas.

## 6.2 Policy and possible Interventions

Policy makers will have the opportunity to tailor the intervention to the location. For example, wards with a relatively high poverty because of poor infrastructure may become the focus of programs that have a stronger emphasis on building infrastructure, while areas with higher poverty rates might obtain programs that tackle the poverty dimension.

Poverty mapping analysis has not only revealed patterns that are not otherwise visible, but has also been effective in addressing politically sensitive questions in an objective manner. As a result, locational decisions about programs and project implementation and funding allocation are likely to be less politically charged.

Formulas for the allocation of funds for various social schemes can be modified. This can be very sensitive politically, as many people stood to receive reduced benefits or none at all because of the changes in the allocation criteria. As a compromise, allocations can remain fairly constant for existing recipient areas, but the poorest of these areas must get an increase in funding. As a benchmark for the allocation of resources, the poverty mapping data are a powerful tool. Given the limited budgets of governments for propoor policies and programs, the ability to identify any mistargeting is a valuable asset.

A poverty map may also be used to validate a program's targeting mechanisms. If the correlation between poverty and the distribution of program benefits is high, the map provides evidence that the existing targeting criteria are working as planned.

Location of interventions (Geographical Targeting): The most common motivation for estimating highly disaggregated poverty indicators and producing associated poverty maps is to improve targeting in interventions. Indeed, a poverty map may be used as the sole criterion or one of several criteria for identifying appropriate intervention locations.

Elbers et al. (2007)[135] simulated and compared the effects on poverty of uniform transfers (whereby all households receive identical transfers) and transfers that are optimally targeted geographically. They show that the use of more highly disaggregated poverty data in targeting cuts the cost of reducing poverty significantly.

## 6.3 Accountability

The information provided by poverty maps has several qualities that contribute to the role of the maps in strengthening accountability mechanisms. First, the information supplied in poverty maps and the visual format is easy to understand. This is especially true when areas are ranked by level of poverty.

Second and perhaps more importantly, the information in poverty maps is relevant to all actors, including local government officials, service providers, civil society organizations, and the public. The maps tell these actors about the level of poverty in the areas where they live, work, and raise their children, and the maps allow for ready comparison with the situation in other communities.

Third, small area poverty maps are objective. They are based on established data sets that are collected and stored in systematic ways. Decisions based on such information help prevent local capture or subjective decision making. Fourth, poverty maps are also transparent in that they follow a methodology that is well established, systematic, and publicly available. The poverty estimates are derived through standard processes.

For all these reasons, the maps provide citizen groups and local authorities with powerful information they may use to hold officials accountable. Poverty maps have already been used as lobbying tools to promote equitable and objective allocation mechanisms and program processes.

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